**Description of the DART process of reproducing**   
**NMFS/Blane Bellerud’s method of Columbia River System Conversion Rates**

* Start compiling the data set with all adult observations at Bonneville Dam adult ladder, and group them by tag\_id and year.
* Next assign an ESU to each tag\_id by using the DART ESU filter (<https://www.cbr.washington.edu/dart/metadata/pit#esu>). If a tag\_id is not able to be assigned to an ESU, it is removed from the data set.
* Then remove any tag\_id with an ESU that is not one of the following ESUs of interest: Snake River Spring/Summer Chinook, Snake River Fall Chinook, Snake River Sockeye, Snake River Steelhead, Upper Columbia Spring Chinook, Upper Columbia Steelhead, or Middle Columbia Steelhead.
* Next assign a transportation status of T to each fish that was assigned a T or S by the DART Transportation filter (<https://www.cbr.washington.edu/dart/metadata/pit#transport>).
* For excluding jacks and mini-jacks, remove fish that were observed at Bonneville Dam at a year less than or equal to their assigned migration year plus one.
  + For steelhead, to be able to handle their run timing and life history, the year is not conventional year but instead assigned as the year at the date 6 months ago. So, any fish observed between June 1st 2023 and May 31st 2024 will be assigned a year of 2023.
* Create a new table using the tag\_ids and years from the observations at Bonneville Dam and find observations at upstream adult ladders that occur after the observation at Bonneville Dam.
  + Upstream dams are The Dalles, John Day, McNary, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams.
  + For steelhead, these observations are limited to within a year of the final observation at Bonneville Dam to separate out returning kelts
* Next, we create a table using all the Bonneville Dam tag\_ids, years, ESU/DPS, and Transportation status and then a column for each dam where a 1 indicates that tag\_id had been observed atthat dam and a 0 indicates that the tag\_id has not been observed at that dam.
* From this table we can group based on return year (the year of the first observation at Bonneville Dam), ESU, and Transportation status and sum the numbers in the columns for each dam to get the count of identified fish at Bonneville Dam, and the count of redetections at each upstream dam.
* Then we take the number of redetections at McNary Dam and divide by the number of detections at Bonneville Dam to get the unadjusted conversion rate from Bonneville to McNary dams.
  + We do the same to get the unadjusted conversion rate from McNary to Lower Granite and Bonneville to Lower Granite dams.
* To get to an adjusted conversion rate from the unadjusted rate we need harvest rate and stray rates.
* The source for harvest rates is the Technical AdvisoryCommittee’s (TAC) Joint Staff Report on Stock status and Fisheries (<https://wdfw.wa.gov/fishing/management/columbia-river/compact/other-information>).
  + Zone 6 Harvest rates for Spring/Summer Chinook are found in the Spring TAC report Table 5 using the Zone 6 Total column divided by the Bonneville Dam Count column.
  + Zone 6 Harvest rates for Sockeye are found in the Spring TAC report Table 15 using the Treaty Catch column plus the Non-Treaty Catch column divided by the Bonneville Dam Count column.
    - This is what Blane did but is not how it should be done
  + Zone 6 Harvest rates for Fall Chinook are found in the Fall TAC report Table 5 using the Treaty Zone 6 Harvest column plus the Non-Treaty Above BON Harvest column divided by the Bonneville Dam Count column.
  + Zone 6 Steelhead ???
  + Above MCN ???
* Stray rate estimates are from Blane citing from M.L. Keefer, C.A. Peery, J. Firehammer, and M.L. Moser. 2005 Straying Rates of known-origin adult Chinook salmon and steelhead within the Columbia River basin, 2000-2003. Technical Report 2005-5.
  + 4.7% for steelhead (other than 2002 and 2003 which have rates of 3.8% and 5.3% respectively)
  + 2.0% for spring and summer Chinook (Based on my reading of the report this should be 2.2% could be typo or some factor I am not privy to)
  + 3.3% for Fall Chinook
  + 0.0% for Sockeye (Sockeye were not a part of the paper)
* Adjusted conversion rates are calculated as the number of redetections at McNary Dam or Lower Granite Dam, divided by the number of detections at Bonneville Dam, all of which is in the numerator, and divided by the denominator of one minus the Harvest Rate multiplied by one minus the Stray Rate: