Description of the DART-Applied NMFS-Method for Conversion Rates in the Columbia River System

https://www.cbr.washington.edu/dart/query/dart_nmfs_conrate

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- Start compiling the data set with all adult observations at Bonneville Dam adult ladder, and group them by tag_id and year.
- Next assign a Species Domain Reach Release Group to each tag_id applicable using a set of definitions to get the populations of interest. If a tag_id does not fall into any group, it is removed. Note: some populations have overlapping definitions, in these cases a tag_id can be assigned to multiple populations.
  - SnakeSpSuChin_LGRabv
    - All Chinook Salmon tagged with a run designation of Spring or Summer (or Unknown if it returned to Bonneville Dam as an adult between March and July) and released at or upstream of Lower Granite Dam in the Snake River Basin.
  - SnakeSthd_LGRabv
    - All Steelhead tagged with a run designation of Summer and released at or upstream of Lower Granite Dam in the Snake River Basin.
  - SnakeFaChin_LGRabv
    - All Chinook Salmon tagged with a run designation of Fall (or Unknown if it returned to Bonneville Dam as an adult between August and October or is part of the Wild Fall Chinook Passage Route and Life History project) and released at or upstream of Lower Granite Dam in the Snake River Basin.
  - SnakeSock_LGRabv
    - All Sockeye Salmon released at or upstream of Lower Granite Dam in the Snake River Basin.
  - CombinedSock_abvMCN
    - All Sockeye Salmon released upstream of McNary Dam.
  - UpColSpChin_abvRIS
    - All Chinook Salmon tagged with a run designation of Spring and released upstream of Rock Island Dam and downstream of Chief Joseph Dam.
  - UpColSthd_abvPRD

- All Steelhead tagged with a run designation of Summer, released upstream of Priest Rapids Dam and downstream of Chief Joseph Dam.
  - MidColSthd_abvMCN
    - All Steelhead tagged with a run designation of Summer and released upstream of McNary Dam, including within or downstream of the Yakima River Basin and excluding the Snake River Basin.
  - MidColSthd_abvJDA
    - All Steelhead tagged with a run designation of Summer and released upstream of John Day, including within or downstream of the Yakima River Basin and excluding the Snake River Basin.
  - MidColSthd_abvTDA
    - All Steelhead tagged with a run designation of Summer, released upstream of The Dalles Dam, including within or downstream of the Yakima River Basin, and excluding the Snake River Basin.
- Next, assign a transportation status of "T" to each tag_id that was assigned a "T" or an "S" by the DART Transportation filter (https://www.cbr.washington.edu/dart/metadata/pit#transport).
  - Sockeye Salmon that were transported as juveniles and juveniles that migrated inriver are combined in this analysis with a code of "C" for combined.
- For excluding jacks (or 1-ocean fish) and mini-jacks (or precocious [0-ocean] fish), remove tag_ids that were observed at the Bonneville Dam adult ladder in a year that is less than two years after it migrated downstream as a juvenile.
- For Steelhead (particularly Snake River Summer Steelhead), some adults may hold and overwinter before completing their upstream migration to their spawning grounds. Thus, to assign a return year for Steelhead, any tag_id observed from June 1 in year t through May 31 in year $t + 1$, is assigned a return year t. For example, any tag_id observed between June 1st 2023 and May 31st 2024 will be assigned a return 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 observation at Bonneville Dam to separate out returning kelts.

- Next, create a table using all the Bonneville Dam tag_ids, years, populations, release river km and transportation code and then a column for each dam where a 1 indicates that tag_id had been observed at that dam and a 0 indicates that the tag_id has not been observed at that dam.
- From this table, group based on return year (the year of the first observation at Bonneville Dam), population, and transportation status and sum the numbers in the columns for each dam to get the count of identified tag_id at Bonneville Dam, and the count of re-detections at each upstream dam.
  - When the sum of detections at Bonneville Dam is less than 40 for a given year, the conversion rate is not calculated.
- Then take the number of re-detections at McNary Dam and divide by the number of detections at Bonneville Dam to get the unadjusted conversion rate from Bonneville to McNary dams.
  - Repeat the method above to get the unadjusted conversion rate from McNary to Lower Granite dams and from Bonneville to Lower Granite dams.
  - For MidColSthd populations, an unadjusted conversion rate is also calculated for John Day and The Dalles dams based on the lower bound for the release rkm.
    - First year of full PIT tag data from John Day Dam is 2018.
    - First year of full PIT tag data from The Dalles is 2013.
- Harvest rates and stray rates are then needed to calculate an adjusted conversion rate from the unadjusted rate.
- The source for harvest estimates is the Joint Staff Report produced by the Oregon Department of Fish and Wildlife and the Washington Department of Fish and Wildlife on stock status and fisheries (https://wdfw.wa.gov/fishing/management/columbia-river/compact/other-information).
  - Zone 6 Harvest rates for Spring/Summer Chinook Salmon are determined from the harvest estimates found in the Spring Joint Staff Report Table 5, using the Zone 6 Total column divided by the Bonneville Dam Count column. Spring Chinook Salmon Harvest estimates are used to approximate the estimates for Spring/Summer Chinook Salmon.
  - Zone 6 Harvest rates for Sockeye Salmon are determined from the harvest estimates found in the Spring Joint Staff Report Table 15, using the Treaty Catch column divided by the Bonneville Dam Count column.
  - Zone 6 Harvest rates for Fall Chinook Salmon are determined from harvest estimates found in the Fall Joint Staff Report Table 27, using the Kept Adult Chinook column from Bonneville Dam to Hwy 395 Recreational Fishery and

the Adult Chinook column in Table 29 as the numerator and the Cumulative Fall Chinook Adult Passage at Bonneville from the DART adult passage query as the denominator.

  ▪ [DART Adult Passage Counts Annual Summary for All Species | Columbia Basin Research](#)

- o Zone 6 Harvest rates for Steelhead are calculated from harvest estimates in the Fall Joint Staff Report, using the sum of the Recreational BON Pool, Recreational TDA-Hwy 395, Recreational Dip-Ins columns from Table 19a and Table 19b, and the Steelhead column from Table 29 in the Numerator, and the Total Passage column from Table 6 in the denominator.
- o Above McNary Dam Harvest rates for Spring/Summer Chinook Salmon are determined from harvest estimates in the Spring Joint Staff Report Table 25, using the Kept column for Snake River Spring Chinook Recreational Fishery section, divided by the Escapement past Zone 6 fisheries Total column from Table 5.

- Stray rate estimates are from Blane Bellerud, 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.
  - o 4.7% for Steelhead
  - o 2.0% for Spring and Summer Chinook Salmon
  - o 3.3% for Fall Chinook Salmon
  - o 0.0% for Sockeye Salmon (because no sockeye habitat or populations exist downstream of MCN, no stray rate is assumed in this analysis)

- Adjusted conversion rates are calculated as the number of re-detections at McNary Dam or Lower Granite Dam, divided by the number of detections at Bonneville Dam, i.e., $\frac{LGR}{BON}$, all of which is in the numerator, and then divided by the denominator of 1 minus the Harvest Rate, multiplied by 1 minus the Above MCN Harvest Rate, and multipled by 1 minus the Stray Rate:

  - o $$\frac{\frac{LGR}{BON}}{(1 - Zone\ 6\ Harvest\ Rate) * (1 - Above\ MCN\ Harvest\ Rate) * (1 - Stray\ Rate)}$$