**July 2022**

**Columbia River Coho**

In a nutshell, coho are a convoluted mess. The situation is outlined below.

Forecasting

* OPI – ocean forecasting skill/performance has never performed particularly well (ie. forecast consistently within 30% of actual), and accuracy has been declining (over-predicting) since ~2012. Mean absolute prediction error: Since 1996 Early = 57% (max = 240%); Late = 59% (max = 240%); Since 2012 Early = 90% (max = 240%); Late = 96% (max = 240%). Some factors include;
  + Stock comp (early/late) is wrong (see comments about OPI tables, in-river spreadsheet, FRAM)
  + Forecasting method (ie. multiple regression) can not be changed without approval from PFMC-SSC
    - As a result, forecasts can not explore different model or include new co-variates (ie. ocean predictors, smolt releases, etc.) without SSC approval
  + Assumes same ocean survival for early-S/late-N stock components
  + OPI data are suspect due ad-hoc and very error prone structure of the tables
* OPI needs to move away from any one forecasting method being “approved” by SSC, and push for forecast performance criteria being approved by the SSC. This will allow new forecasting methods to be brought forward to OPI each year for comparison against any/all other proposals.
* Forecasting in-river components - Haphazard and inconsistent at best, very tedious, undocumented, and extremely difficult to monitor/evaluate skill&performance
* LCN components – WDFW in-river LCN forecasts have recently been substantially improved and documented by WDFW Sci Div. However, translating WDFW LCN forecasts to ocean abundance is haphazard.
* OPI forecast uses marine survival estimate from WDFW for both early/late stocks. However, WDFW marine survival estimate is based on data from the WA coast, and does not include OR data. Since the ocean distribution of WA and OR fish is quite different (ie. North vs South migrating from CR mouth), it likely problematic to assume same ocean survival. Particularly in the face of marine heat waves off OR coast, it is important to know if marine survival of south migrating fish is similar to north migrating fish.

Run reconstruction (ie. OPI)

* Entire process is largely undocumented, convoluted, opaque, and happens under very tight timelines.
* OPI tables are extremely cumbersome, highly error prone, inconsistently applied, and undocumented.
  + 7 different spreadsheets with ~75 different tabs tied together by links that break as soon as the files are opened, dependent on countless circular/redundant cell-references, many unknown/abandoned calculations, all requiring very tedious manual updating each year.
  + Another 5-10 spreadsheets are tied directly, or indirectly to the above 7 spreadsheets for forecasting, allowable ER estimation, etc.
* Full of assumptions hard-wired into the tables and inconsistent data structures
  + Early/late stock composition is hard-wired by fishery into the tables, regardless of fishery structure and length, and has never been updated with CWT to my knowledge.
    - B10 stock composition is defined to be 87% Early and 13% late.
    - LCR sport stock comp defined as Early: Aug = 100%, Sept = 25% , Oct = 0%; Late defined as 1-Early stock comp
    - Z1-5 is defined as Early: Aug = 100%, Sept (through week ending nearest Sept 20) = 50%, Sept 21 onward = 0%. Late defined as 1-Early stock comp
  + Total mortality – applied as harvest + release mortality in commercial mainstem commercial fisheries, but as only kept fish in LCR and B10 fisheries. Very difficult to tell if the OPI tables have been labeled wrong, or if the time-series have indeed been developed inconsistently.

FRAM

* Base period Early/late stock composition has never been updated in ~30 years.
* Unknown if FRAM LCN units are aligned with OPI table 5
* FRAM stock composition is based on opaque internal process and OPI tables, and the CR components of the OPI tables are based on the in-river “model”.
  + Haphazard process for defining a fixed stock composition from multiple circular/opaque sources. FRAM depends on OPI tables, which depend on in-river spreadsheet, which depends on FRAM.

Columbia river harvest accounting spreadsheet (the “model”)

* Undocumented, ad-hoc, inconsistently implemented across fisheries, requires very tedious manual updating
* Stock comp either comes from FRAM (B10, which comes from OPI tables, which come from the model), or is hard wired to the file (see bullets on stock comp from OPI tables).
* Does not do any of the following;
  + Use CWT data for stock composition
  + Consistently apply HR/ER calculations across fisheries.
    - Aggregates sport fishery data (B10 and LCR, ignores above Bonn) into cumulative season totals, but goes through some pretty convoluted processes to track commercial fisheries (SAFE, Z1-3, Z4-5) by stat week
  + Document any of its calculations or process

New Columbia River harvest accounting tool

* Uses a tabular data template to store data in a consistent format across all fisheries
  + Facilitates documentation of data entries
* Enables early/late timing curves to be updated regularly (annually???) by time/location using CWT (and/or PIT, genetic data, etc)
* Documents process, including;
  + User manual
  + Calculation processes (ie. exploitation rates and harvest rates, by gear, location).
* Is very efficient to implement, and 100% reproducible
  + Streamlines tedious processes like setting up fishery calendar/stat weeks
  + Pulls essential information from FRAM output automatically, such as ocean abundances, expected vs observed Bonn passage.
  + Rapidly produces consistent, reliable output
  + Visualizes output using graphs and plots
  + Easy to update/customize
  + Easy to add new gears (Pound Net), fisheries (tributaries when needed for updated FMP), etc.
* Is key component to improving/rebuilding run reconstruction (ie. OPI tables) and thus improve forecasting, etc.

Recommendations to improve coho process and outcomes

* Use new in-river coho harvest tool to rebuild Columbia River harvest time-series for OPI.
  + Rebuild early/late stock comp and fishing mortality by fishery (B10, LCR, SAFE, mainstem commercial) back in time, using CWT
  + Rebuild OPI tables using new OPI table templates built from stock comp and fishing mortality outputs of new CR harvest tool.
  + Use rebuilt OPI dataset for new OPI and CR forecasting processes
    - Revised forecasting process should focus on performance/skill methods relative to other proposals, rather than focus on any one method being “approved” by the SSC.