

AD HOC SOUTHERN RESIDENT KILLER WHALE WORKGROUP UPDATE

In response to the National Marine Fisheries Service (NMFS) reinitiating Endangered Species Act consultation on the effect of Council-area ocean salmon fisheries on Southern Resident Killer Whales (SRKW), the Pacific Fishery Marine Council (Council) formed the Ad Hoc SRKW Workgroup (Workgroup) in April 2019. The Workgroup was tasked with reassessing the effects of Council-area ocean salmon fisheries on the Chinook salmon prey base of SRKW. NMFS has developed a webpage dedicated to the Workgroup which includes meeting schedules, materials shared, etc. (<https://www.fisheries.noaa.gov/west-coast/southern-resident-killer-whales-and-fisheries-interaction-workgroup>).

At the September 2019 Council meeting, the Workgroup presented initial results from its draft risk assessment (RA), which was developed through a series of public meetings and webinars since the April 2019 Council meeting. The draft RA provided in September included background information and detailed modeling analysis and results performed to date. It also included a description of methodology and criteria for evaluating Council-area ocean salmon fisheries. In trying to quantitatively assess indirect effects on SRKW due to Chinook salmon removals in Council-area ocean salmon fisheries, the Workgroup approached the analysis in four steps:

- 1) Develop annual indices of adult (age-3+) Chinook salmon by ocean area corresponding to three fishery periods.
- 2) Fit statistical models relating these indices of Chinook salmon abundance to measures of SRKW demographic rates and body condition, with the goal of identifying times or areas that were consistently correlated with killer whale demography or condition.
- 3) Estimate reductions in Chinook salmon abundance by time and area that are attributable to Council-area ocean salmon fisheries.
- 4) Estimate the changes in predicted vital SRKW rates that the statistical relationships fitted in step 2, predict for Chinook salmon abundances with and without the reductions in abundance estimated in step 3.

The draft RA provided in September included analysis through step 2. Based on questions and input from the Council at its September 2019 meeting, the Workgroup updated the datasets and included an additional 'lag-time' component of Chinook abundance to the evaluation of SRKW survival, as had previously been done only for fecundity. The decision to consider this temporal lag was based on plausible physiological mechanisms linking food supply to future performance, and may also account for some uncertainty in the timing of SRKW mortality events. This approach is consistent with the methods used and reviewed during bilateral NMFS – Department of Fisheries and Oceans workshops in 2011-2012.

At the Workgroup meeting held October 8 - 9, 2019, the updated datasets and outcomes from this new 'lag-time' component were discussed. Clustering analysis which grouped years of similar SRKW demographic performance was also performed. This clustering was done independent of Chinook salmon abundance, and may be useful in identifying past periods of greater or lesser risk for the SRKW population (inputs included birth and death rates, and a binary indicator related to positive population growth/decline). The Workgroup opted to not include metrics of condition in

the clustering analysis. Detailed results of both these analysis will be included in the pending draft RA submitted for the November Council meeting.

Constraints of the data and confounding factors influence the quantitative modeling results. Even with the new ‘lag-time’ approach to modeling survival, none of the fitted regressions met the typical criterion of $p < 0.05$ that is often associated with “statistical significance”. However, multiple regressions had $p < 0.10$. Although $p < 0.05$ is the typical criterion for "statistical significance", there is precedent for using larger values, especially in the face of noisy data, small sample sizes, and/or cases where the consequences of erroneously rejecting an effect are considered more severe than the converse.

As a reminder, a p-value of 0.05 means that given the level of variability in the data and the model assumptions, there is a five percent probability of seeing a relationship at least as strong as the one observed purely by chance under a null hypothesis of no effect. It should not be interpreted as the probability that there is or is not an effect in any particular case ([Wasserstein and Lazar 2016](#)). Rather, a small p-value means that it is unlikely that a pattern in the data at least as strong as the one seen would arise by chance, whereas a large p-value means that a pattern as strong as the one observed could easily arise by chance.

The Workgroup is also exploring qualitative components to incorporate into the assessment, and has begun assessing fishery effects by the same stratifications developed in step 1 described above. Details will be discussed in the pending draft RA for the November Council meeting.

In preparation for November 2019 Council meeting, the Workgroup will hold a webinar meeting on October 29, 2019. The Workgroup will focus on the analysis completed since the October 8-9 meeting, and work to update the draft risk analysis and submit for Council consideration. The Workgroup will also try to have methodology material used to date available in time for review by the Scientific and Statistical Committee at the 2019 November Council meeting.

NMFS has indicated that a Biological Opinion on the effects of Council-area ocean salmon fisheries on the Chinook salmon prey base of SRKW will need to be in place by the onset of the 2020 Council-area ocean salmon fisheries. If directed by the Council, the Workgroup is ready to continue to work with NMFS after the 2019 November meeting, and strive to complete its primary task to inform NMFS on the effects of Council-area ocean salmon fisheries on the Chinook salmon prey base of SRKW in both quantitative and qualitative manners. If the Council agrees the Workgroup should continue its task, the Workgroup has identified three potential meeting dates between the November and March Council meetings. Potential dates are December 10, 2019, January 8-9, and February 4, 2020.

References

Wasserstein, R. L. and Lazar, N. A. 2016. The ASA Statement on p-Values: Context, Process, and Purpose. *The American Statistician*, 70:129-133.
<https://doi.org/10.1080/00031305.2016.1154108>

PFMC
10/18/19