Cutoff Value Determination

This is a simple R package that implements an updated version of the method first developed and used in Medeiros et al. (2018). It can be used to determine an objective cutoff value between a significantly bimodal distribution of log-transformed data and plot a representative graph of the results.

This package first determines whether a distribution is bimodal using the excess mass test from the “multimode” R package (Ameijeiras-Alonso et al 2021) method and provides a p-value. The package then utilizes the NormalMixEM code (from the “mixtools” package; Benaglia et al 2009) to fit a two-component mixture model to the distribution. Using the values from the fitted mixture model, a cutoff value (with equal probability of being from either curve) is calculated, effectively separating the data into high and low groups.

Finally, the input data, the fitted finite mixture model, and the cutoff value are used to produce a histogram depicting the data with an x-axis overlay to display actual data values (instead of the log-transformed values).

# References

Ameijeiras-Alonso, J., Crujeiras, R. M., & Rodriguez-Casal, A. (2021). multimode: An R Package for Mode Assessment. *Journal of Statistical Software*, *97*(9), 1–32. <https://doi.org/10.18637/jss.v097.i09>

Benaglia, T., Chauveau, D., Hunter, D. R., & Young, D. S. (2009). mixtools: An R Package for Analyzing Mixture Models. *Journal of Statistical Software*, *32*(6), 1–29. <https://doi.org/10.18637/jss.v032.i06>

Galbreath, P.F., Staton, B.A., Nuetzel, H.M., Stockton, C.A., Knudsen, C.M., Medeiros, L.R., Koch, I.J., Bosch, W.J., and Pierce, A.L. 2022. Precocious Maturation of Hatchery-Raised Spring Chinook Salmon as Age-2 Minijacks Is Not Detectably Affected by Sire Age. Transactions of the American Fisheries Society **151**(3): 333-346. doi:10.1002/tafs.10343.

Medeiros, L.R., Galbreath, P.F., Knudsen, C.M., Stockton, C.A., Koch, I.J., Bosch, W.J., Narum, S.R., Nagler, J.J., and Pierce, A.L. 2018. Plasma 11-Ketotestosterone in Individual Age-1 Spring Chinook Salmon Males Accurately Predicts Age-2 Maturation Status. Transactions of the American Fisheries Society **147**(6): 1042-1051. doi:10.1002/tafs.10097.

Pearl, A.M., Laramie, M.B., Baldwin, C. M., Rohrback, J.P., Phillips P.E. 2018. The Chief Joseph Hatchery Program 2016 Annual Report. BPA Project No. 2003-023-00, 231 pages.

Pearl, A.M., Laramie, M.B., Baldwin, C. M., Brudevold, K., McDaniel, M.T. 2022. The Chief Joseph Hatchery Program Summer/Fall Chinook 2019 Annual Report. BPA Project No. 2003-023-00, 202 pages.

Pearl, A.M., Baldwin, C. M., Brudevold, K., McDaniels, M.T. 2022. The Chief Joseph Hatchery Program Spring Chinook 2020 Annual Report. BPA Project No. 2003-023-00, 106 pages.

Pierce, A.L., Medeiros, L.R., Hoffman, B., Koch, I.J., Narum, S.R., Galbreath, P.F., and Nagler, J.J. 2021. Dietary tetradecylthioacetic acid supplementation during the fall prevents an increase in body lipid levels but does not influence precocious male maturation rate in juvenile spring Chinook salmon. Aquaculture Research **52**(11): 5483-5492. doi:10.1111/are.15422.

North Fork Lewis River Aquatic Technical Subgroup. 2023. 2023 Annual Operating Plan, Hatchery and Supplementation Program, North Fork Lewis River. FERC Project Nos. 935, 2071, 2111, 2213, 266 pages.

Snow, C., C. Frady, D. Grundy, B. Goodman, and A. Haukenes. 2019. Monitoring and evaluation of the Wells Hatchery and Methow Hatchery programs: 2018 annual report. Report to Douglas PUD, Grant PUD, Chelan PUD, and the Wells and Rocky Reach HCP Hatchery Committees, and the Priest Rapids Hatchery Subcommittees, East Wenatchee, WA.