**Spatiotemporal Models for Ecologists**

**Index standardization using spatially unbalanced data**

Goal: Compare performance with and without epsilon bias-correction given spatially unbalanced data

**Data generating process**

Envision a spatial index standardization model with an autocorrelated interaction of space and time, adapting “Spatio-temporal-models-for-ecologists\Chap\_8\pollock\_index.cpp” and based on Section 8.4.3:

Fit this model to data for Alaska pollock using data from Chap\_8, but reducing data to only those stations that are consistently available (i.e., using overlap with the “EBS.rda” shapefile provided). The modified R and CPP scripts are provided in “2024\_FSH556 \Week 8\Lab”.

Next, please explore model performance when estimating an abundance index given spatially unbalanced samples. To do so:

1. Add code to the CPP to simulate new Tweedie-distributed observations;
2. Fit the model to available survey data and record the area-expanded biomass;
3. Simulate new survey data conditional upon estimated fixed and random effects from Step-2;
4. For two-thirds of years (chosen randomly), exclude all simulated data poleward of 6500 km north of the equator (given the UTM projection used in the script), such that simulated data are spatially unbalanced;
5. Refit the model to these simulate data and record the estimated area-expanded biomass with or without epsilon bias-correction;
6. Repeat steps 3-5 multiple times, perhaps accelerating the process by using a coarser SPDE mesh during step-5;
7. Compare performance with and without the epsilon bias-correction method.

If you finish quickly, please consider either (A) comparing performance for biomass-weighted location northwards of the equator, to measure northward distribution shifts, or (B) use an alternative data-exclusion scenario from [Bryan and Thorson (2023)](https://www.frontiersin.org/articles/10.3389/fmars.2023.1198260/full).