**Spatiotemporal Models for Ecologists**

**Dynamic Factor Analysis**

Goal: Gain experience with multivariate state-space models.

Steps:

Load data for sockeye salmon returns in various fisheries across the North Pacific, using “Sockeye\_returns.csv”, and construct a dynamic factor analysis (DFA) for log-returns (while excluding any return of 0). Specifically, define a model with variables and times, such that is a matrix. Then sweep forward in time through rows:

Where factors is a matrix, where each column is a treated as an column matrix, and is a matrix. Please fit this using factors, such that is a matrix. Similarly, define as a standard normal random effect:

And define the conditional likelihood for data:

I recommend writing this code from scratch but feel free to instead start with Chap\_4/crawlR.cpp. Remember that must be lower-triangular, such that .

If you have time after fitting this model, explore what happens when you exclude data. Specifically remove rows of data and extract the estimated state-variable . How does the variance change when excluding a sequence of data for a single variable?