

Productivity

Environment for t generations
Short- or long-term dynamics



n environmental-tolerance curves
Maximum possible Ricker a (a_i^{max})
Optimal temperature (e_i^{opt})
Thermal tolerance curve width (W_i)



n Ricker a parameters

Demographic stochasticity

Lognormal spawner-return residuals for populations $i:1:n$ and t generations
Variance σ_r^2
Autocorrelation ρ_w



Density dependence

Pick asset weights that add to one
Minimum weight



Distribute total "habitat" based on weights
Total habitat



n Ricker b parameters

Calculate returns based on Ricker spawner-return relationship



Return abundance



Straying between populations
Straying fraction (f)

Decay of straying with distance (m)



Return abundance after straying



Estimate Ricker a and b and set escapement targets
Escapement target rules



Harvest salmon
Implementation uncertainty
 $\text{beta}(\alpha_h, \beta_h)$



Fisheries catch

Escapement

Calculate metapopulation growth rate and variance



Metapopulation portfolio
"risk" and "return"

Repeat for t generations

Repeat with new habitat weights

Repeat with new sample of spawner-return residuals, temperature time series, and implementation uncertainty