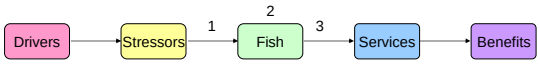
Fish Metapopulation Modeling

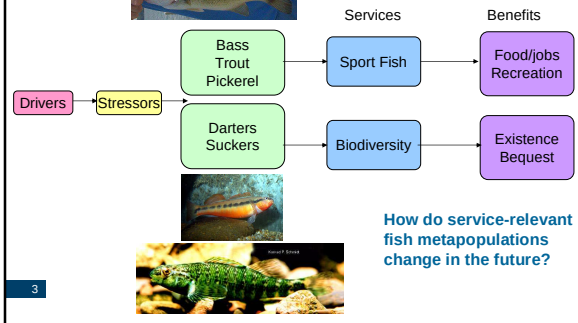
Brenda Rashleigh, NERL/ERD
Denis White, NHEERL/WED
Joe Ebersole, NHEERL/WED

U.S. Environmental Protection Agency
Office of Research and Development

Main Points

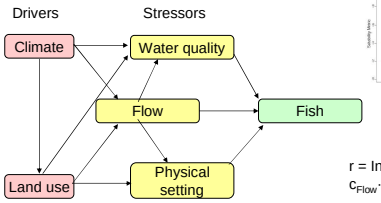
1. Empirical models relate stressors to different fish species
2. Represent populations with age and spatial structure
3. Combine population results to get services

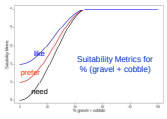




How do service-relevant fish metapopulations change in the future?

Effects of Multiple Stressors

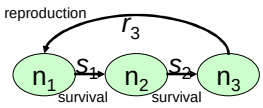




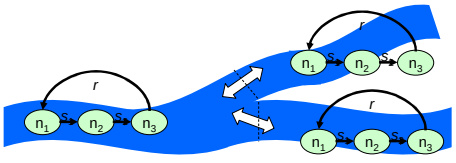
$r = \text{Intercept}_{\text{EcoregionXBasin}} + c_{\text{Flow}} \cdot \text{Flow} + c_{\text{Temp}} \cdot \text{Temp} + \ldots$

0 (Unsuitable) to 1 (Most suitable)

Population Matrix Model



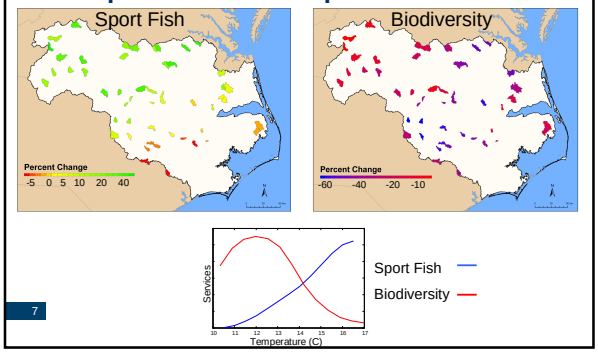
$$\begin{bmatrix} n_{1,\,t+1} \\ n_{2,t+1} \\ n_{3,t+1} \end{bmatrix} = \begin{bmatrix} 0 & 0 & r_3\ \text{f(Stressors)} \\ s_1\ \text{f(Stressors)} & 0 & 0 \\ 0 & s_2\ \text{f(Stressors)} & 0 \end{bmatrix} \begin{bmatrix} n_1 \\ n_2 \\ n_3 \end{bmatrix}$$



Who moves?
How far?
Why?

ECOSYSTEMS SERVICES RESEARCH PROGRAM

Response to 1℃ Temperature Increase



7

ECOSYSTEMS SERVICES RESEARCH PROGRAM

Fish Metapopulation Modeling for ESRP Decision Making

- Impacts of climate change
- Water quality trading
- Priority streams for restoration
- Land development decisions

8