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What can we learn about community dynamics and climate impacts from spatiotemporal models? A case study of freshwater fishes.

Many natural communities are responding rapidly to climate changes. However, species interactions and habitat heterogeneity also affect community dynamics, such that spatial variation may confound or invalidate tests for climate impacts. It is therefore necessary to analyze climate impacts on fish communities while accounting for spatial and temporal patterns in community dynamics. As one example, Lake Aleknagik is rearing habitat for juvenile sockeye salmon in the Wood River system of Bristol Bay. Fish surveys are available annually 1963-2014 for multiple species at 11 sites across the lake. To explore climate impacts in this community data set, we develop spatial dynamic factor analysis (SDFA). SDFA estimates the sensitivity of population density to changing water temperature for each species, and simultaneously estimates density-dependent variation in one or more “factors” to account for residual spatiotemporal community dynamics. This analysis indicates positive and statistically significant impacts of rising temperatures on three- and nine-spine stickleback and char, and negative impacts on juvenile sockeye and sculpin densities. It also provides an easily interpreted summary of species associations while visualizing spatiotemporal variation in species’ dynamics. (Received September 08, 2015)