Individual-based and structured population models based on dynamic energy budgets

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This lecture will review two families of model that relate population dynamics to the physiology and behavior of individual members of a population. Individual-based models are computer simulations of a collection of organisms, characterized by individual or "i-state" variables such as age or mass, and interacting with a shared environment. Structured population models describe the dynamics of the distribution of individuals in a very large population among its i-states, for example its age or size structure. Good examples of both approaches make use of bioenergetic or Dynamic Energy Budget (DEB) models. DEB models describe the rates at which individual organisms assimilate energy and elemental matter, and utilize them for growth, development and reproduction. Because DEB theory is founded on general principles, it has the potential to increase understanding of population-level effects of environmental stress for a wide range of organisms and environmental conditions.