Life history implications of allocation to growth versus reproduction in Dynamic Energy Budgets

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The study of energy allocation strategy between somatic growth and reproduction is central to life history theory [1,2]. An organism can only acquire a limited amount of material and energy for which the physiological processes such as maintenance, somatic growth, development and reproduction compete. Dynamic Energy Budget (DEB) models specify the tight links between life history traits, such as feeding, aging, growth and reproduction [3,4].

In the present work we concentrate on a DEB model [3] and compare the consequences of two allocation strategies for a parthenogenetic iteroparous 3D-isomorphic ectotherm at constant food availability: indeterminate growth, where growth continues during the reproductive stage, and determinate growth, where growth is ceased during the reproductive stage. We do a comparative analysis using as measure of fitness the life span reproduction, the population growth rate, and the conversion efficiency of food to biomass. In addition, we investigate the problem of evolutionary stable strategies in a spatially homogeneous population that receives a constant food input. We study the evolutionary stable strategy for energy allocation as the lowest food density at which an individual produces on average one viable offspring during its entire lifetime. We include comparisons assuming different type of mortalities (aging, constant, and size-dependent).

Results [5] indicate that the optimal allocation strategy depends on the measure of fitness as well as the type of mortality. In terms of ESS of partitioning of catabolic power to reproduction, we find that in populations of short living species, determinate growers can invade, and displace, a population of indeterminate ones. However, when mortality risk is higher for individuals with small size than those of large size, indeterminate growers can be superior.

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