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Modeling the energy-mortality tradeoffs of invertebrate decorating behavior.

Many animals decorate themselves with foreign material, for a variety of reasons. Decorating behavior occurs in nearly 25% of the major metazoan phyla, suggesting that it is an advantageous behavior with multiple origins. Paradoxically, the phenotype is rare within each phylum, suggesting that its selective advantage is fragile, limited perhaps by cost-benefit tradeoffs. We model tradeoffs among energy expenditure, energy intake, and mortality risk (biotic and abiotic), using reproductive value R as a function of average lifetime decoration level d , involving ten parameters. Using $R'(0) > 0$ as the primary test for invasibility of a decorating mutant, we find that the marginal cost of decoration is severely constrained by seven of the other parameters. While the mathematics here is completely elementary, we believe this may be a useful preliminary step in modeling the evolution of an apparently advantageous, but rare, phenotype. The model, moreover, draws upon actual field data, especially for the green sea urchin *Strongylocentrotus droebachiensis*. (Received August 30, 2005)