On the edge of death: Rates of decline and lower thresholds of biochemical condition in food-deprived fish larvae and juveniles

Gaining reliable estimates of how long fish early life stages can survive without feeding and how starvation rate and time until death are influenced by body size, temperature and species is critical to understanding processes controlling mortality in the sea. The present study is an across-species analysis of starvation-induced changes in biochemical condition in early life stages of nine marine and freshwater fishes. Data were compiled on changes in body size (dry weight, DW) and biochemical condition (standardized RNA–DNA ratio, sRD) throughout the course of starvation of yolk-sac and feeding larvae and juveniles in the laboratory. In all cases, the mean biochemical condition of groups decreased exponentially with starvation time, regardless of initial condition and endogenous yolk reserves. A starvation rate for individuals was estimated from discrete 75th percentiles of sampled populations versus time (degree-days, Dd). The 10th percentile of sRD successfully approximated the lowest, life-stage-specific biochemical condition (the edge of death). Temperature could explain 59% of the variability in time to death whereas DW had no effect. Species and life-stage-specific differences in starvation parameters suggest selective adaptation to food deprivation. Previously published, interspecific functions predicting the relationship between growth rate and sRD in feeding fish larvae do not apply to individuals experiencing prolonged food deprivation. Starvation rate, edge of death, and time to death are viable proxies for the physiological processes under food deprivation of individual fish pre-recruits in the laboratory and provide useful metrics for research on the role of starvation in the sea.

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