Optimal life-histories in seasonal environments Modeling copepod strategies

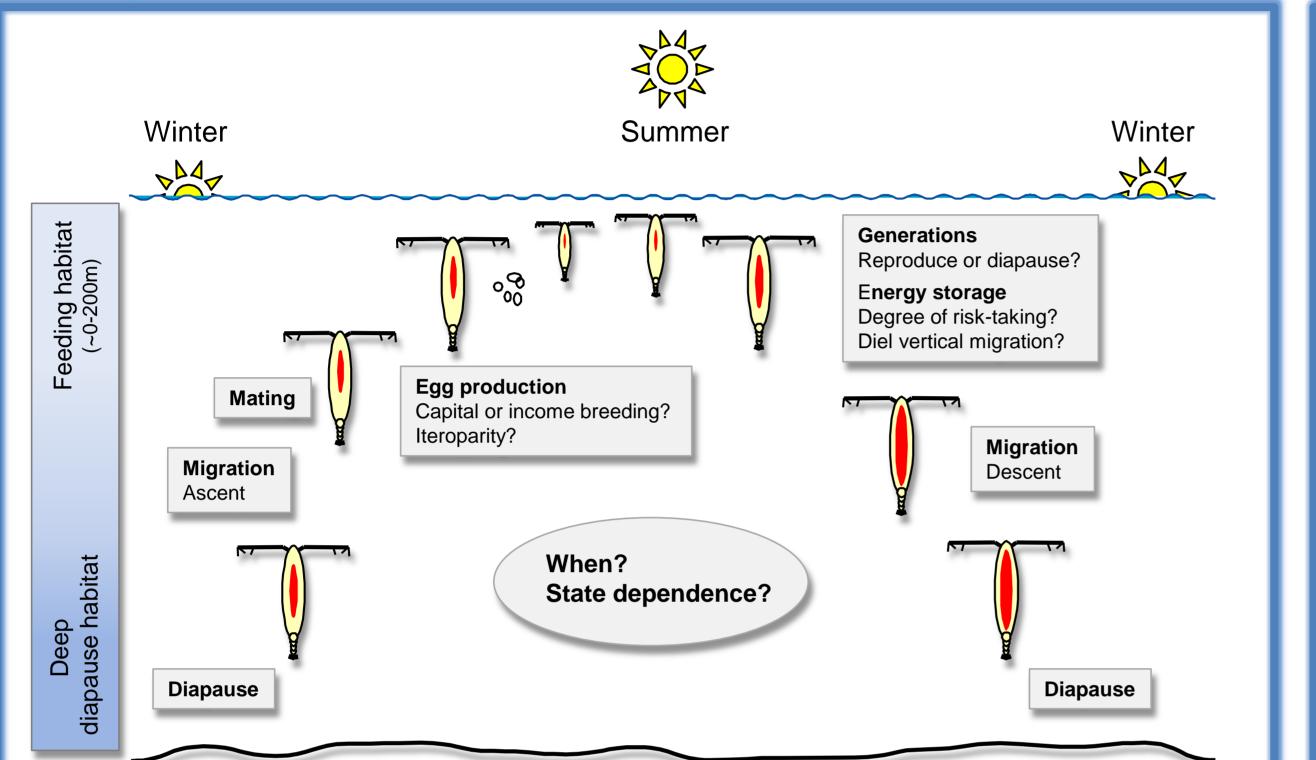
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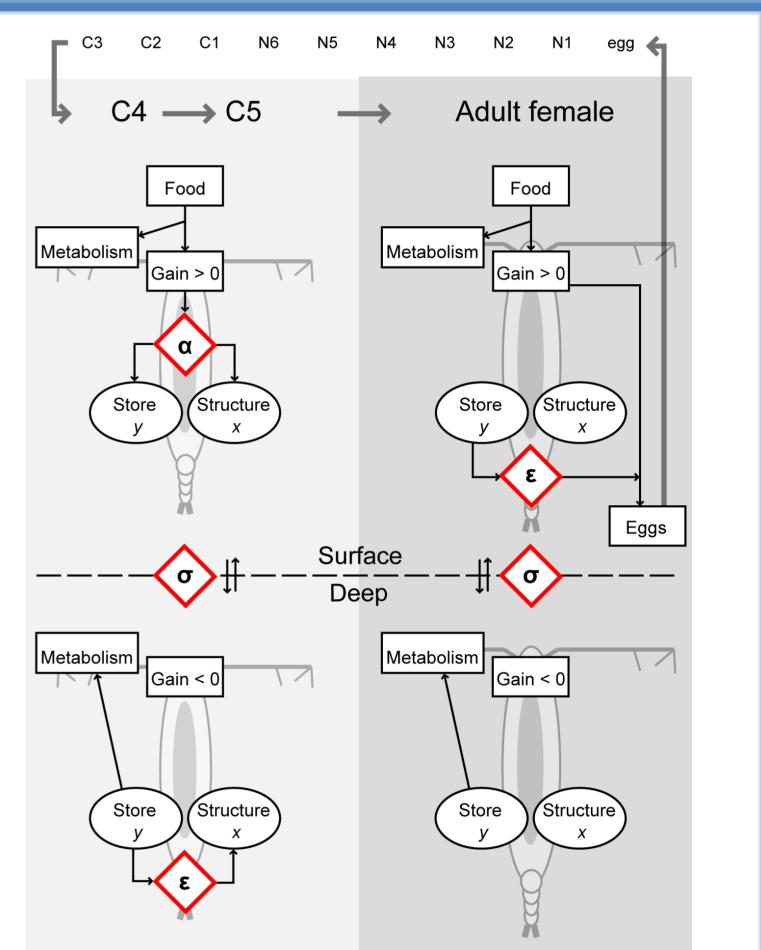
Introduction

Behavior and life-history strategies of zooplankton have evolved in response to seasonal cycles in food availability, predation risk and abiotic conditions. How are the different activities over the year linked and what are their optimal schedule? Here I present a state-dependent life history model for a herbivorous high-latitude copepod as well as some recent empirical studies developing methods and testing predictions.

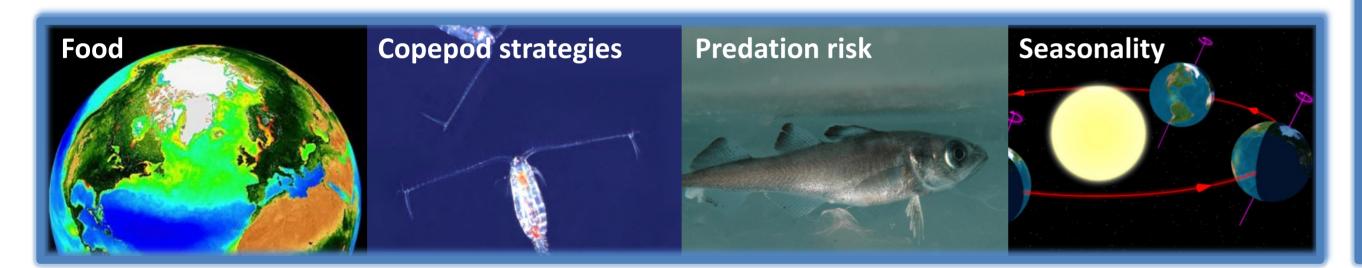
Background and research questions





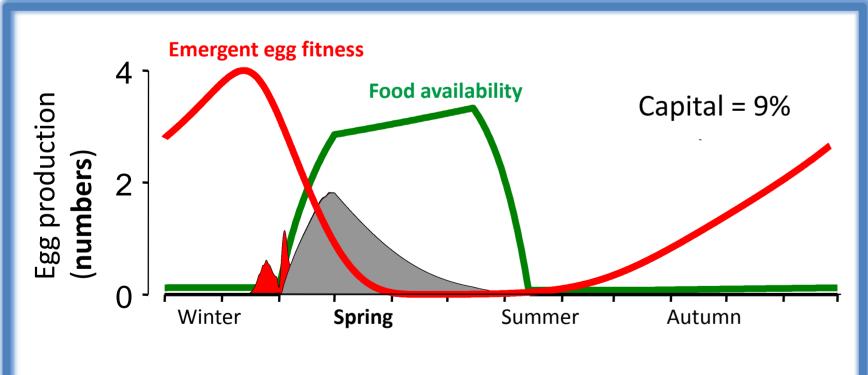


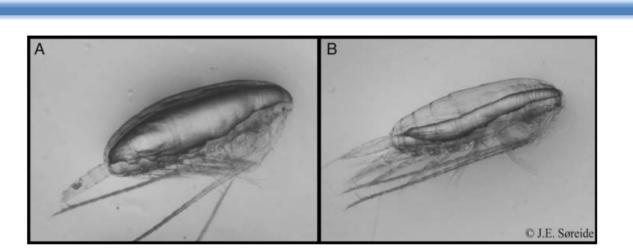
Schematic life cycle and annual routine of a herbivorous high-latitude copepod. Key life-history traits and behaviours are indicated (Varpe 2012).



Processes and decisions in a copepod life history model. Allocation and diapause decisions (diamonds) are optimized, based on maximization of reproductive value (Varpe et al. 2007).

Results

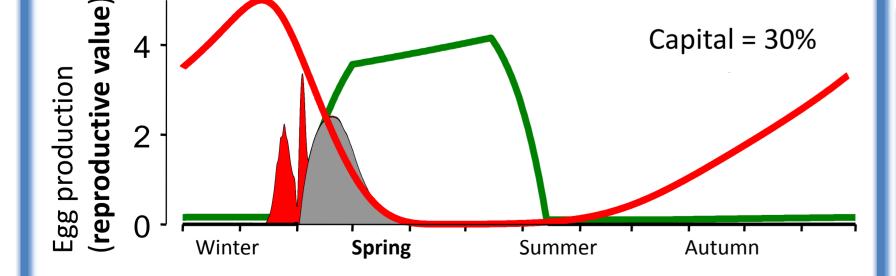




Copepods with large and small oil sac (Vogedes et al. 2010). Behavior and life history strategies depend on this state.

Conclusions

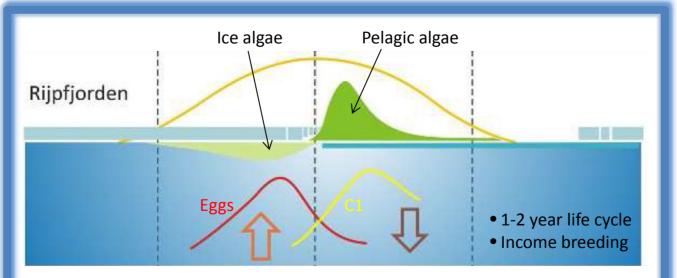
The reproductive value of an egg is predicted to be highly seasonal. Time of peak egg fitness depends on the interaction between food availability and predation risk. Most eggs were produced later than the time of peak egg fitness - an internal **history mismatch**. Knowing the life seasonality in offspring fitness is essential to appreciate evolutionary and populationlevel consequences of capital breeding.



Predicted egg fitness (red line) and population level egg

production. Capital (red) and income (grey) breeding separated

(Varpe et al. 2009). Egg production units: daily percentage of the



Calanus glacialis. Timing of reproduction in relation to food availability reviewed for eight Arctic locations – here Rijpfjorden (Daase et al. 2013).

Field studies need to consider statedependent behaviour and strategies. The pronounced regional and intra-specific variability in Calanus glacialis life history and phenology is partly explained by the dynamics of the bimodal food source (ice algae followed by pelagic algae).

Thanks

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