



Predicting the effects of a changing environment on green turtle energetics

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Ningaloo Outlook – A partnership between BHP and CSIRO

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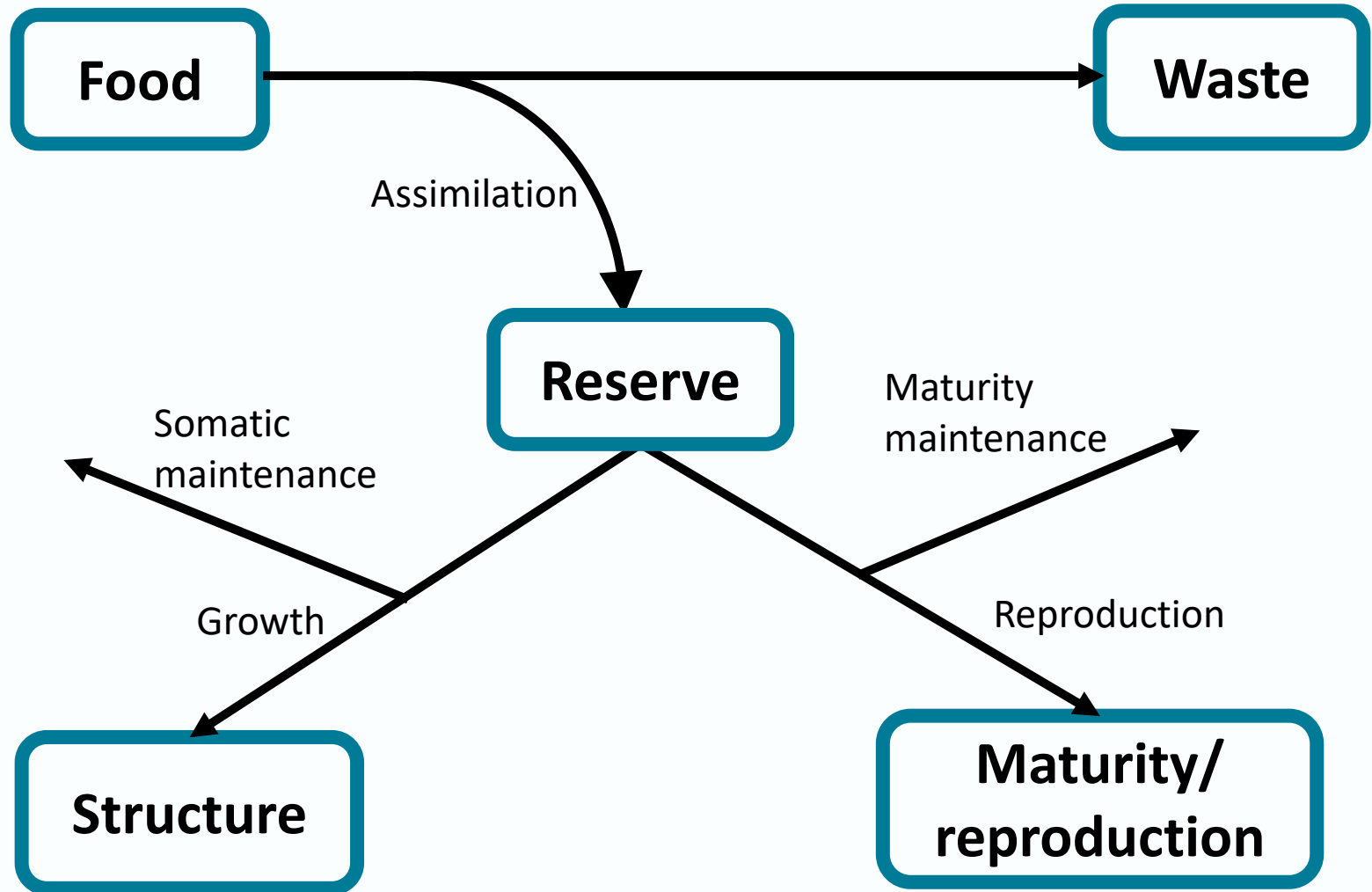
Ningaloo Outlook is a BHP-CSIRO Industry-Science Marine Research Partnership investing A\$5.4 million over five years to gather new knowledge on the Ningaloo reef and its important ecological values

Green turtles at Ningaloo

- **Slow growing and long lived**
- **Models** allow us to look at **whole life cycle**
- **Dynamic Energy Budget** model
 - Model **energetics** of Ningaloo population
 - Response to **changing conditions**

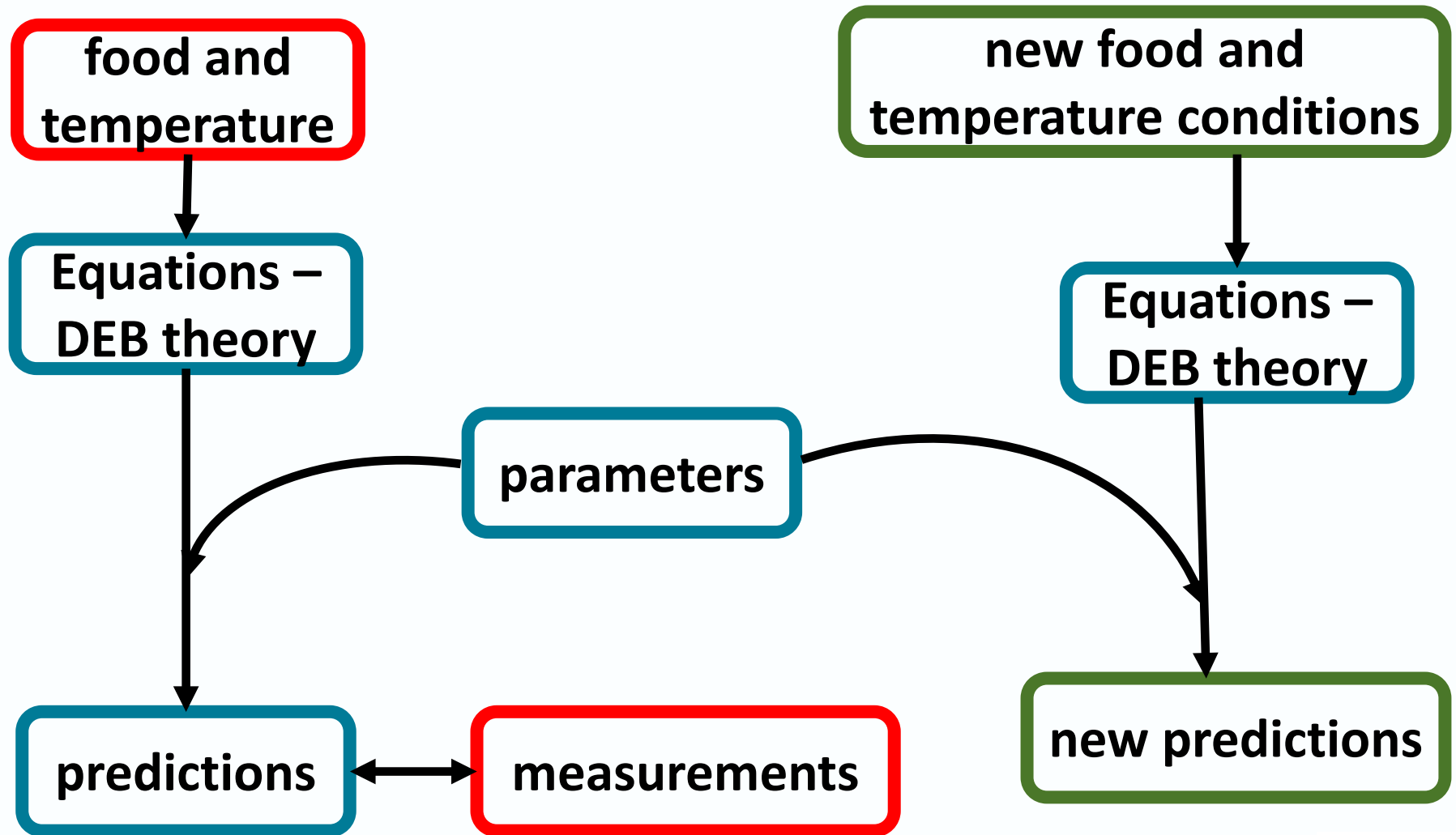


Dynamic Energy Budget (DEB)



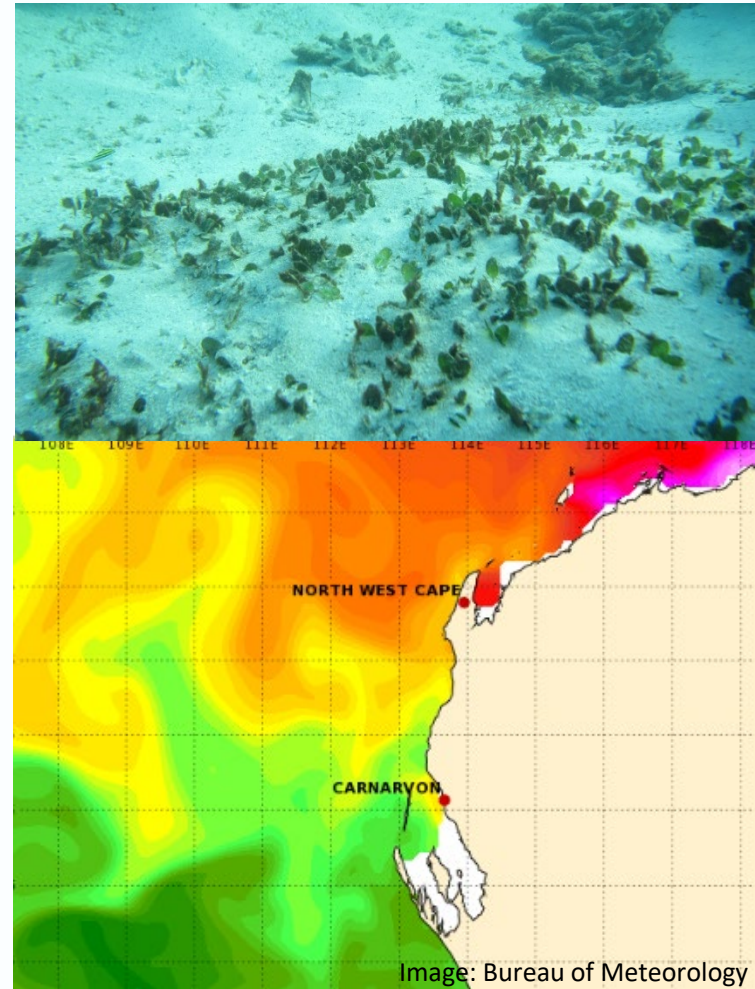
modified from Kooijman 2010

DEB – building and using a model

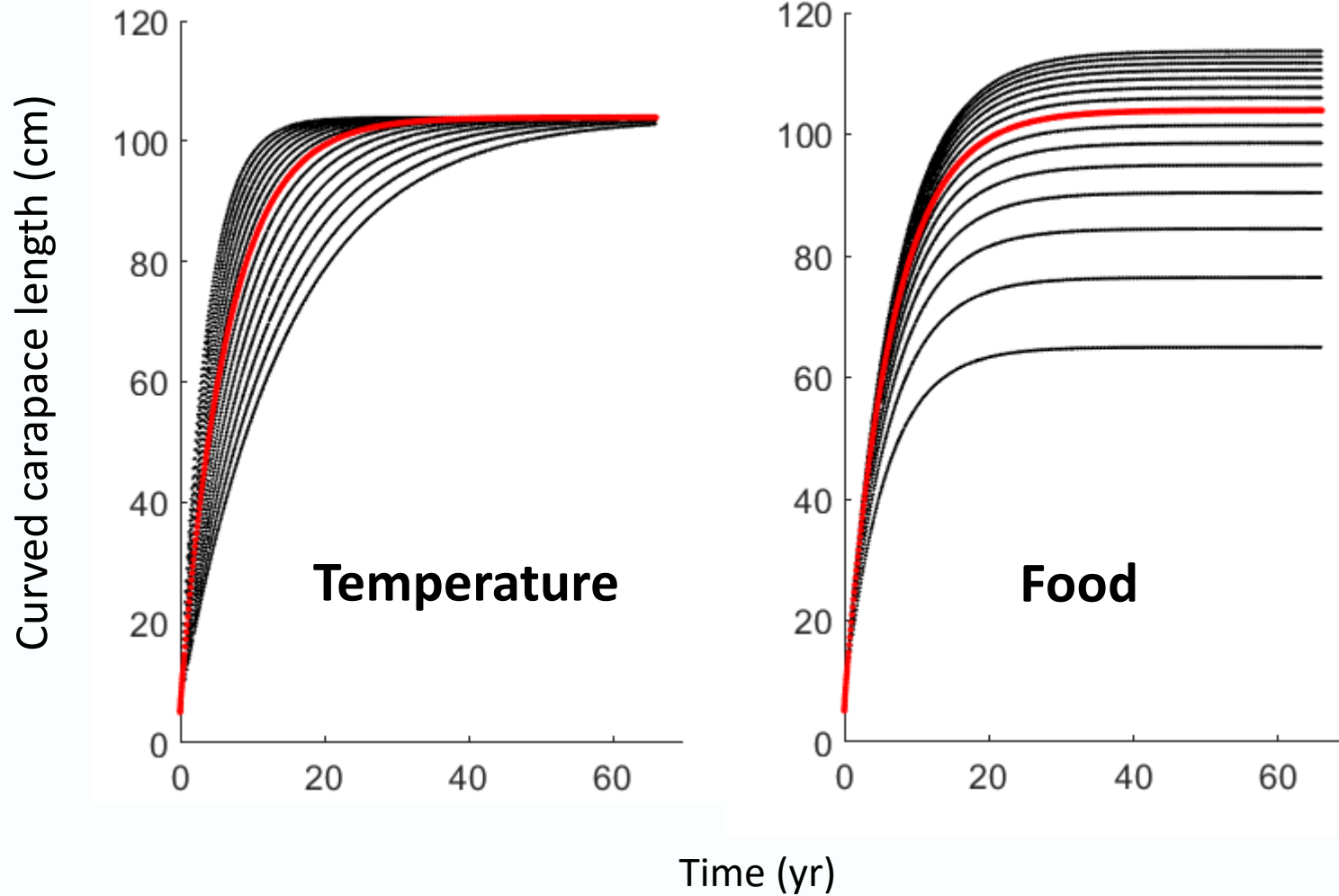


Effects of food and temperature

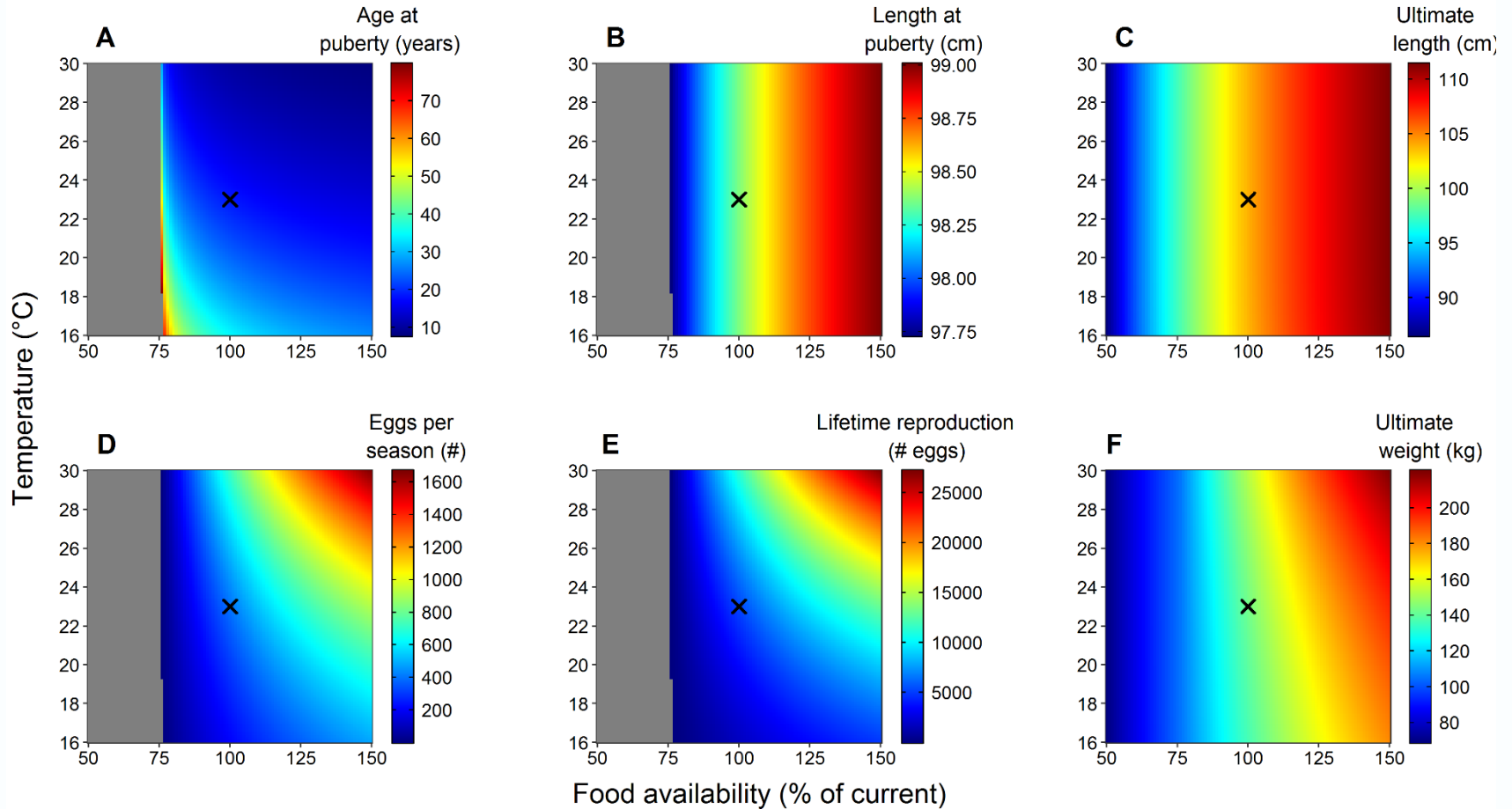
- **Food** influences **amount** of **energy** entering the system
 - Ultimate size
 - Reproductive output
- **Temperature** influences the **rate** of metabolic processes
 - Growth
 - Rate of egg formation



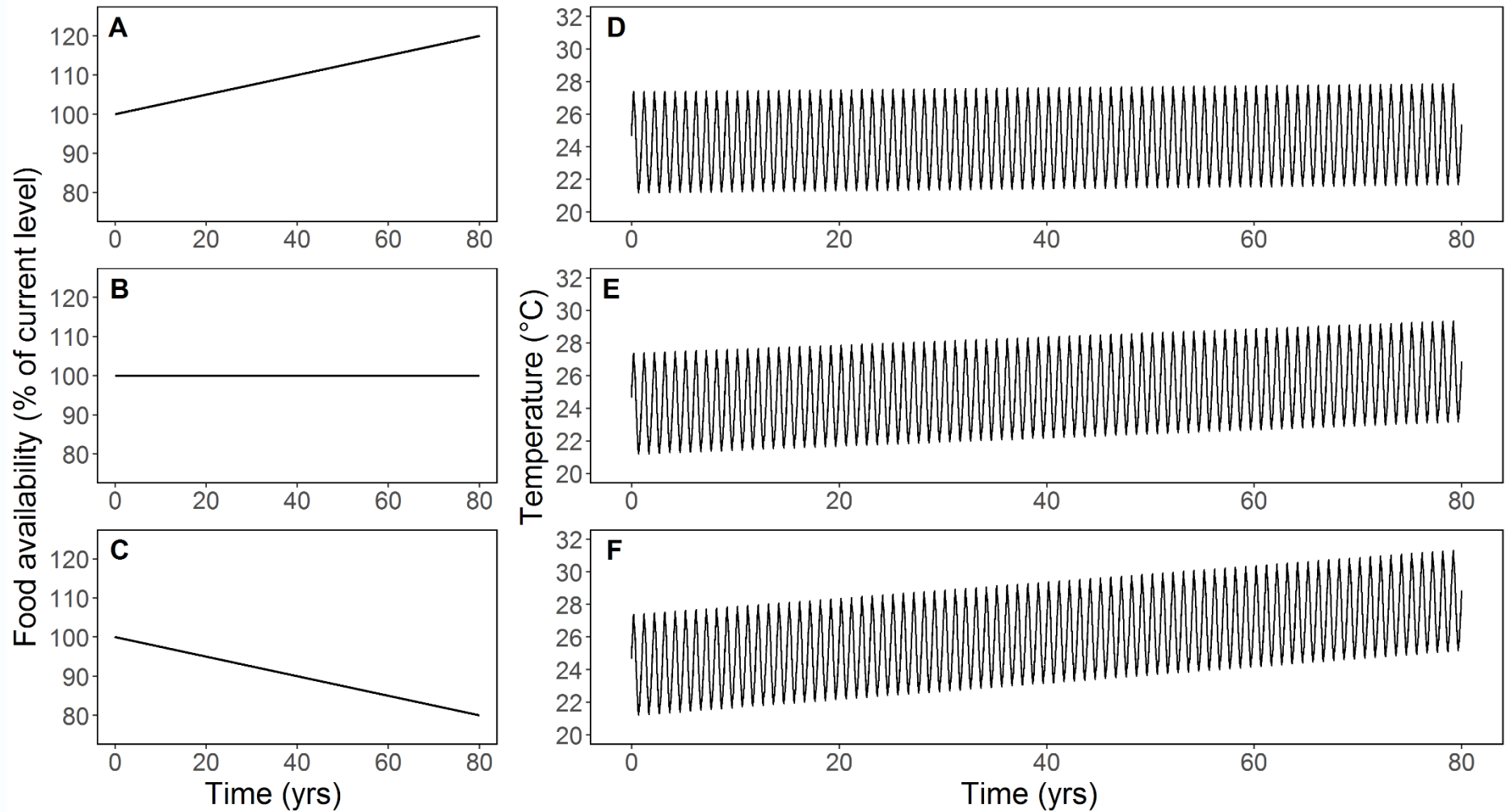
Curved carapace length



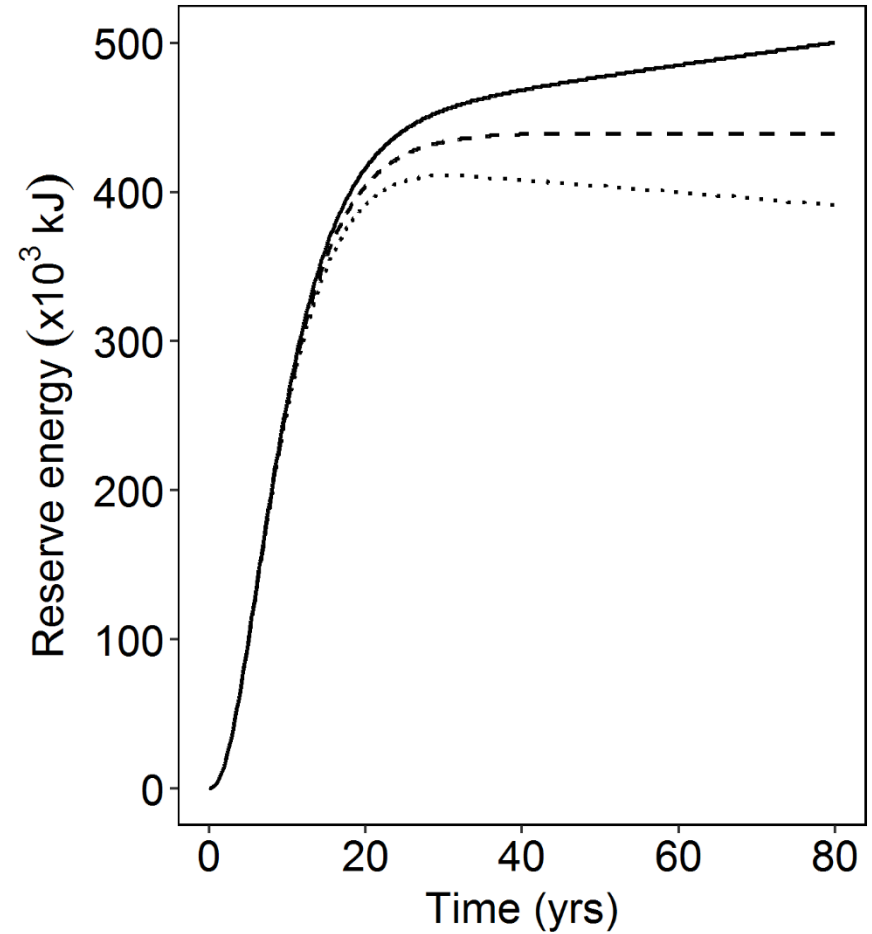
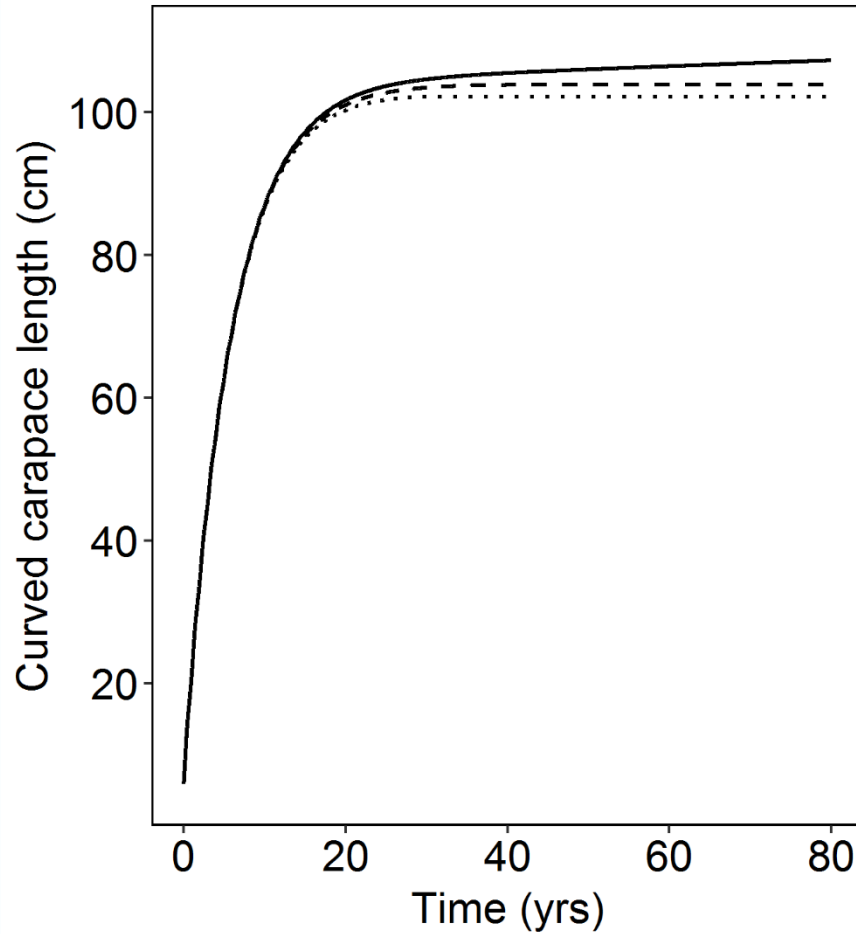
Constant conditions



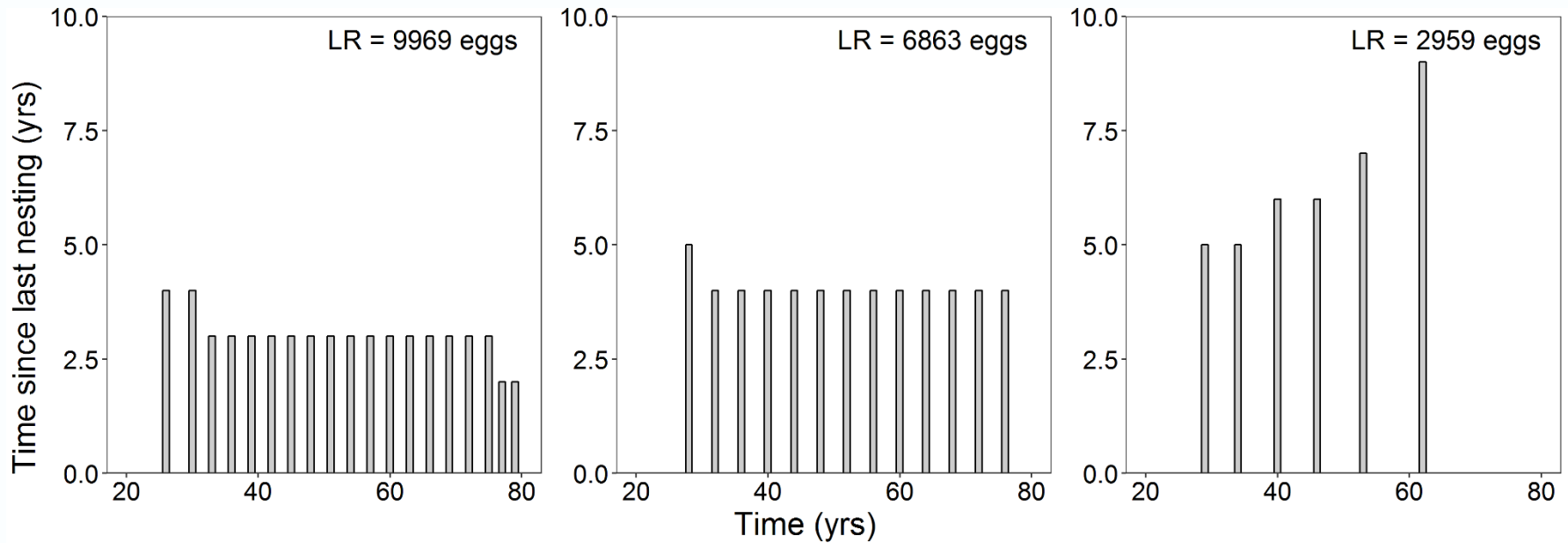
Varying conditions



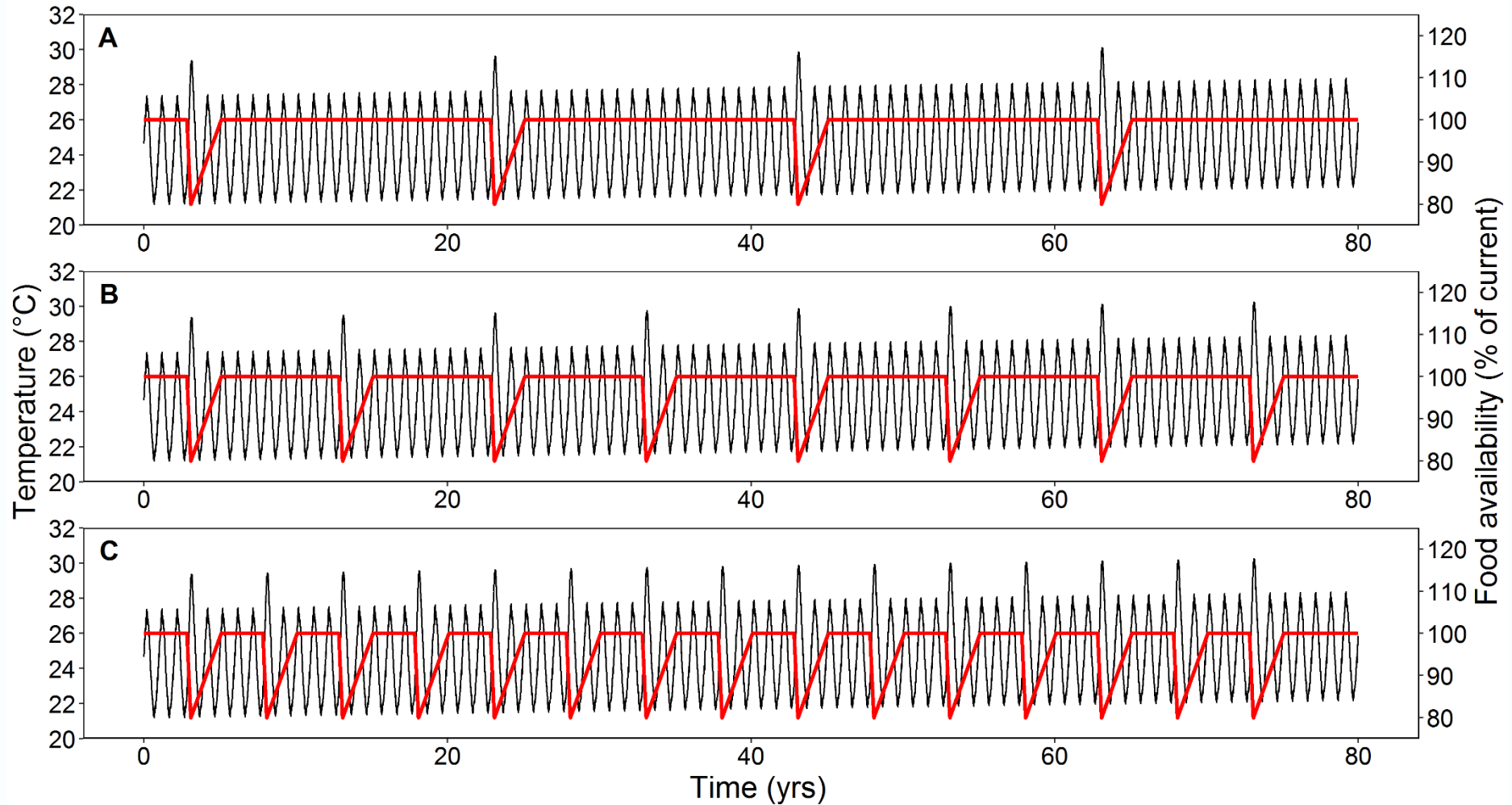
Growth

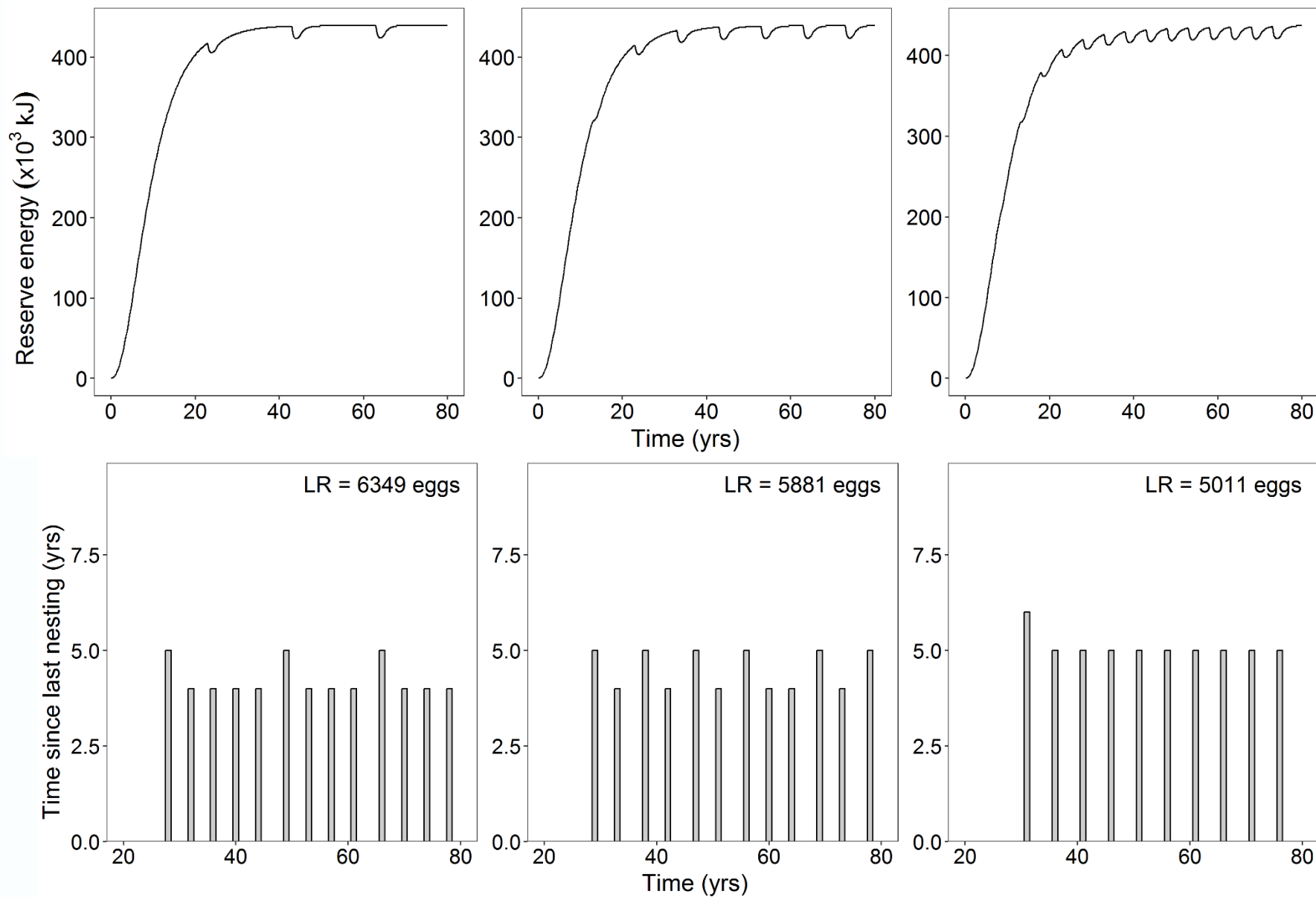


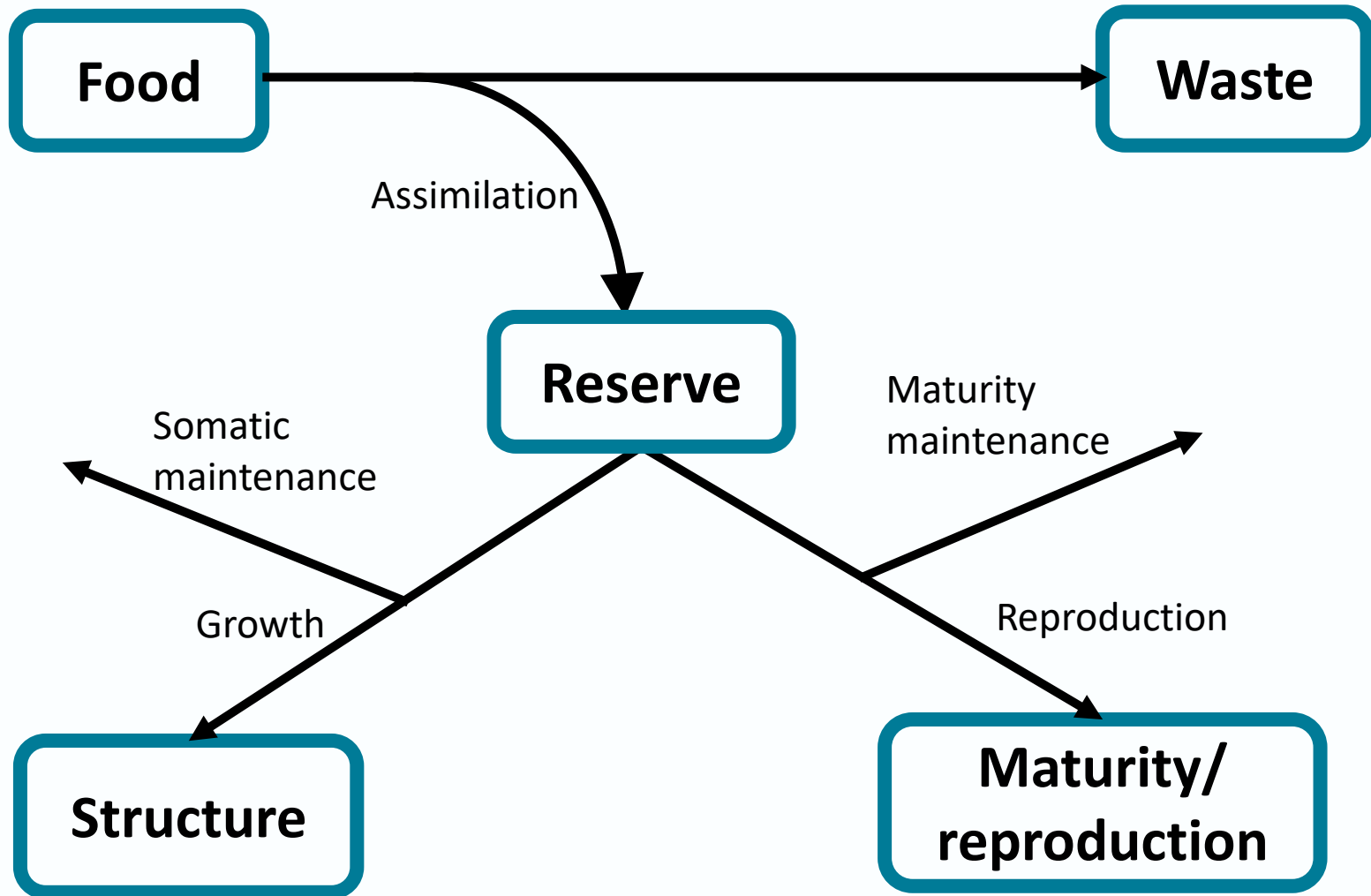
Reproduction



Marine heatwave scenarios







modified from Kooijman 2010

Diet of Ningaloo green turtles

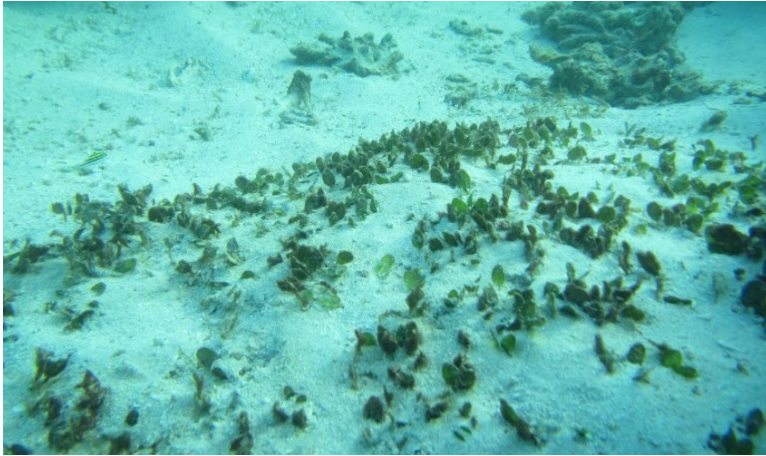
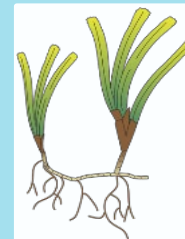
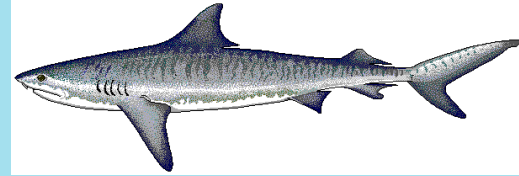


Photo credit: Mat Vanderklift



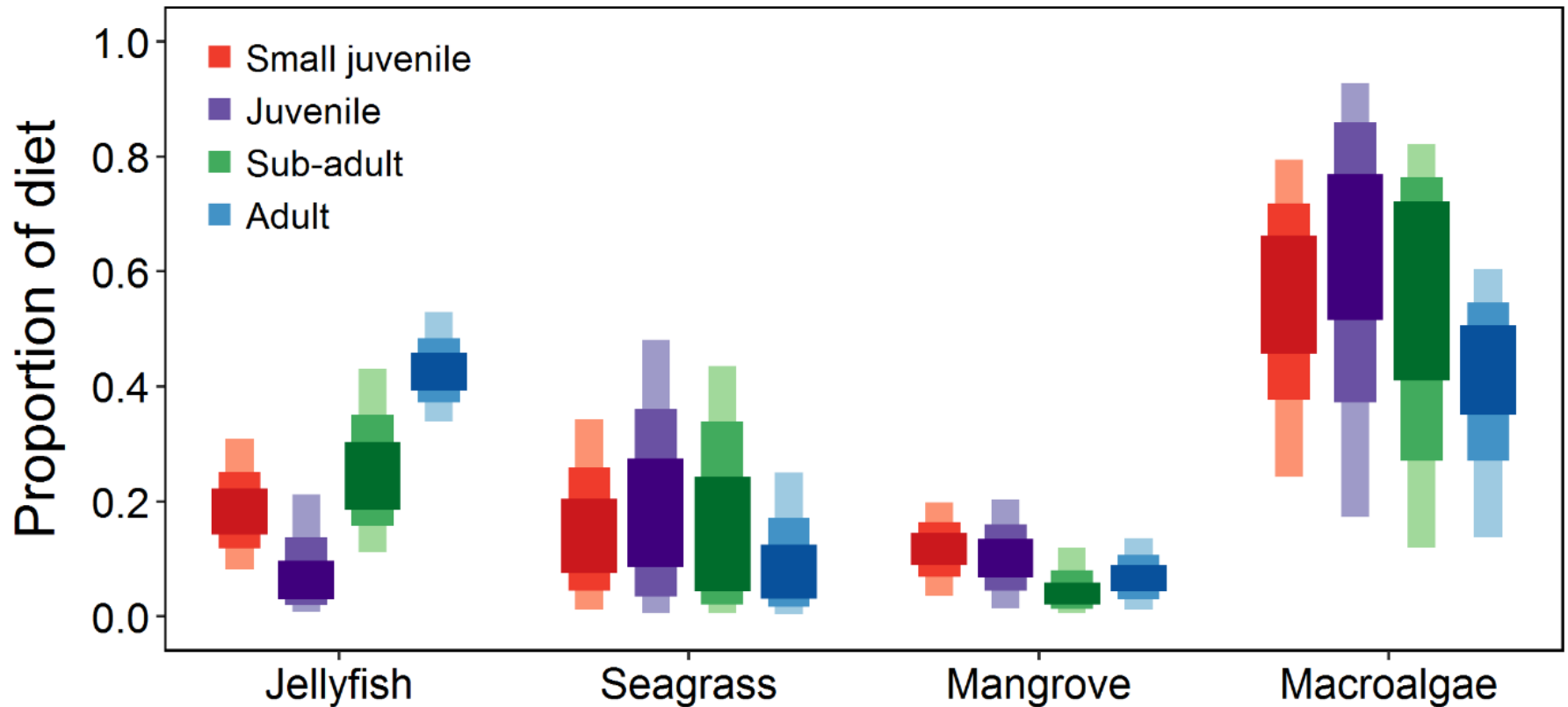
Stable Isotope Basics

$^{15}\text{N} : ^{14}\text{N}$

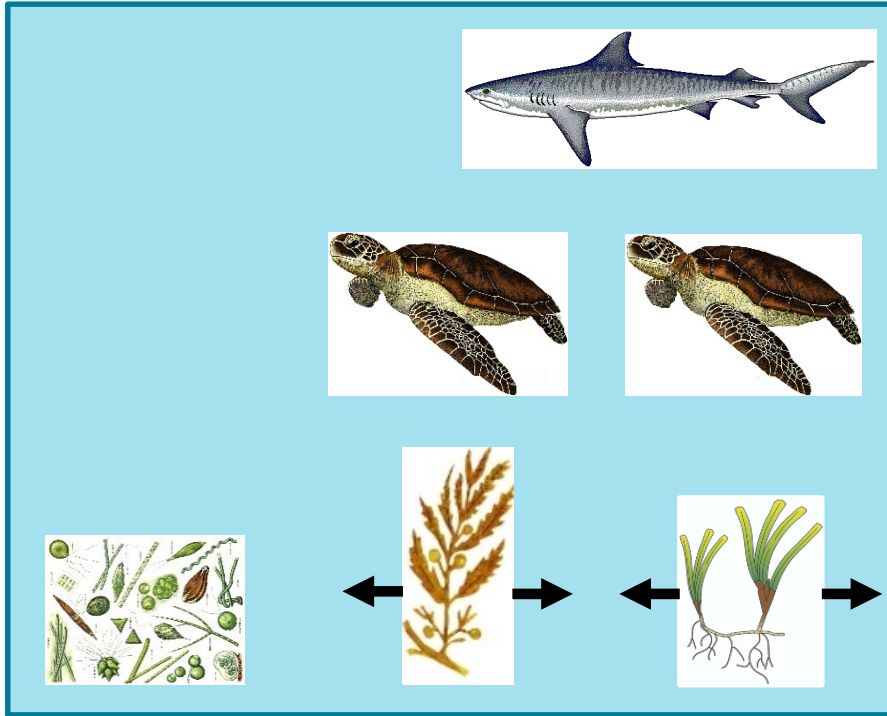


$^{13}\text{C} : ^{12}\text{C}$

Ningaloo green turtle diet



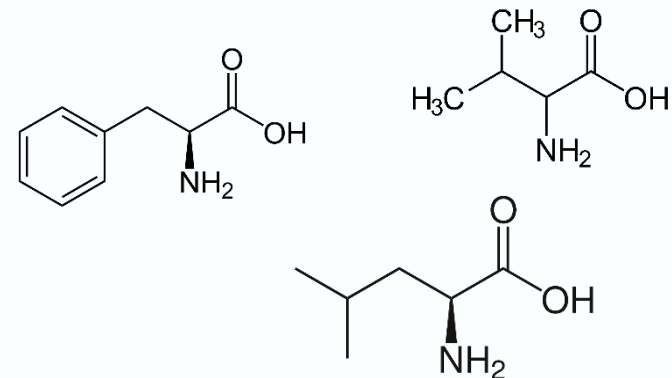
Stable isotope techniques

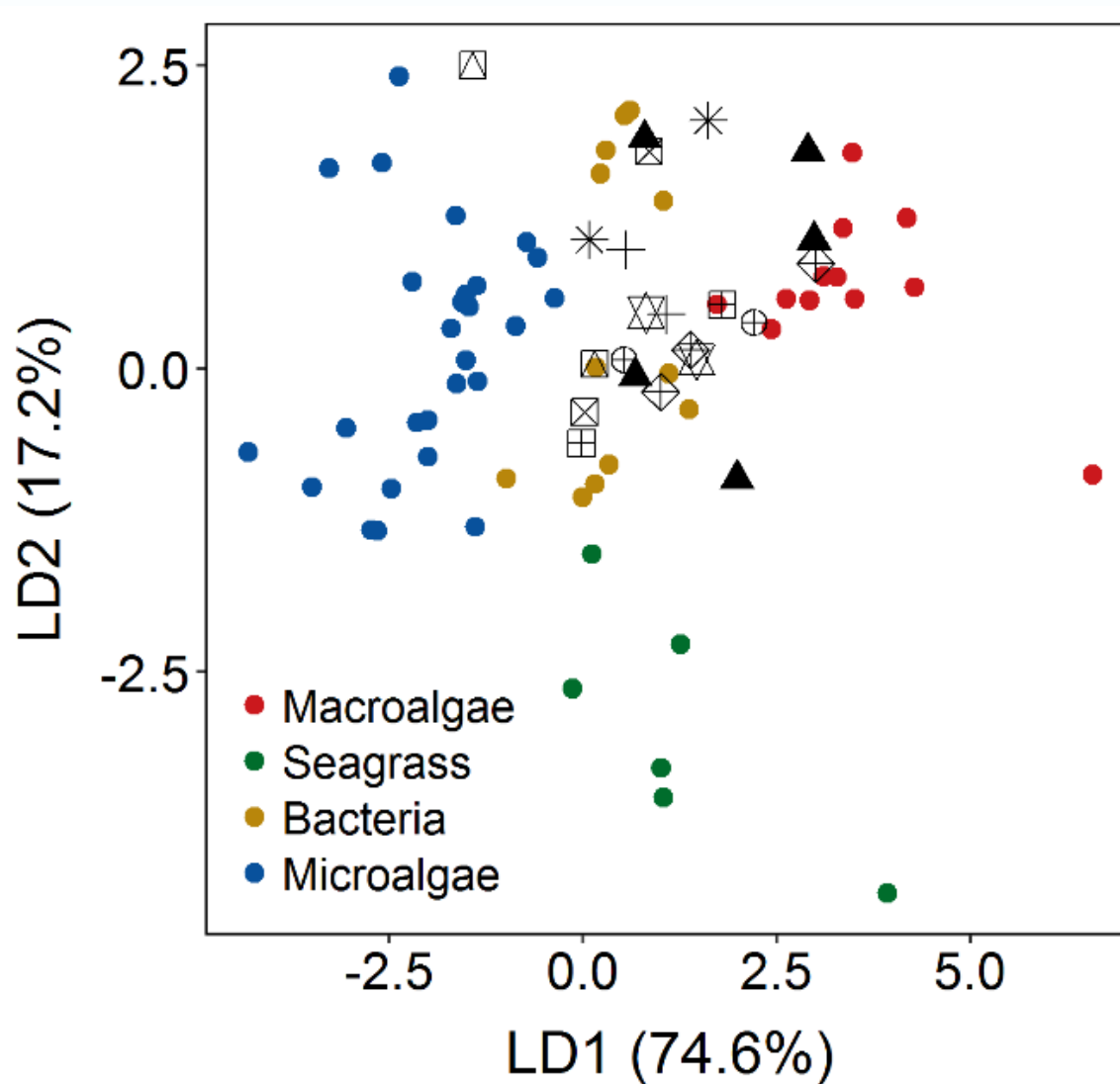


bulk tissue



amino acids





Conclusions

- Food availability changes are predicted to influence growth and reproduction
- Frequent marine heatwaves are predicted to reduce reproductive output
- Amino acid isotope analysis supports bulk tissue analysis – primarily herbivorous diet
- Dietary differences with size



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Thank you!



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