Energy Investment in Growth Rate and Reproduction

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Keywords

allometry; life history; metabolism; productivity; reproduction

Introduction

Recent results from Barneche et al. (2018) have shown that larger fish produce disproportionately more offspring than smaller fish, that is to say reproductive output is hyper-allometric. In other words, a single 2kg fish will produce more offspring than two 1kg fish. Currently, many models make the assumption that reproduction is isometric with mass, for example Charnov et al. (2001) and West et al. (2001). Additionally, it has been shown that organism resource interactions can also show an allometric relationship based on the dimensionality of interactions, where 3D interactions, such as those in many fish, also showed hyper-allometric scaling (Pawar et al., 2012). This project aims to use and build upon these reproductive and growth models to understand how, from a metabolic standpoint, this phenomenon occurs.

Methods

The project will use a lifetime reproductive output model to infer how energy allocation to reproduction and growth changes throughout development. Some models will be implemented with some modification so as to take allometric reproduction into account (Charnov et al., 2001, West et al., 2001). Others which already incorporate allometric reproductive output, such as Burger et al. (2019), will be compared to these modified models for comparison. First, parameters will be optimised so as to maximise reproductive output, then the model will be fitted to data in order to compare how "real world" growth compares to the purely theoretical case and what inferences can be made based on the results.

The results will then be used to compare the allometry of reproduction with the dimensionality of resource interaction to examine the possibility of a relationship between the two.

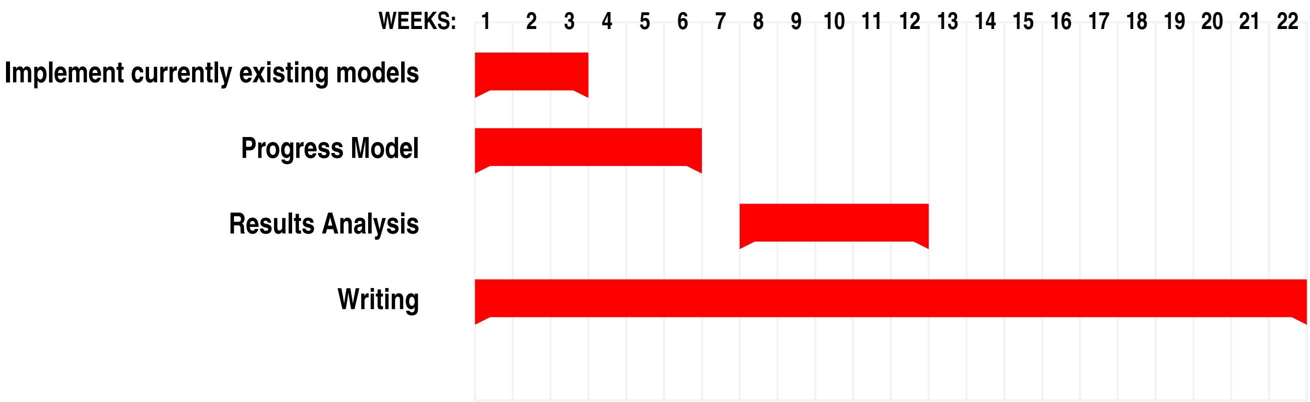
Anticipated Outcomes

- Design of a model that can describe the growth of organisms, regardless of whether reproduction is allometric or isometric.
- To quantify the energy allocation of an organism throughout ontogeny, specifically with regard to growth and reproduction.

- Determine whether dimensionality of resource interaction may be an indicator of the hypo- or hyper-allometry in reproduction.

Timeline

April 15th	Implement currently existing models
May 15th	Finish progressing the model / model ready to apply to data
May 15th	Introduction rough draft
May 22nd	Methods rough draft
June 26th	Finish results analysis
July 10th	Results rough draft
August 14th	Hand in full draft to Supervisor
August 27th	Submit thesis



Budget

Category	Item	Cost	Justification
Data Backup and storage			Backup and storage of project data to ensure no lose of time or progress due to data loss
	1TB external Hard drive	£62	
Travel			Travel to the UK once travel restrictions are lifted
	Flight	£100	

References

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