PRIOTITISING FISH EVOLUTIONARY HISTORY
FOR CONSERVATION ACTION

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1   Key Words

- Conservation

- Genetics

- Phylogenetic diversity

- Computational

- Marine biology

- Quantitative

2   Introduction

We are currently undergoing the 'sixth mass extinction', which is widely attributed to be caused by human action (Barnosky et al. 2011). If we wish to preserve the biodiversity of the planet, there is an urgent need to act swiftly to preserve what is left (Barnosky et al. 2011). There are limited resources available for conservation work, and therefore it would be beneficial to have a way to 'rank' or prioritise organisms that require the most protection.

The EDGE programme is a programme designed for this purpose. The analysis scores species according to how Evolutionary Distinct and Globally Endangered they are (Isaac et al. 2007). These EDGE scores are used to inform conservation action and policy across the world (Isaac et al. 2007).

EDGE lists have been created for many clades of organisms, but nothing has yet been done for ray-finned fish. This project aims to start the process for the EDGE analysis of ray-finned fish.

3   Methods

To determine which clade within the ray-finned fish group should be selected for EDGE analysis in this project, we will run workshops with the marine experts at ZSL. This project will not be aiming to create an EDGE list for every ray-finned fish species, as there are approximately 31,000 species.

To perform the EDGE analysis we will use two data sources. The endangered status of the species will be taken from IUCN Red List extinction risk data, where available. The phylogenetic trees will be sourced from publicly available data, which is available from http://fishtreeoflife.org (Faith et al. 2018). The evolutionary-distinctness of the species can be calculated in a number of ways, and this project will drawn from the methodology developed by Gumbs et al. 2018, Faith 2008, and Steel, Mimoto, and Mooers 2007.

The majority of the computational work in this project will be performed in R, as there are a number of packages developed specifically for this type of work.

Once EDGE analysis has been performed on the chosen clade(s), this project will work further with the marine team at ZSL and do desk research to discover if there are any conservation efforts underway for any of the species in the clade, and produce an analysis of any action that is being taken.
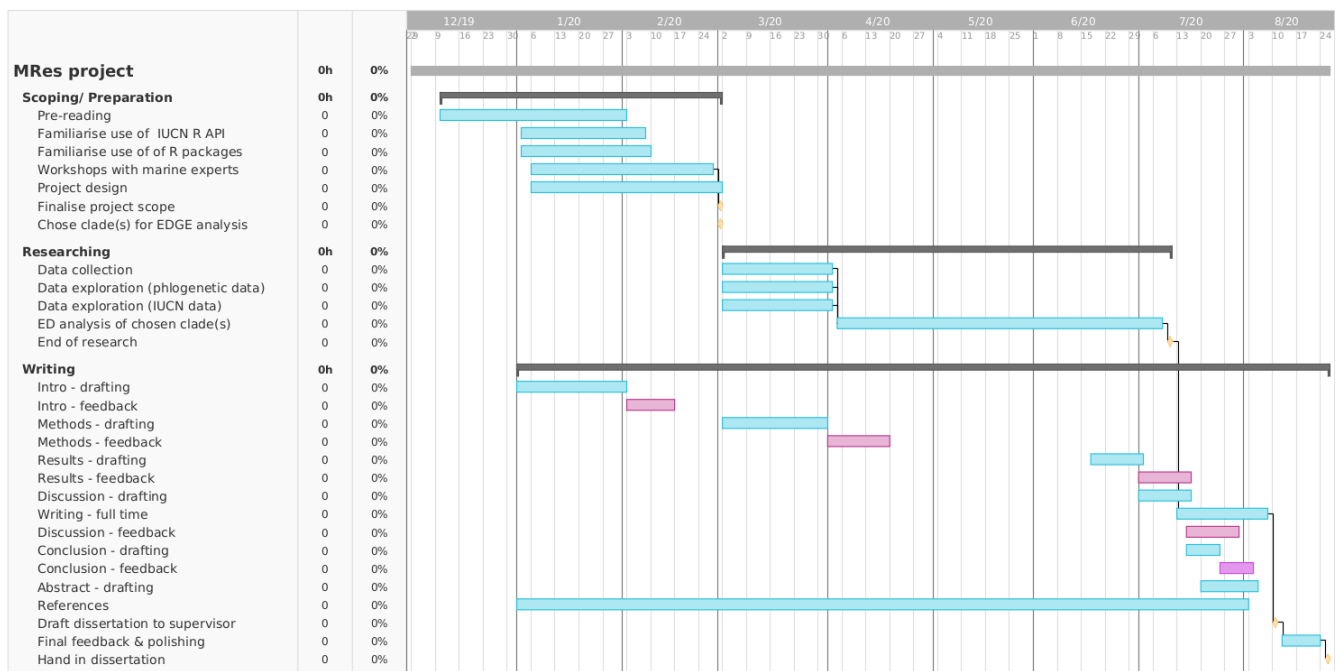
MRes project	**0h**	**0%**
Scoping/ Preparation	**0h**	**0%**
Pre-reading	0	0%
Familiarise use of IUCN R API	0	0%
Familiarise use of of R packages	0	0%
Workshops with marine experts	0	0%
Project design	0	0%
Finalise project scope	0	0%
Chose clade(s) for EDGE analysis	0	0%
Researching	**0h**	**0%**
Data collection	0	0%
Data exploration (phlogenetic data)	0	0%
Data exploration (IUCN data)	0	0%
ED analysis of chosen clade(s)	0	0%
End of research	0	0%
Writing	**0h**	**0%**
Intro - drafting	0	0%
Intro - feedback	0	0%
Methods - drafting	0	0%
Methods - feedback	0	0%
Results - drafting	0	0%
Results - feedback	0	0%
Discussion - drafting	0	0%
Writing - full time	0	0%
Discussion - feedback	0	0%
Conclusion - drafting	0	0%
Conclusion - feedback	0	0%
Abstract - drafting	0	0%
References	0	0%
Draft dissertation to supervisor	0	0%
Final feedback & polishing	0	0%
Hand in dissertation	0	0%

Figure 1: Gantt Chart

4   Anticipated outcomes

The anticipated outcomes of this project are:

- An EDGE list for a clade/clades within the group of ray-finned fish

- An updated methodology that could be applied to the other clades within this group.

- An analysis of the current conservation initiatives that apply to the species within the EDGE list.

5   Budget

The majority of the budget for this project will go towards travel between ZSL and Silwood, with the remained for some computing hardware.

- Equipment: hard drive: 40
  This will be used to back-up all of the work. Online back-up with also be used to store specific work (e.g. github for code).

- Equipment: projector: 40
  Projectors can be used to help de-bug code by projecting it onto whiteboards and walking through step by step. As this project will be very computationally intense, this tool is likely to be used very frequently.

- Travel: Silwood - London: £12 * 30 trips = £360

- **Total: £440**

References

Barnosky, Anthony D. et al. (2011). "Has the Earth's sixth mass extinction already arrived?" In: *Nature* 471.7336, pp. 51–57. ISSN: 00280836. DOI: 10.1038/nature09678.

Faith, Daniel P. (2008). "Threatened species and the potential loss of phylogenetic diversity: Conservation scenarios based on estimated extinction probabilities and phylogenetic risk analysis". In: *Conservation Biology* 22.6, pp. 1461–1470. ISSN: 08888892. DOI: 10.1111/j.1523-1739.2008.01068.x.

Faith, Daniel P. et al. (2018). "Tetrapods on the EDGE: Overcoming data limitations to identify phylogenetic conservation priorities". In: *PLoS ONE* 22.11, pp. 51–57. ISSN: 19326203. DOI: 10.1038/nature09678. URL: http://dx.doi.org/10.1038/s41586-018-0273-1.

Gumbs, Rikki et al. (2018). "Tetrapods on the EDGE: Overcoming data limitations to identify phylogenetic conservation priorities". In: *PLoS ONE* 13.4, pp. 1–19. ISSN: 19326203. DOI: 10.1371/journal.pone.0194680.

Isaac, Nick J.B. et al. (2007). "Mammals on the EDGE: Conservation priorities based on threat and phylogeny". In: *PLoS ONE* 2.3. ISSN: 19326203. DOI: 10.1371/journal.pone.0000296.

Steel, Mike, Aki Mimoto, and Arne Mooers (2007). "Hedging our bets: The expected contribution of species to future phylogenetic diversity". In: *Evolutionary Bioinformatics* 3, pp. 237–244. ISSN: 11769343. DOI: 10.1177/117693430700300024. arXiv: 0704.2649.

6 Supervisor approval

I have seen and approved the proposal and the budget.

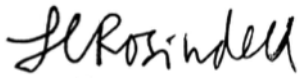Supervisor name: Dr. James Rosindell

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