Open Research Case Study

DEBBIES: Building an Open Life History Database to Predict Animal Responses to Environmental Change

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Introduction

What began as small, student-led datasets has grown into a global open resource, published in Scientific Data ([Smallegange & Lucas 2024](#)) and downloaded >400 times. Here, I reflect on how openness shaped DEBBIES, its benefits and the challenges faced.

Research context

My research explores how life history strategies determine animal population responses to environmental change, central to understanding biodiversity under global change. Existing datasets target species where individuals can be followed ('tagged') from birth to death, but this excludes most of Earth's biodiversity and the insights 'data-deficient' species offer for predicting responses to change.

DEBBIES includes easy-to-collect life history traits (growth, mortality, reproduction) for 330 data-deficient, coldblooded species (Fig. 1). These traits can be used to parameterise dynamic energy-budget-integral-projection-models (DEBIPMs) to calculate quantities like population growth and resilience that can be linked to conservation status or biogeographical characteristics. Compared to existing datasets, DEBBIES accommodates easy cross-taxonomical comparisons, many data-deficient species and population forecasts under novel environmental conditions because DEB-IPMs incorporate a mechanistic description of the energy trade-off between growth and reproduction.

Figure 1. DEBBIES dataset covers 330 species from mites to manta rays. AI-generated.

No single student project could have created such a resource on its own, but by pooling contributions over time and committing to open practices, we built a dataset with the potential to unlock general predictions on ectotherm population responses from only a few key traits.

Open practices embedded in DEBBIES

Open practices have been embedded in DEBBIES from the outset:

- **Open data:** Published in Scientific Data as a FAIR, peer-reviewed, citable resource.

- **Student-driven:** Since 2017, students have expanded and refined the dataset, learning open science and leaving a resource for others.

- **Open access publishing:** Analyses using DEBBIES, including papers in [Ecology Letters](#), [Ecology and Evolution](#), and [Journal of Animal Ecology](#), have all been published open access.

- **Open education**: I have developed an [interactive DEBBIES Shiny App](#) that allows students to explore demographic parameter values and calculate key demographic quantities. This tool provides hands-on experience with population modelling, supporting teaching in conservation and ecology courses, accompanied by [YouTube tutorials](#).

- **Open communication**: Outputs shared via [blogs](#), [podcasts](#) and [press releases](#), with coverage by [Phys.org](#) and [OneGreenPlanet](#).

- **Beyond DEBBIES**: I have also championed open peer review and publishing. As a recommender for [Peer Community in Zoology](#) and an author in the [Peer Community Journal](#), I have both contributed to and benefited from a system that removes barriers to access and emphasises transparent evaluation. I have encouraged colleagues to adopt these practices and several have since published their work through [Peer Community In](#) (PCI).

Barriers and challenges

Data standardisation challenges were overcome with robust metadata protocols and student training. Sustainability was addressed by embedding contributions in student projects, ensuring annual growth of the dataset. Finally, communicating complex demographic models to non-specialist audiences required new approaches, which I developed through blogs, videos and media engagement.

However, I have also encountered institutional barriers. While I sought to involve the university library in supporting PCI, financial constraints meant this was not possible. This experience highlights a wider challenge: sustaining open publishing models requires institutional and individual commitment.

Benefits realised

The open practices underpinning DEBBIES have generated wide-ranging benefits:

- **For students:** They gain authentic experience in contributing to a global, open resource and see their projects live on beyond their research.

- **For research:** DEBBIES underpins multiple open access papers and is widely reused. • For teaching: The Shiny app allows interactive exploration of demographic models, embedding open science and modelling skills into the curriculum.

- **For society:** Public-facing communication has raised awareness of biodiversity responses to environmental change, engaging wider audiences with ecological research.

Lessons learned

I have learned that openness sustains research in unexpected ways. Students are motivated when they know their work contributes to something larger than their dissertation. Good documentation and metadata are as important as openness itself, enabling others to reuse and expand the dataset. And open communication is not an add-on but an essential step in making research relevant and trusted beyond academia.

Conclusion

DEBBIES demonstrates how embedding open science into student research, publishing, communication and teaching creates a living dataset that supports science, empowers students and can engage society. Open science is not only transparency; it builds communities and resources that make research more robust and accessible.

References

Smallegange IM, Lucas S. 2024. [DEBBIES Dataset to study life histories across ectotherms](#). Scientific Data 11: 153.