OER authorship as a project-based graduate course

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Intro

1. brief review course-based research/projects for undergraduate and graduate classes

Project description

2. OER creation as a course-based project
3. Our project: OER creation in a biology grad course

What we learned

4. Lessons so far

Inspiration

Trust, T., Maloy, R. W., & Edwards, S. (2022). College student engagement in OER design projects *Active Learning in Higher Education*

Course-based research

Course-based research: undergraduate

- **main feature: whole classes of students address a research question of interest to scientists/community members (Auchincloss et al. 2014).**
- allow scaling of mentor-based research experiences to large program enrollments (e.g., biology)
- greater engagement of students through real-world meaningful outcomes (see Dolan 2016).
- students' work is iterative: fail, trouble-shoot/problem-solve, and repeat
- will require a range of related skills (e.g., collecting data, defending arguments, and collaboration)
- examples

https://taylorinstitute.ucalgary.ca/sites/default/files/Resources/Course-Design/CURE-Examples-2019.pdf

https://serc.carleton.edu/curenet/collection.html

Course-based research or projects: graduate

- not much documentation at the graduate level, more examples of OER course projects
- e.g.

Jacobsen, M., McDermott, M., Brown, B., Eaton, S. E., & Simmons, M. (2018). Graduate students' research-based learning experiences in an online Master of Education program

Zapata, G. C. (2020). Sprinting to the finish line: The benefits and challenges of book sprints in OER faculty-graduate student collaborations.

How does a project-based course differ from a typical graduate course in biology

- typically two types of courses:
  - reading or literature review (reception/analysis of content)
  - techniques (e.g., stats) (application of skills)
- project-based course will require both these elements, and in addition:
  - **selection of content**
  - other skills not specific to the course (e.g., use of public repository)

BIOL 652 OER project

Using OER creation as a course-project

- Shifting students' roles from consumers to curators and creators of OERs (Trust et al. 2022)
  - increased motivation,
  - improved attitudes about learning,
  - aided the achievement of course learning objectives, and
  - supported the development of other valuable skills

Ebook OER creation

- survey of 5 courses (55 students) in Trust et al. (2022)
  - a majority of students (76%) reported a positive impact of OER design project on attitude and motivation
  - none reported a negative impact
  - across design projects, largest reported for ebook (100% of students)

BIOL 652 project: Create an OER resource on structured population modelling

- the first author (instructor) proposed a course project of creating an OER resource
  - could benefit other biology graduate students and early career professionals anywhere on the globe,
  - would be a permanent record of scholarship,
  - might provide incentive for students to more thoroughly engage with the material.

BIOL 652 Course design

Relevance - professional development: students are producing public educational products that can be used by others, rather than simply receiving information

Iteration - opportunity for formative comments from instructor and peers:

present outline $\rightarrow$ incorporate input in draft of online text $\rightarrow$ final round of revision

Ownership - project lead on each section: provides outline, divides material among other students, and gives feedback

Exemplar - the instructor completed assignments at the same time as the students: examples of coding and pedagogical techniques

Specific output

- an online e-text (see draft at https://www.ecotheory.ca/teach/BIOL652.html)

Module 1: Unstructured Population Models

Introduction

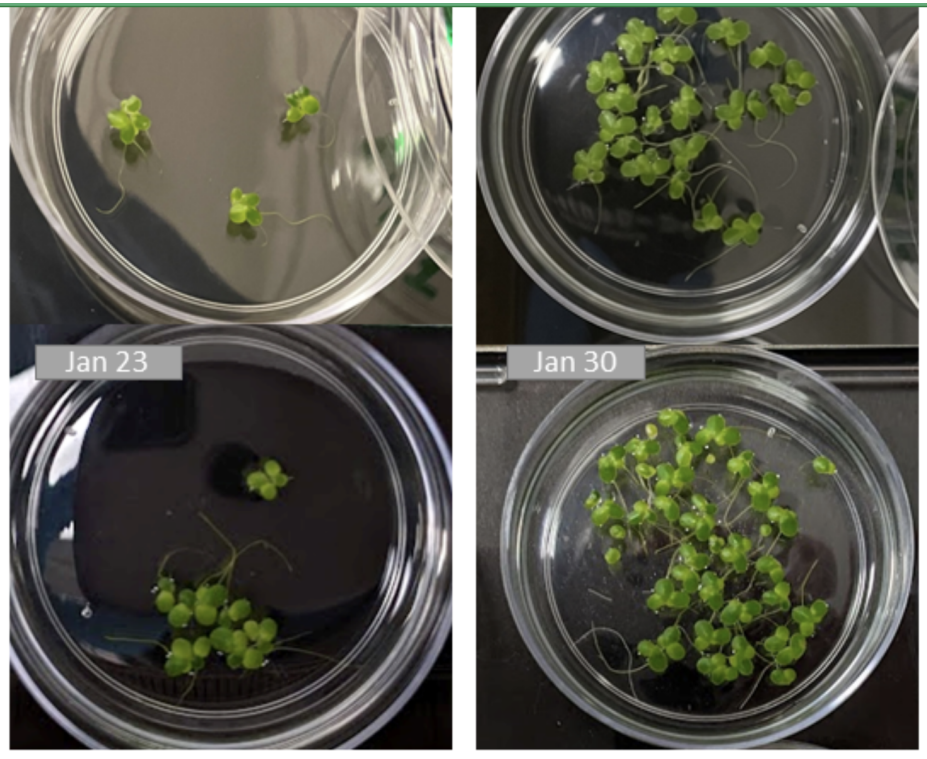
This module covers the most simple models to predict the dynamics of populations, such as **exponential models**. Next, **stochasticity**, or random effects, is approached as affecting population dynamics. Then, **density-dependency** is introduced as a phenomena that takes place when the amount of individuals present in a given population interferes with the growth rate of that population. Lastly, you will learn techniques to compare models to data and perform **model assessment**.

Learning outcomes

- Develop practical skills to independently run a model using your own data based on relevant theory and codes
- Assess the results of population models to analyze a problem of your interest

Specific output

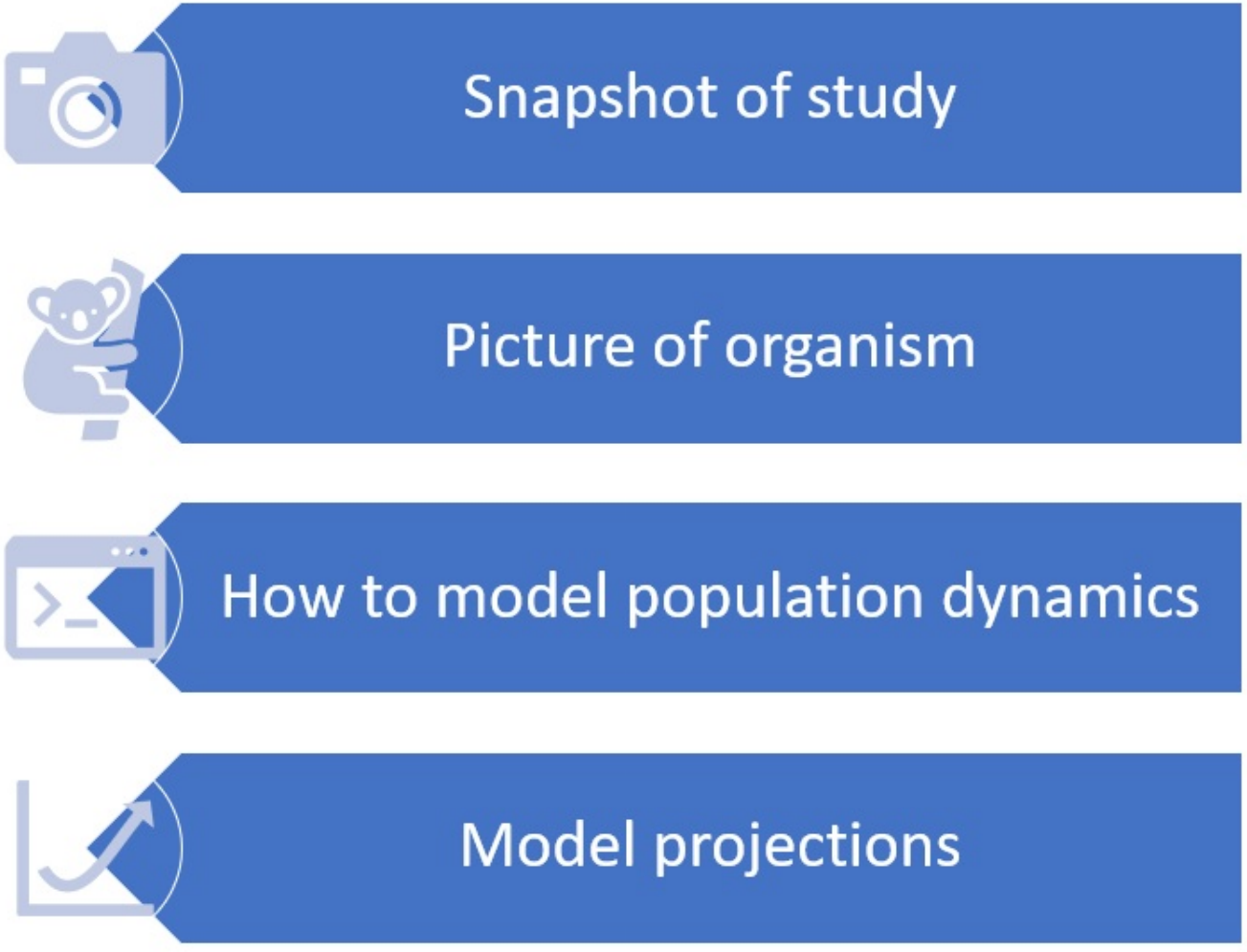
- embedded R code and examples



Populations of duckweeds (Lemna minor) grown in laboratory conditions and optimal temperature

```
# Let's create a dataframe using the duckweed population counts we have just obtained
# from the picture above:
duckweed <- data.frame(day=(c(1,3,5,7,9,11)),pop_size=(c(9,12,23,45,68,103)))

# Now, let's calculate the average daily $\lambda$:
lambda <- (duckweed[6, "pop_size"]/duckweed[1, "pop_size"])^(1/(duckweed[6, "day"]-duckw
```

Connecting Theory, Research, and Application



Applying Theory to Understand Big Problems

- The case of invasive hippos in Colombia

Illustration of current application

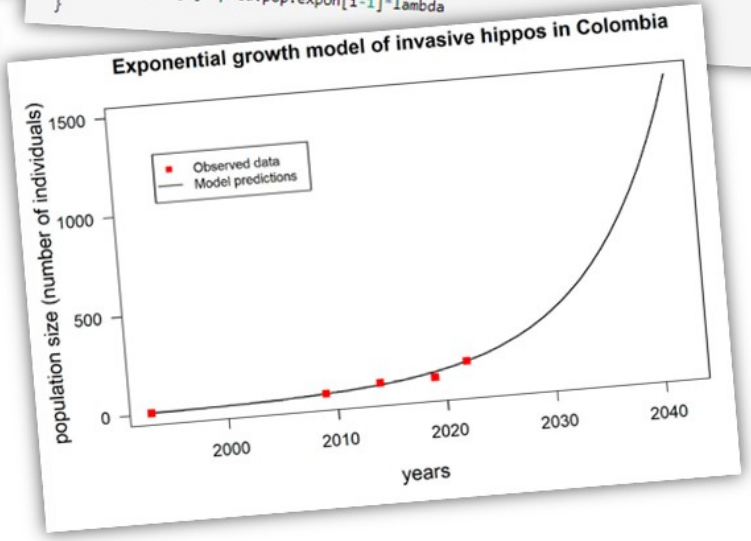
Ecosystem effects of the world's largest invasive animal (Shurin et al., 2020). This research paper discusses population dynamics of invasive hippos in Colombia.

Snapshot of the study

- An invasive population of hippopotamus (*Hippopotamus amphibus*) is showing an exponential growth in Colombia
- These large mammals were brought from Africa to the famous drug trafficker Carlos Scobar's private zoo

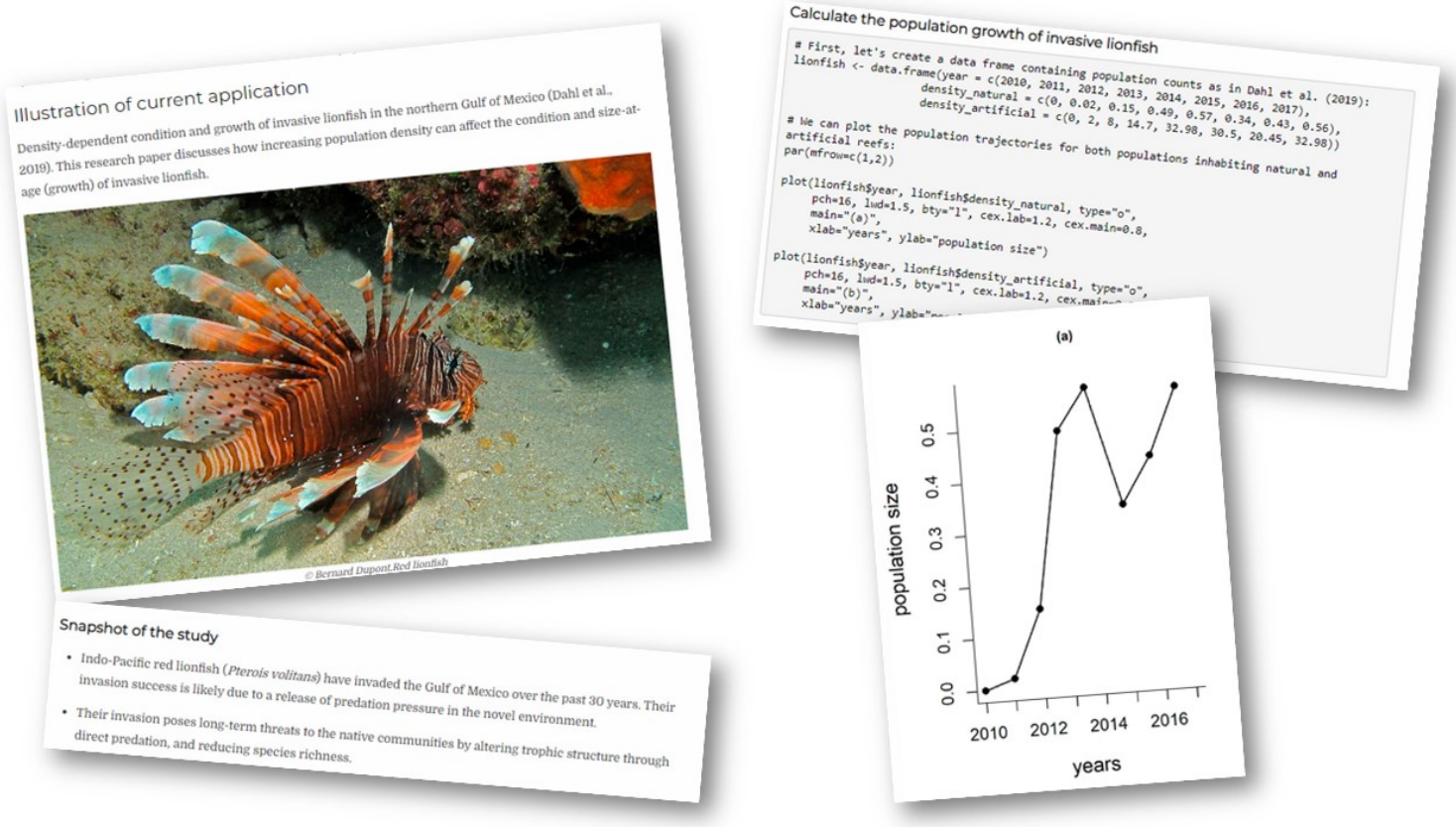
```
# To predict population sizes, we first set our initial population size
initial<-hippo$pop_size[1]

# And we create an empty vector in which we will later include population sizes for the
# next 50 years
pred.pop.expon<-vector("numeric", 50)

# Our modelling starts with initially observed population sizes
pred.pop.expon[1]<-initial

# And we add a function to calculate population sizes according to our previously
# estimated growth rates
for(i in 2:50){
  pred.pop.expon[i]<-pred.pop.expon[i-1]*lambda
  }
```

© Bernard Dupont, Grazing hippos, Creative Commons CC-BY-SA-2.0 license



Improving Learning Through Case Studies

- The case of invasive lionfish in Mexico



Lessons

Perceived difficulties: Jan 2023 - Now

- Overwhelmed by multiple skills/requirements
  - the course topic, population modelling, requires programming, mathematical and statistical skills in addition to conceptual and quantitative content
  - combining all this with an additional task of formatting materials for OER presentation
- completing assignments which involve teaching others requires reading and summarizing far more literature than an ordinary course with curated materials.

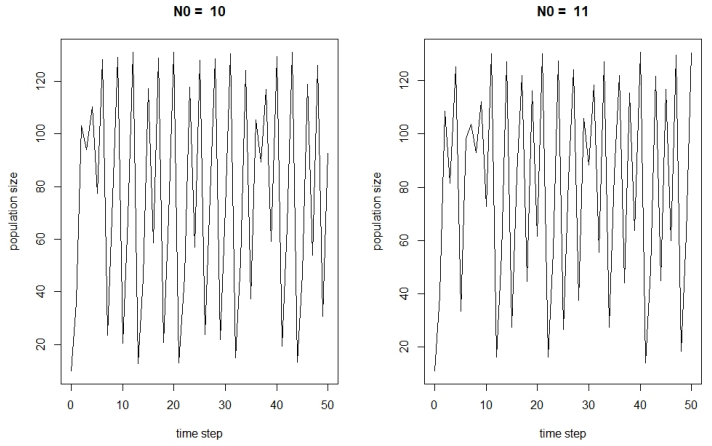
Perceived benefits: Jan 2023 - Now

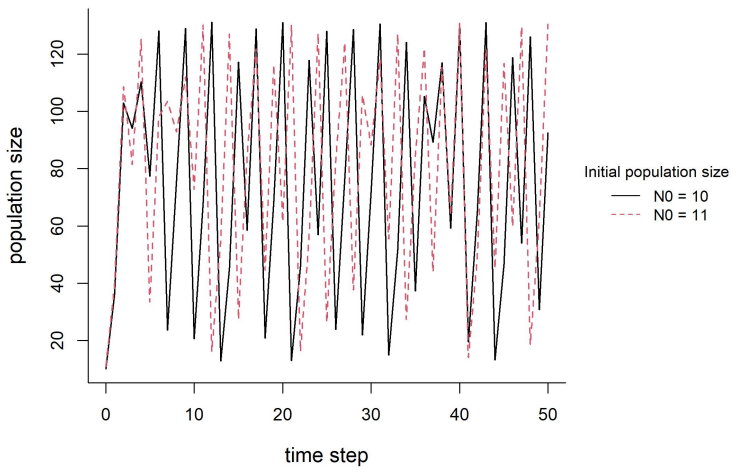
- the curation of the OER materials using versioning on github, and markdown format for open access, is an important additional training component
  - directly relates to needed skills in open science and file versioning
- the development of additional teaching skills, such as the need to identify with learners that are less familiar with the topics in order to simplify and organize the materials
- permanent record!

Coding skills developed from the OER experience

Graphic skills

- Graphs and figures are provided in many section for demonstrating some important concepts.
- The process of re-creating the graphs through code deepens the understanding of the material.
- Better formatting and visualization for the audience.





Coding skills developed from the OER experience

Skills in markdown, Rmarkdown, latex and github

- Compile the .md file into different formats for demonstration and presentation.
- Different sections of each module are usually divided among the authors.
- Version control is necessary and important.
- Bibliography and citation using RMarkdown and BibTex file.

Summary

Summary

- benefits:
  - developing professional skills related to teaching, literature review, and open science practices, beyond the stated learning objective of developing mastery in population modelling
  - permanent public resource
- difficulties:
  - workload cost associated with these benefits

Would I do this again? Instructor

Yes! But....

- I would include a smaller section of material
- I would scaffold by:
  1. providing an example set of OER materials that are appropriate for course(for example, relevant intro material) $\rightarrow$ learn material, critique design
  2. second set of partially completed materials that students populate $\rightarrow$ learn material, practice coding, writing materials and design
  3. have the students complete the final portion of the material with no template

Would I do this again? Students

Literature cited

Jacobsen, M., McDermott, M., Brown, B., Eaton, S. E., & Simmons, M. (2018). Graduate students' research-based learning experiences in an online Master of Education program. *Journal of University Teaching & Learning Practice*, *15*(4), 4. https://ro.uow.edu.au/jutlp/vol15/iss4/4/

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