

# MNS 352/382 MARINE COMMUNITY ECOLOGY



# Today

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Overview course structure

Housekeeping

Short intro to R

Background on my research

Primer to community ecology



# COURSE STRUCTURE

## Course Details

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**Time:** Mondays, 10.30am – 12.00pm (Lecture), Thursdays, 1.00pm – 4.00pm (Lab)

**Location:** UTMSI Admin Wing Video Classroom (S06 201C) and on Zoom

**Instructor:** Dr. Simon J. Brandl (he/him/his), [simon.brandl@austin.utexas.edu](mailto:simon.brandl@austin.utexas.edu)

**Office location:** Marine Science Institute, Main Research Building, 3.05

**Office hours:** by appointment, in-person or [Zoom](#)

# **Undergraduate and Graduate Students**

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**52950 – undergraduate students in Port Aransas**

**53020 – graduate students in Port Aransas & Austin**



# Lectures, coding, and labs

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**Lectures:** 80 minutes, slides on Canvas approximately 30 minutes prior to lecture.

**Labs:** Coding labs with class exercises, fieldwork, and lab processing.



## **Learning outcomes: all students**

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- 1) Gain a thorough understanding of ecological theory.
- 2) Acquire/improve computational skills to explore, analyze, and visualize data in R.
- 3) Express scientific knowledge in writing via research papers, syntheses, and short essays.
- 4) Present your work and follow/contribute to discussions on marine community ecology.
- 5) Survey, sample, process, and analyze marine and estuarine communities in the field.
- 6) Learn how to assess your own progress and growth in a non-traditional grading format.

## Learning outcomes: grad students

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- 1) Gain advanced skills in R that allow you to troubleshoot coding issues and help your peers navigate the pitfalls of data wrangling, analyses, and visualization in R.
- 2) Develop leadership skills in research, including the capacity to steer discussions, tackle problems, find solutions, and delegate tasks.
- 3) Synthesize research outcomes into a brief, compelling narrative, pitched to a journal using a cover letter, abstract, and figures.



Christina Marconi, TA

Dr. Chris Hemingson, Co-instructor





The background of the slide features a wide-angle photograph of a dark blue sea with small, scattered white waves. The horizon line is visible in the distance, and the sky above is a lighter shade of blue with no clouds.

# Resources and policies

## UT Canvas

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- syllabus
- announcements
- lectures
- assignments
- homework
- files and materials

# CHECKS CANVAS REGULARLY



## Companion page

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- coding demos
- coding exercises
- coding solutions



Other resources  
on syllabus

# Policies

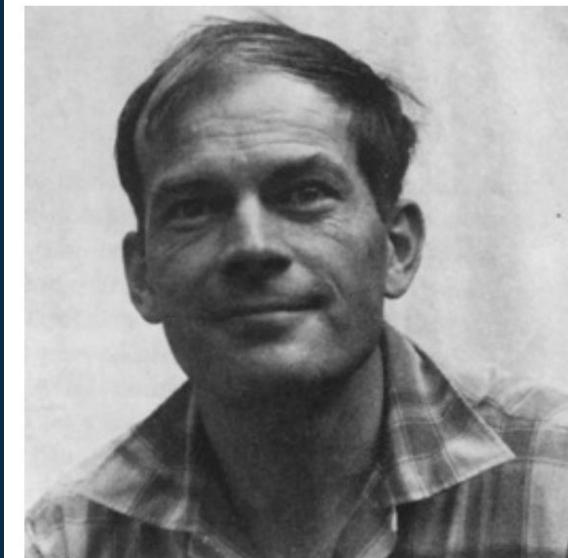
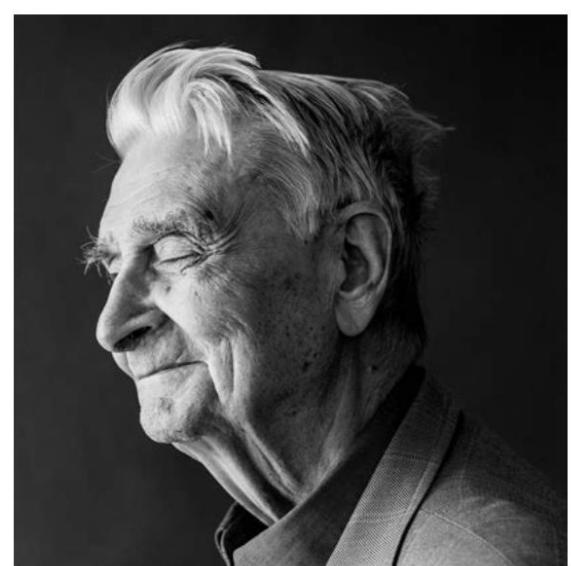
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- Late work and unexcused absences are generally not accepted, but I am flexible in the case of religious observance, illness, or emergencies.
- Accessibility statement: If you have disability, I can work with you to ensure you have equal opportunity to participate. File an Accommodation Letter Request through the Services for Students with Disabilities (SSD) and talk with me ASAP.
- Academic dishonesty, such as plagiarism, is subject to disciplinary penalties. No materials from this course may be shared outside of the class.
- Title IX reporting: I am a responsible employee and must report any Title IX related incidents. Further info on reporting can be found in syllabus.
- AI: Suit yourself.

# Policies

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- 1) Safe and inclusive learning environment
- 2) Respect other's contributions and provide constructive criticism without judgement
- 3) I will honor your request to change your name or pronouns from those listed on the official course roster
- 4) A word on historical community ecology...



# Overview

# Four Modules

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## Module I

Introduction to community ecology

- Community ecology is a dumpster fire

## Module II

A general theory of ecological communities

- Four processes: drift, selection, dispersal, speciation

## Module III

Empirical evidence in marine systems

- How these processes shape real-world communities

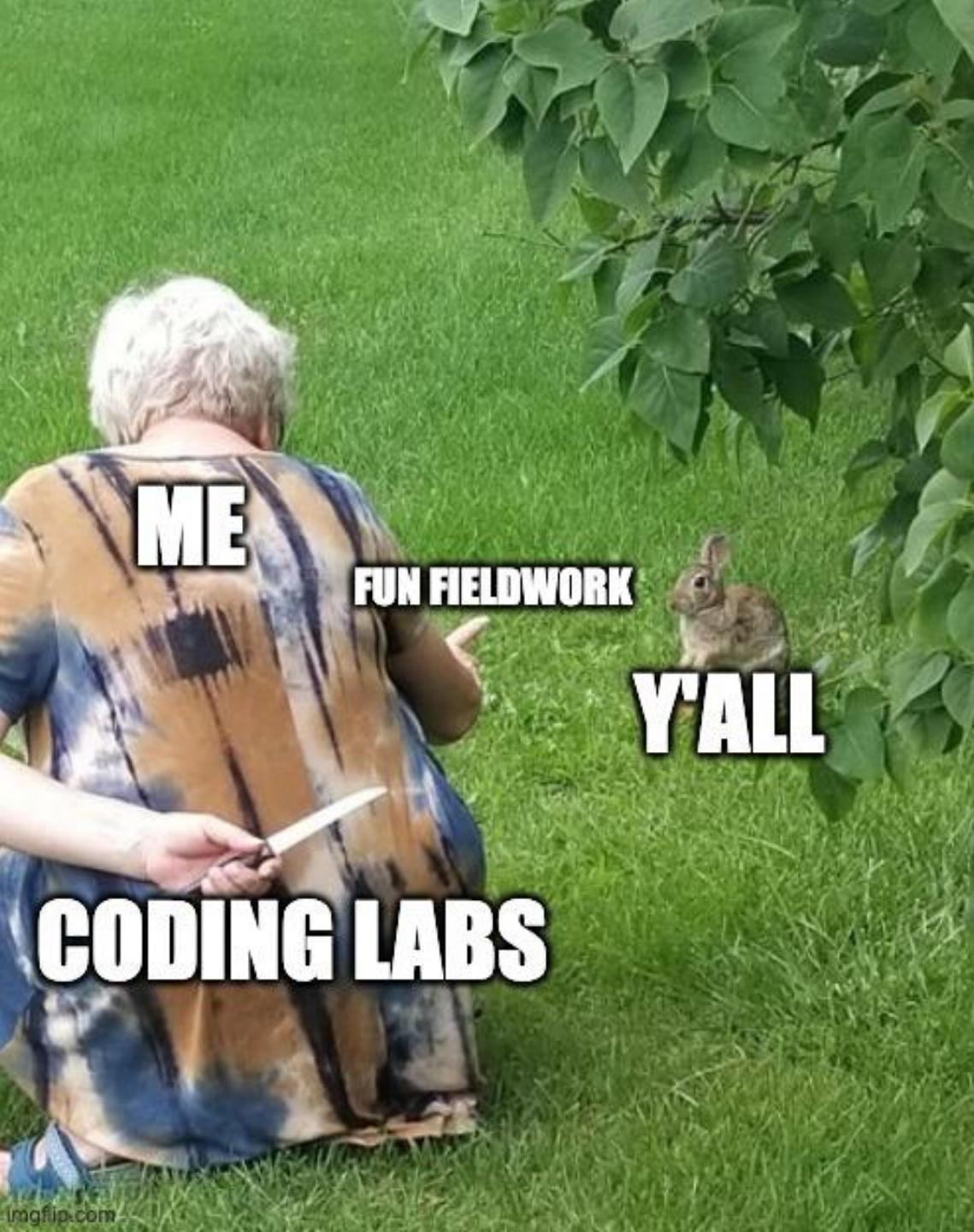
## Module IV

Marine communities in the 21<sup>st</sup> century

- Current research: global change, new methods, and management

The background of the image is a dark, monochromatic blue, representing a vast expanse of water or a sky. There are subtle, faint horizontal lines and slight variations in tone across the surface, suggesting a sense of depth and movement without being explicitly detailed.

# Labs



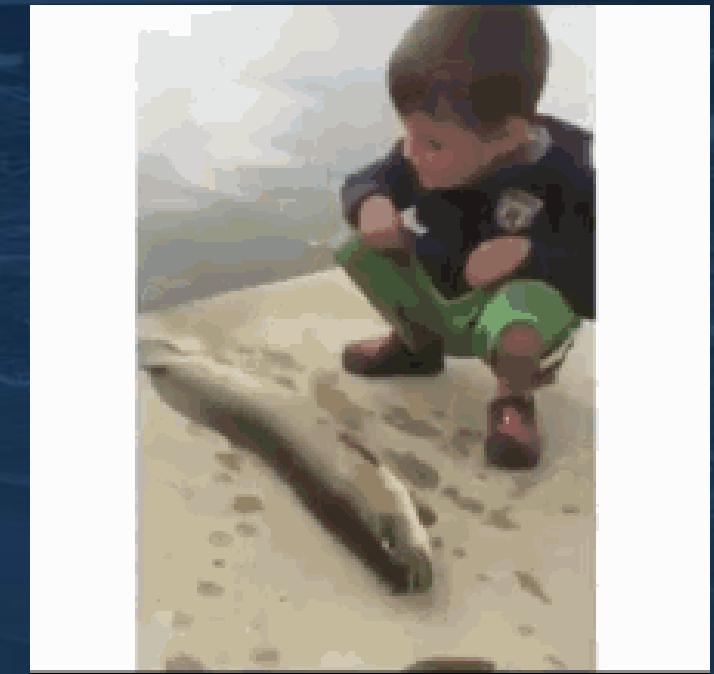
# Fieldwork I

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## Fieldwork II

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The background of the slide is a photograph of a vast, dark blue ocean. The water is relatively calm with small, scattered white-capped waves. Above the horizon, the sky is a lighter shade of blue, suggesting a clear day or early evening. There are no clouds, birds, or other elements in the sky.

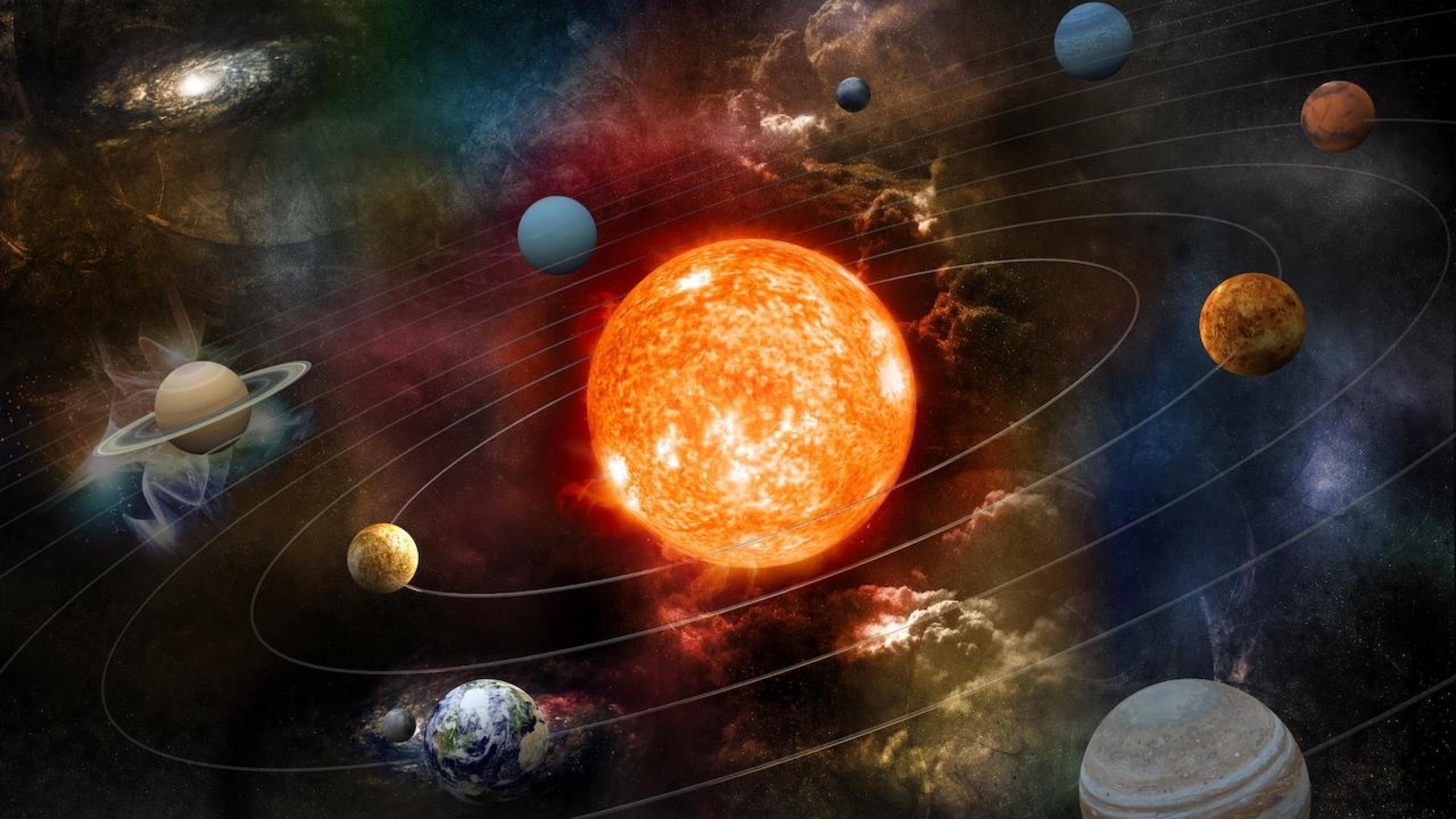
# Grades



Let me take a moment to move over to  
a different board so I can show you  
how I will grade you in this course



There's NOTHING HERE!



# Ungrading

*A system based on trust between students and the instructor to achieve learning based on intrinsic motivation and a growth mindset.*

## 1) Learning contract: my side

B- if all deliverables are submitted, rest is up to you!



## 2) Learning contract: your side

Set your own goals and expectations for each learning objective



## 3) Self-evaluation

Two times to reflect on your learning, growth, and achievement of goals

## **Learning outcomes: all students**

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- 1) Gain a thorough understanding of ecological theory.
- 2) Acquire/improve computational skills to explore, analyze, and visualize data in R.
- 3) Express scientific knowledge in writing via research papers, syntheses, and short essays.
- 4) Present your work and follow/contribute to discussions on marine community ecology.
- 5) Survey, sample, process, and analyze marine and estuarine communities in the field.
- 6) Learn how to assess your own progress and growth in a non-traditional grading format.

# Grading contract

Skill/learning objective	Goal	Actions	Mid-semester	Final
1) Gain a thorough understanding of ecological theory	Exceed expectations – I have a good foundation in ecology, but since I want to pursue a graduate degree in ecology, I really want to go above and beyond	1 - Complete all readings outside of class 2 - Stay engaged and take notes during class 3 - Read at least 2 extra papers per week 4 - Spend 1 hour per week reviewing class materials 5 - Revise written assignment to incorporate feedback 6 - Ask at least one question during grad student symposium	1 - On track 2 - On track 3 - fell short of goal but read 5 extra papers throughout semester, aiming to improve 4 - started revising assignment 1 but ran out of time, likely won't have time to revise assignment 2 5 - On track 6 - asked 2 questions that sparked discussion during the symposium, aiming to ask 5 questions during class for the rest of the semester	1 - Completed 2 - Mostly completed, but notes got lighter towards the end 3 - did not read as much, only 3 extra papers 4 - actually did find the time to revise assignment 1, did well on it with limited corrections 5 - spent 1 hour consistently 6 - asked more than five questions  <b>Summary: Exceeded expectations but less than I was hoping (92%)</b>

# Actions for reflections

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## In class

- Attend class
- Be timely
- Complete readings
- Write notes
- Prepare and ask questions
- Display engagement
- Contribute to discussions
- Listen actively
- Be respectful
- ...

## Outside class

- Review notes
- Solicit & provide feedback
- Seek dialogue
- Don't give up & help others
- Practice
- Attend office hours
- Review concepts/topics you didn't follow
- Watch recordings
- ...

## Assignments & Homework

- Read more
- Write more
- Code more
- Revise & resubmit
- Seek feedback
- Track your hours
- Metacognition: learn to assess your own progress
- ...

## Talk to me

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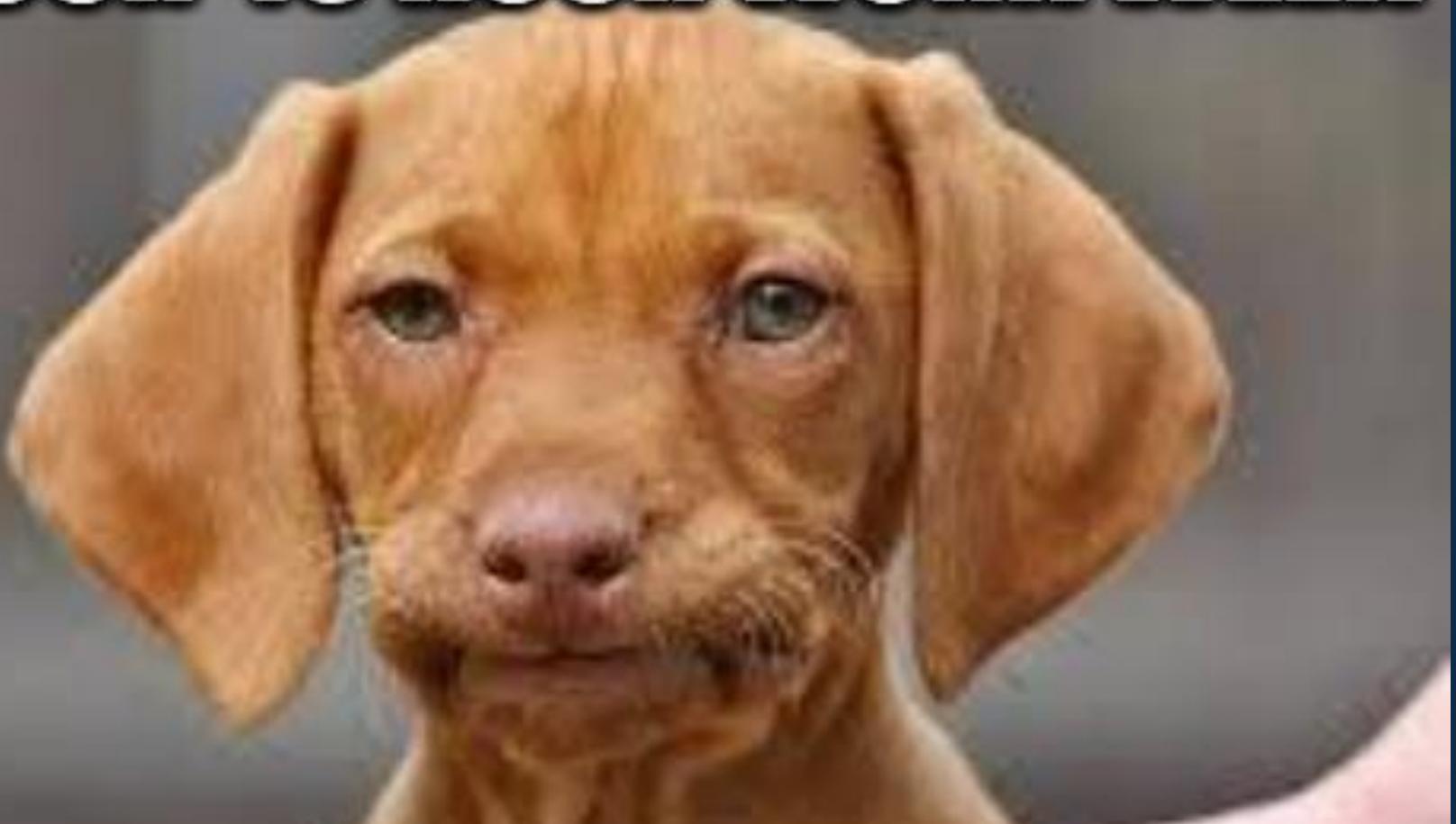
*Office 3.05 (main research building, 3<sup>rd</sup> floor)*

*Office hour Zoom link*

Me: I don't understand why people think  
I'm so unapproachable  
Also me:



**WHEN YOUR 40 HOUR WORK WEEK**



**HAS 50 HOURS OF MEETINGS**

# Assignments

## **Undergraduate + Graduate**

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- 10 x Homework
- 2 x Self evaluation
- Project 1
- Project 2
- Project 3

## **Graduate Only**

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- Project 1 Presentation
- Paper pitch

**GETTING INTO GRAD SCHOOL    STARTING THE 2ND SEMESTER**



# Homework

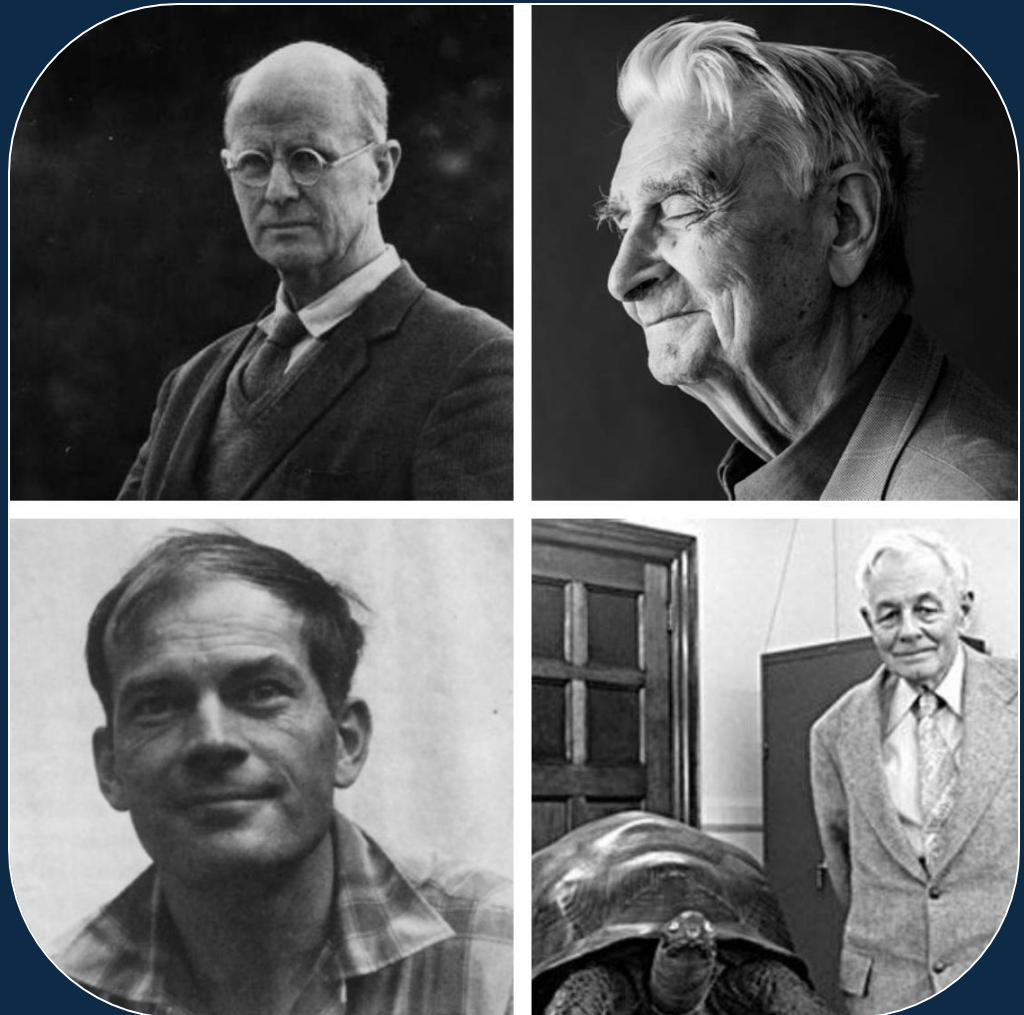
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- 10 homework assignments, 1-2 hours each
- Details on each homework assignment provided in class
- Needs to be fully completed and submitted by 9am on the due date



# Project 1: paper critique

- Critical evaluation of a seminal theory or hypothesis in community ecology
- Group activity to collect/evaluate literature, but paper is written individually!
- Group assignments on Canvas
- Paper: 3 pages, template on Canvas
  - Introduce theory
  - Evidence for and against theory
  - Concluding support or rebuttal



Due: TBA

## Project 2: research paper

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Group-based project:

- Clean, process, and visualize historical data
- Collect new data using visual surveys
- Process, analyze and visualize data
- Research paper
  - 5 pages (including figures), template on Canvas
  - Abstract, Introduction, Methods, Results, Discussion



Due: TBA

# Project 3: research presentation

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- Group-based data collection on coastal fish communities
- Laboratory processing of fishes to obtain traits
- Data analysis and visualization
  - Submit R code
  - Produce figures
- Research presentation
  - 12 minute presentations on findings as a group



**Due: TBA**

## Graduate Only: critique presentation

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- Presentation on your written paper critique  
(Project 1)
  - 10 minutes max
- Create a compelling narrative and engaging presentation that clearly conveys the theory and your assessment thereof
- develop a dialogue with the rest of the class to test their understanding of your presentation
  - 5 minutes max



**Due: TBA**

## Graduate Only: paper pitch

- ‘Pre-submission inquiry’ for the paper resulting from data collection and analysis
- Consists of a cover letter, title and abstract, and figures for submission to one of the *Ecological Society of America* journals
- maximum of six pages, arranged in the following order:
  - 1) cover letter (one page)
  - 2) title & abstract
  - 3) figures & captions (4 display items)



**Due: TBA**

# SHORT INTRO TO R

# Learning objectives

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- Execute basic commands in R
- Load and use packages
- Manipulate and analyze data
- Plot data and their uncertainty
- Run basic simulations
- Run multivariate ordinations (and maybe more)



# R Coding by Module



## Module I

- Introduction, tidy data processing and visualization



## Module II

- Simulations of ecological processes



## Module III

- Multivariate analysis and trait-based analyses



## Module IV

- Analyzing and visualizing your own data

# Why R?

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- Free!
- Most commonly used platform in ecology & evolution
- Large, helpful, active user community
- Open-source, community-built
  - Computational platform for special building blocks (packages) made by the community
- Forces basic understanding of statistics unlike drop-down menu statistics platforms
- Helps you gain programming skills



## R is Challenging



**AFTER YEARS OF  
EXPERIENCE WITH R**

## Download R!

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R

<https://www.r-project.org/>

R Studio

<https://www.rstudio.com/>

Swirl

<https://swirlstats.com/>



The background of the slide is a dark, moody photograph of ocean waves under a cloudy sky.

<https://simonjbrandl.github.io/marinecommunityecology/>

The background of the slide is a photograph of a dark, choppy sea under a cloudy, overcast sky. The water has small white caps and ripples across its surface.

# MY RESEARCH

# Background

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- B.Sc. | Biology | University of Innsbruck, Austria
- PhD | Marine Biology | James Cook University, Australia
- Postdoc | Marine Global Earth Observatory | Smithsonian Institution, USA
- Postdoc | Simon Fraser University | Vancouver, Canada
- Postdoc | École Pratique des Hautes Études | Perpignan, France
- Assistant Professor | Marine Science | UT-Austin Marine Science Institute, USA





MARINE BIODIVERSITY



ECOSYSTEM FUNCTION



GLOBAL CHANGE

[www.fishandfunctions.com](http://www.fishandfunctions.com)







Rivi Aurelia Indigo (09/28/2024)



# PRIMER TO COMMUNITY ECOLOGY





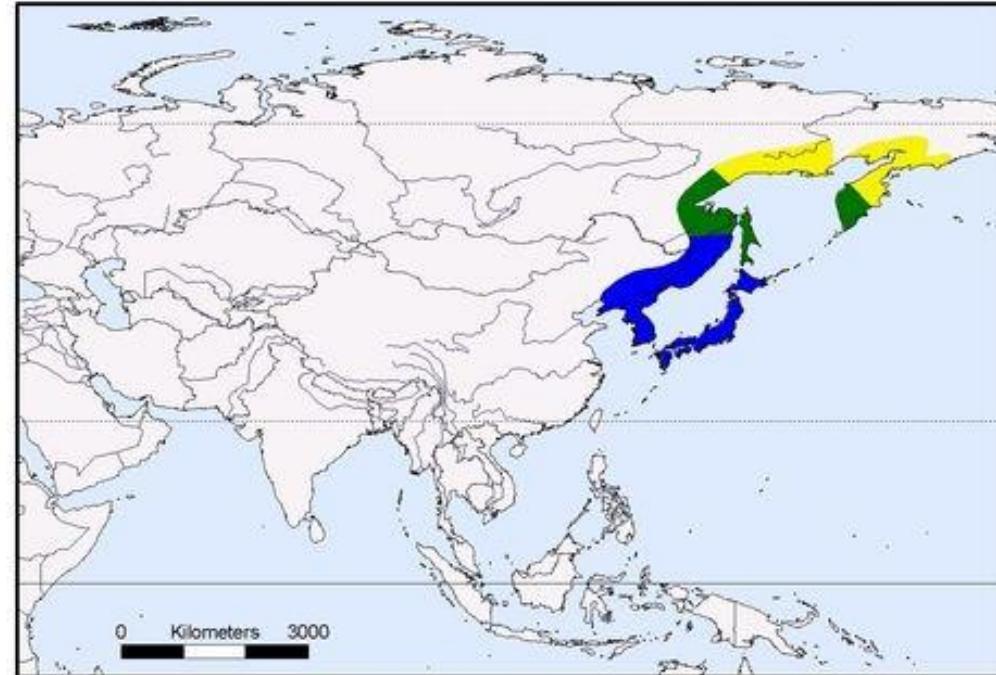
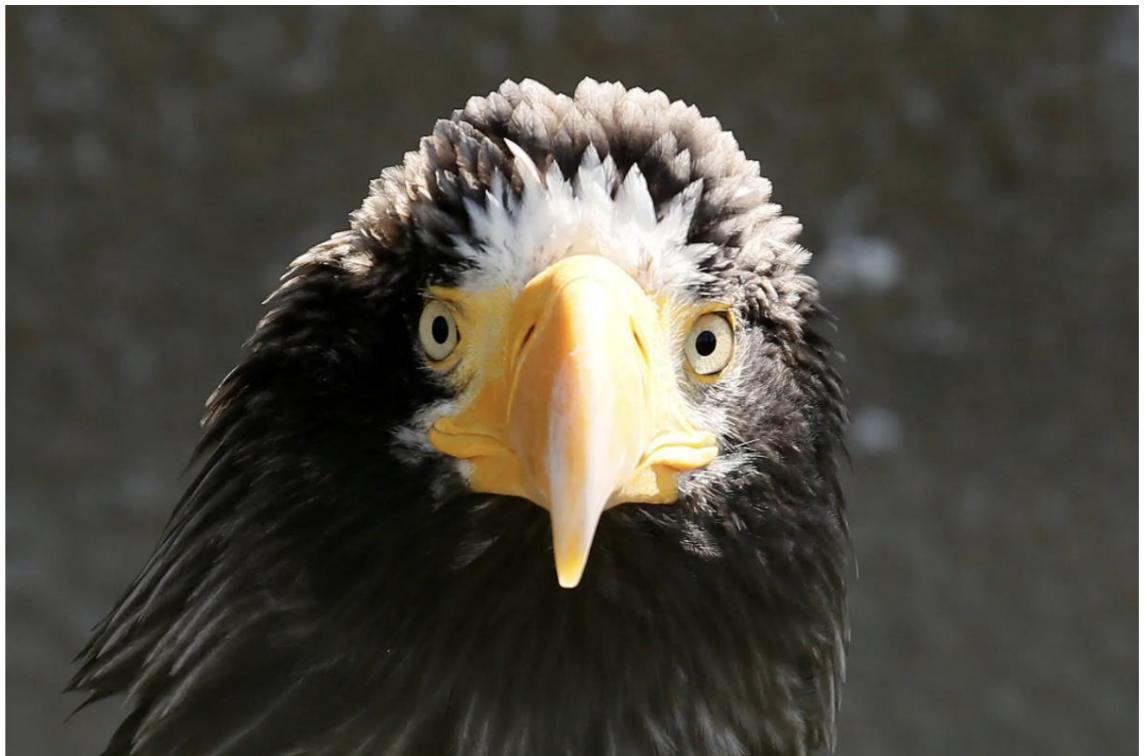
Maine, January 2022

© Erika Zambello

TRILOBITES

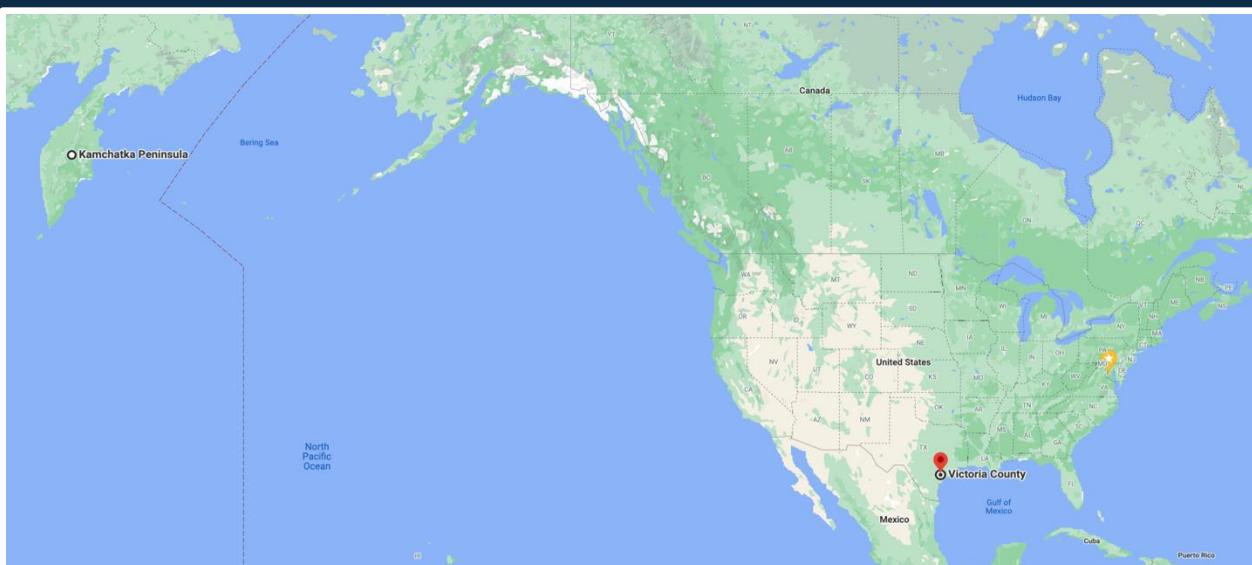
# This Eagle Is Very, Very Lost

Bird-watchers have been tracking a Steller's sea eagle. They're usually found in Asia, but this one turned up in Eastern Canada and may have flown as far as South Texas.



breeding      feeding, wintering      resident

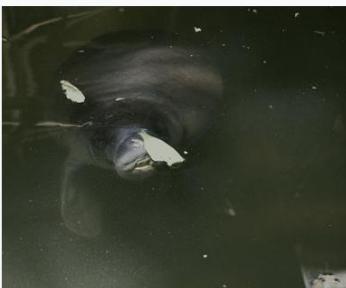
digitised by GROMS, after  
del Hoyo et al.1991-1999,  
[www.hbw.com](http://www.hbw.com)  
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The background of the slide is a photograph of a vast, dark blue ocean. The water is relatively calm with small, scattered white caps from minor waves. Above the horizon, the sky is a lighter shade of blue, suggesting a clear day or early evening. The overall mood is serene and expansive.

What determines where species occur?

**Extant order Sirenia – two genera, four species**

Common name	Genus	Scientific name	Status	Distribution	Picture
West Indian manatee	<i>Trichechus</i> (manatees)	<i>T. manatus</i> Linnaeus, 1758	VU IUCN		
African manatee	<i>Trichechus</i> (manatees)	<i>T. senegalensis</i> Link, 1795	VU IUCN		
Amazonian manatee	<i>Trichechus</i> (manatees)	<i>T. inunguis</i> Natterer, 1883	VU IUCN		
Dugong	<i>Dugong</i>	<i>D. dugon</i> Müller, 1776	VU IUCN		

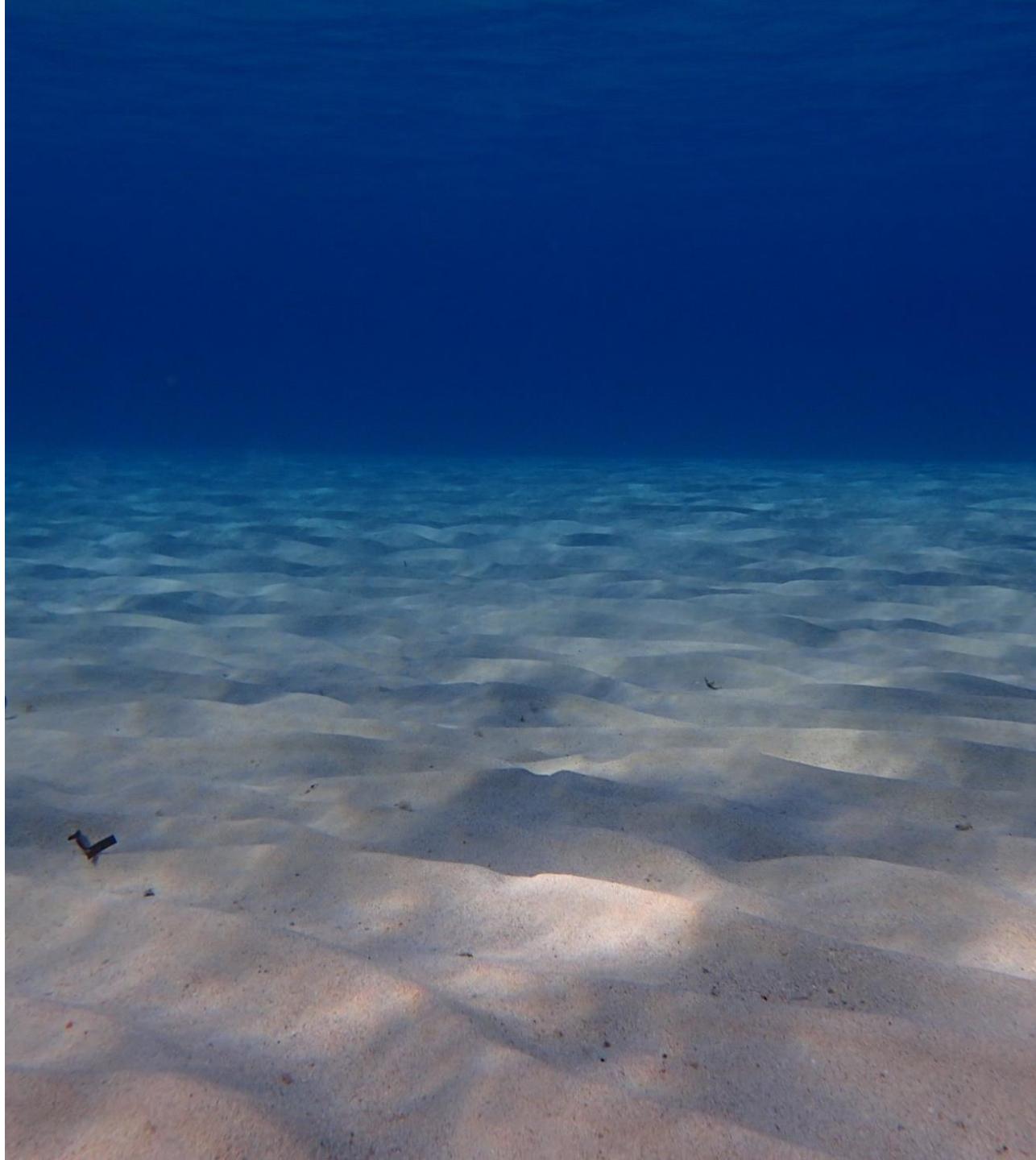


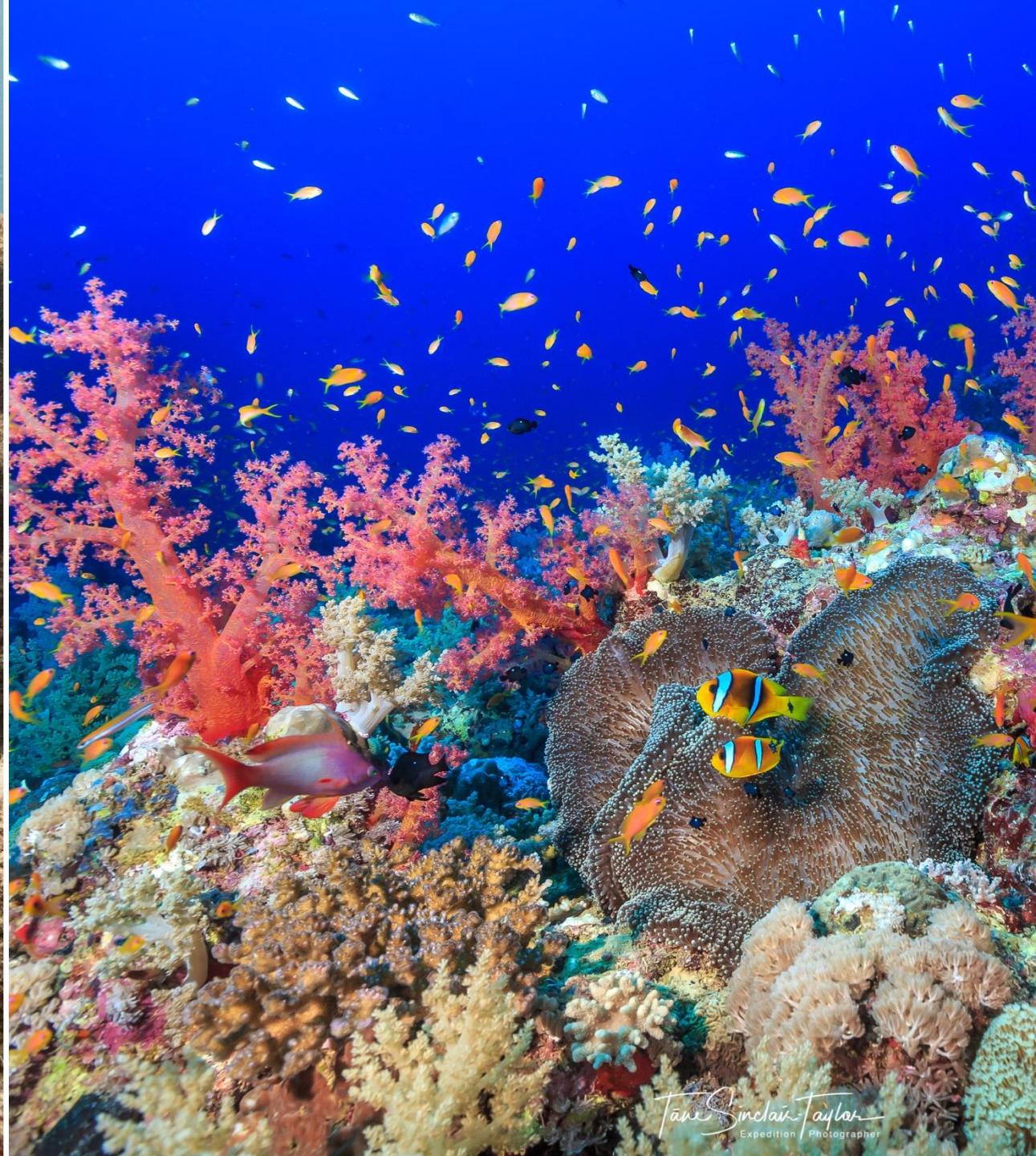






Tane Sinclair-Taylor  
Expedition Photographer





Tami Sinclair Taylor  
Expedition Photographer

# Biological Scales

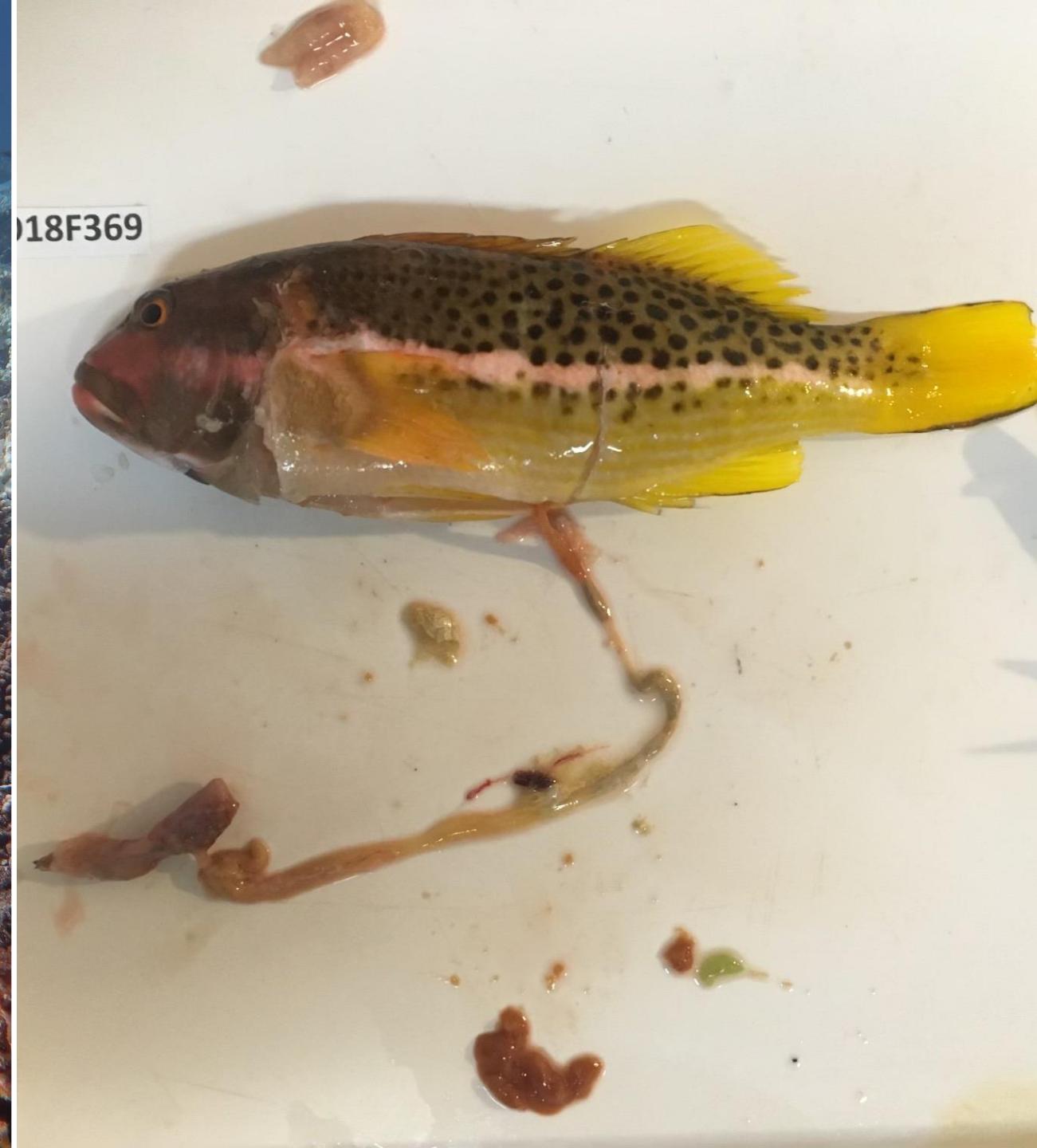
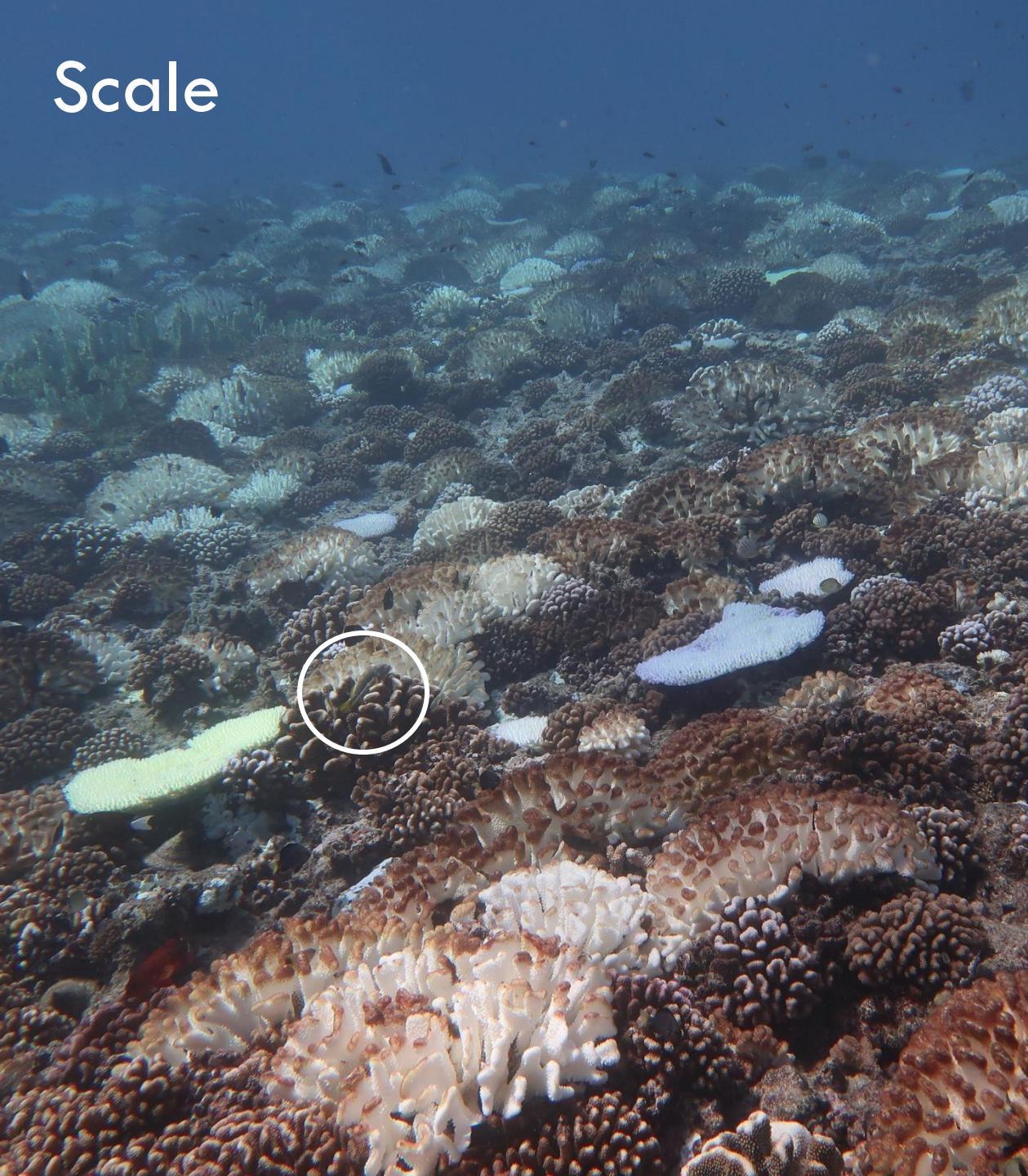
## Community ecology





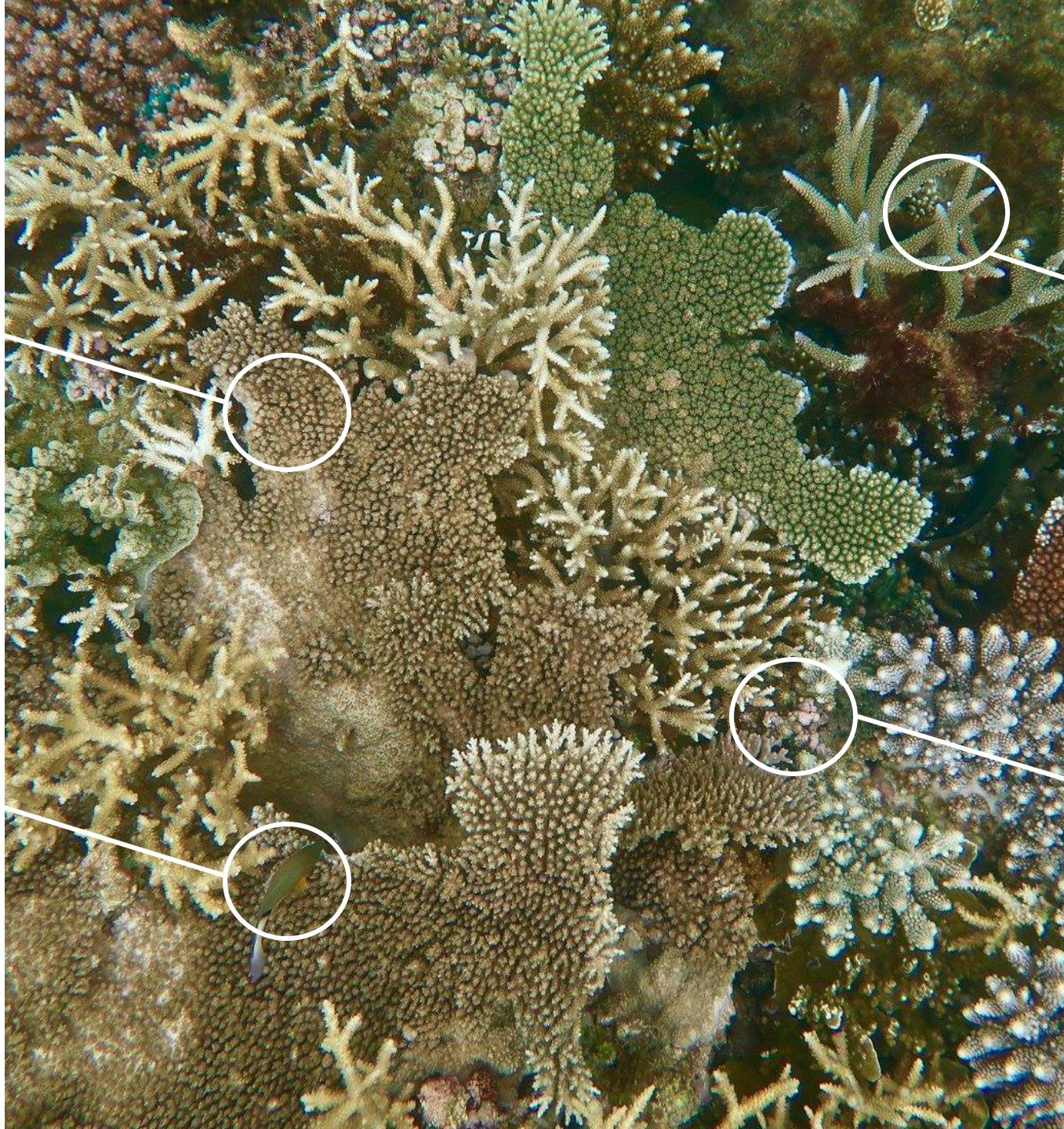
## Spatial Scales

# Scale



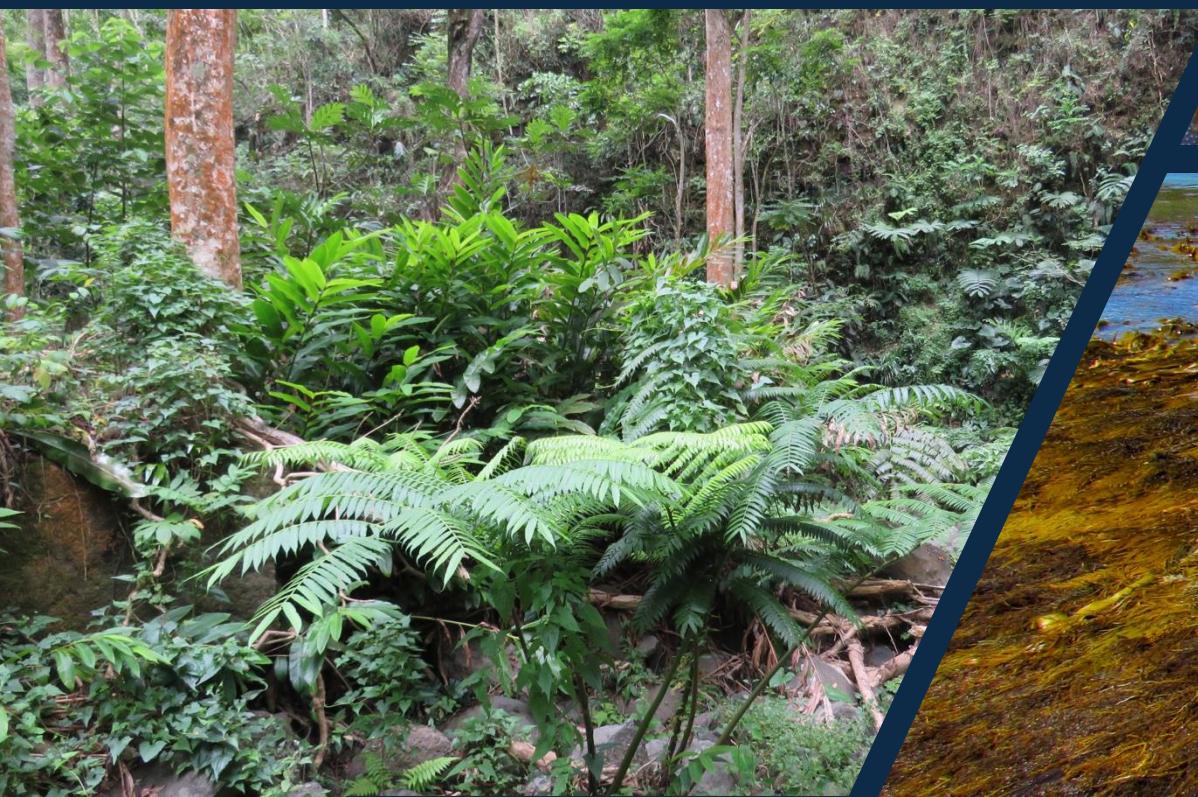
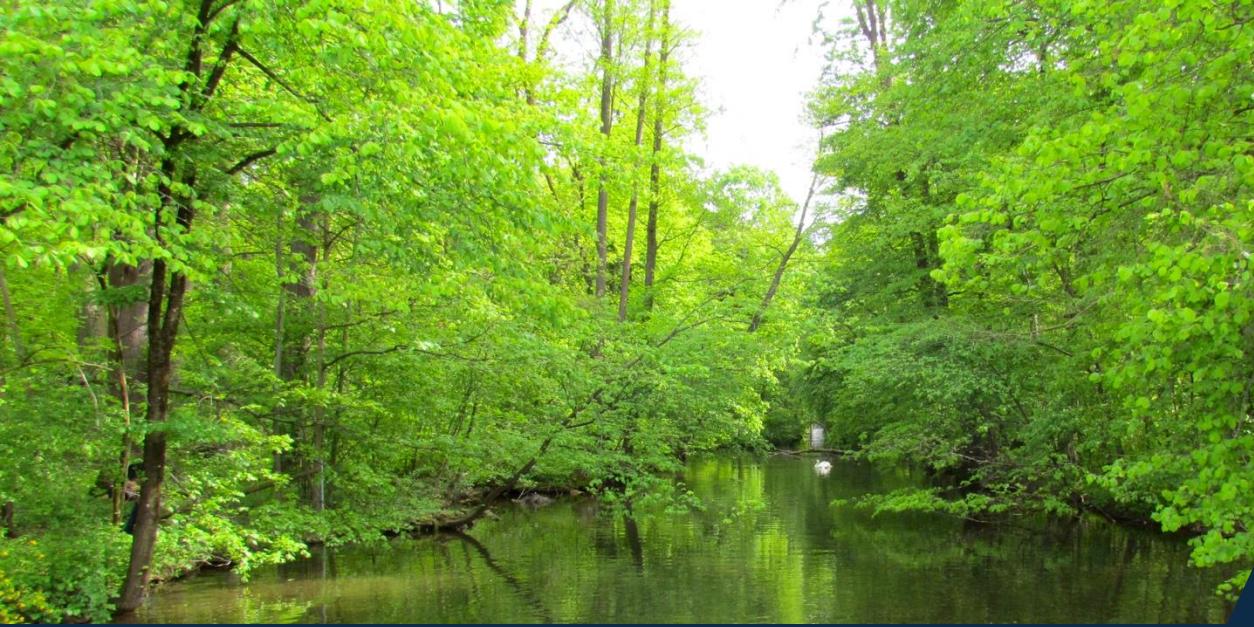
temperature:  
megameters

larvae:  
kilometers



zooxanthellae:  
micrometers

other corals:  
centimeters







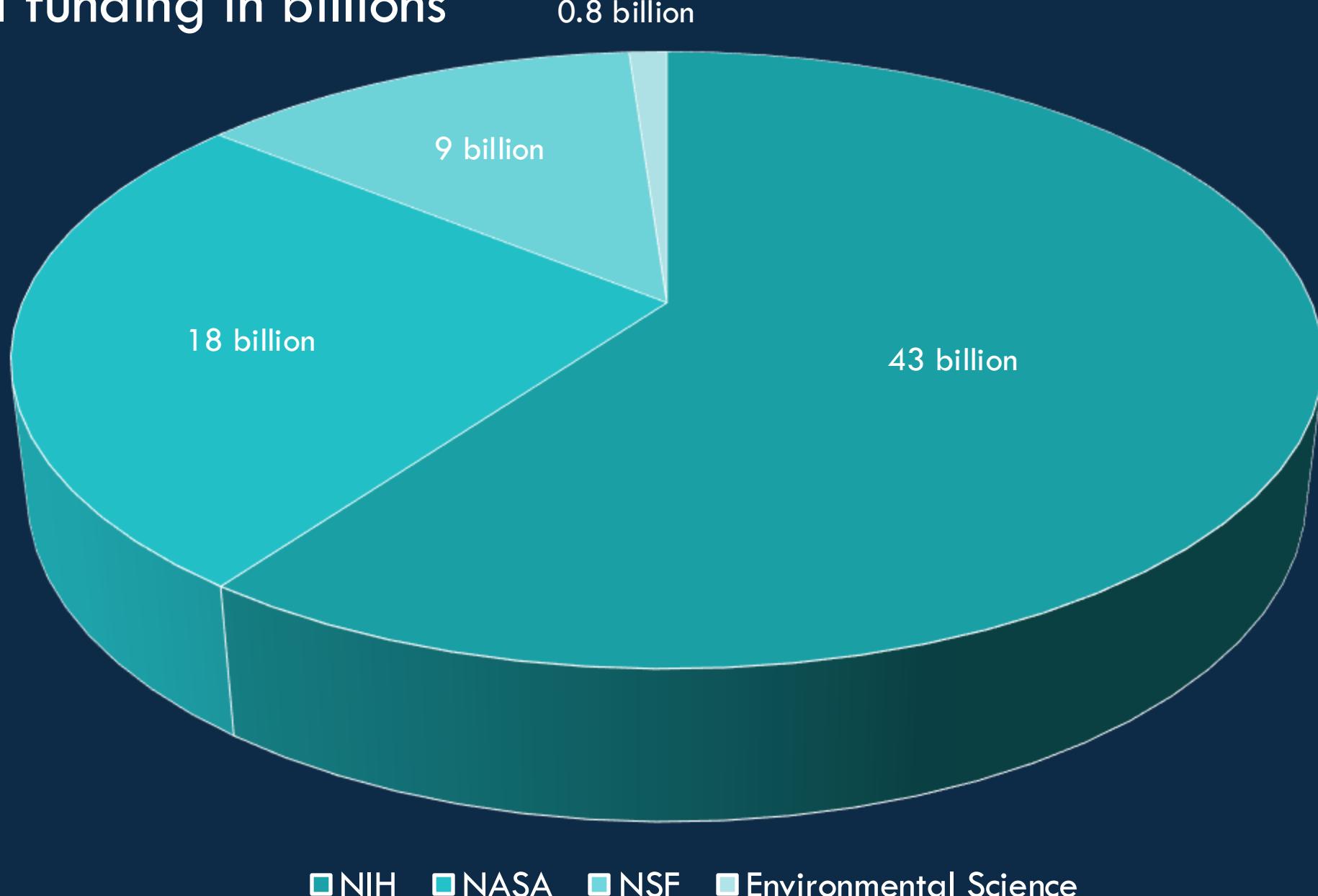
# Our planet's heartbeat goes through ecological communities





**NOT THAT KIND  
OF DOCTOR**

# Federal funding in billions



**YOU DON'T BELONG HERE**



Surgeonfishes  
Family Acanthuridae  
**85 species globally**

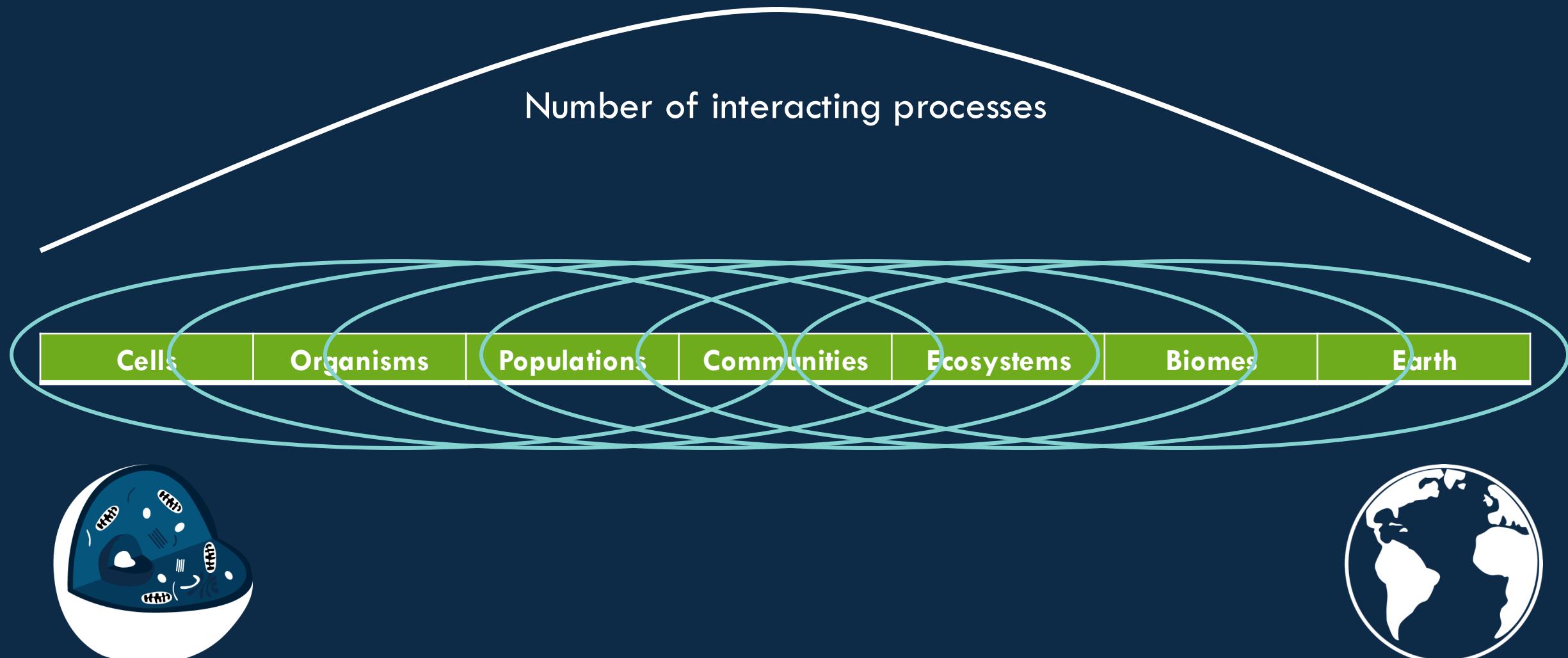


85 species, 7 species on any given reef

$$85! / [7! * (85 - 7)!] = 4,935,847,320$$



# Drivers of community assembly: a mid-domain effect?



**SHOCK!** Parrot learned to  
say "depends on the  
context" and defended his  
Ph.D. in **Community Ecology**



Current state of knowledge?





- identification
- spatial scale
- temporal scale
- convenience

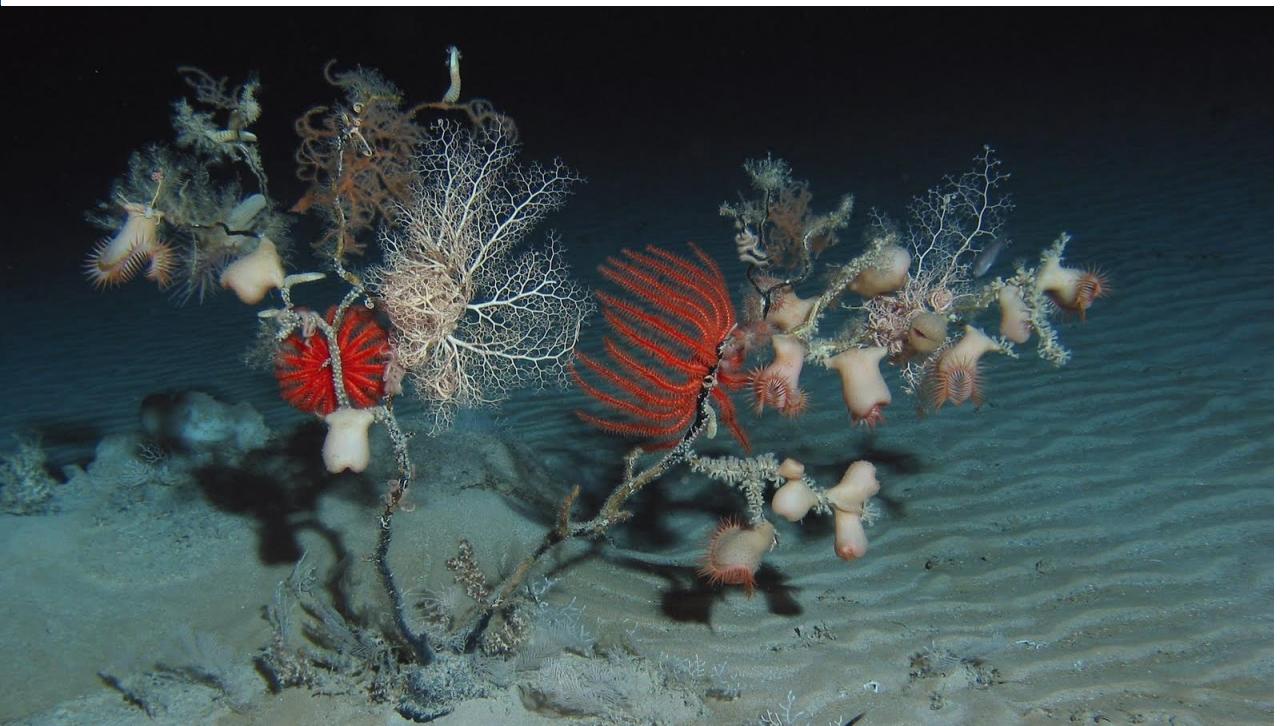






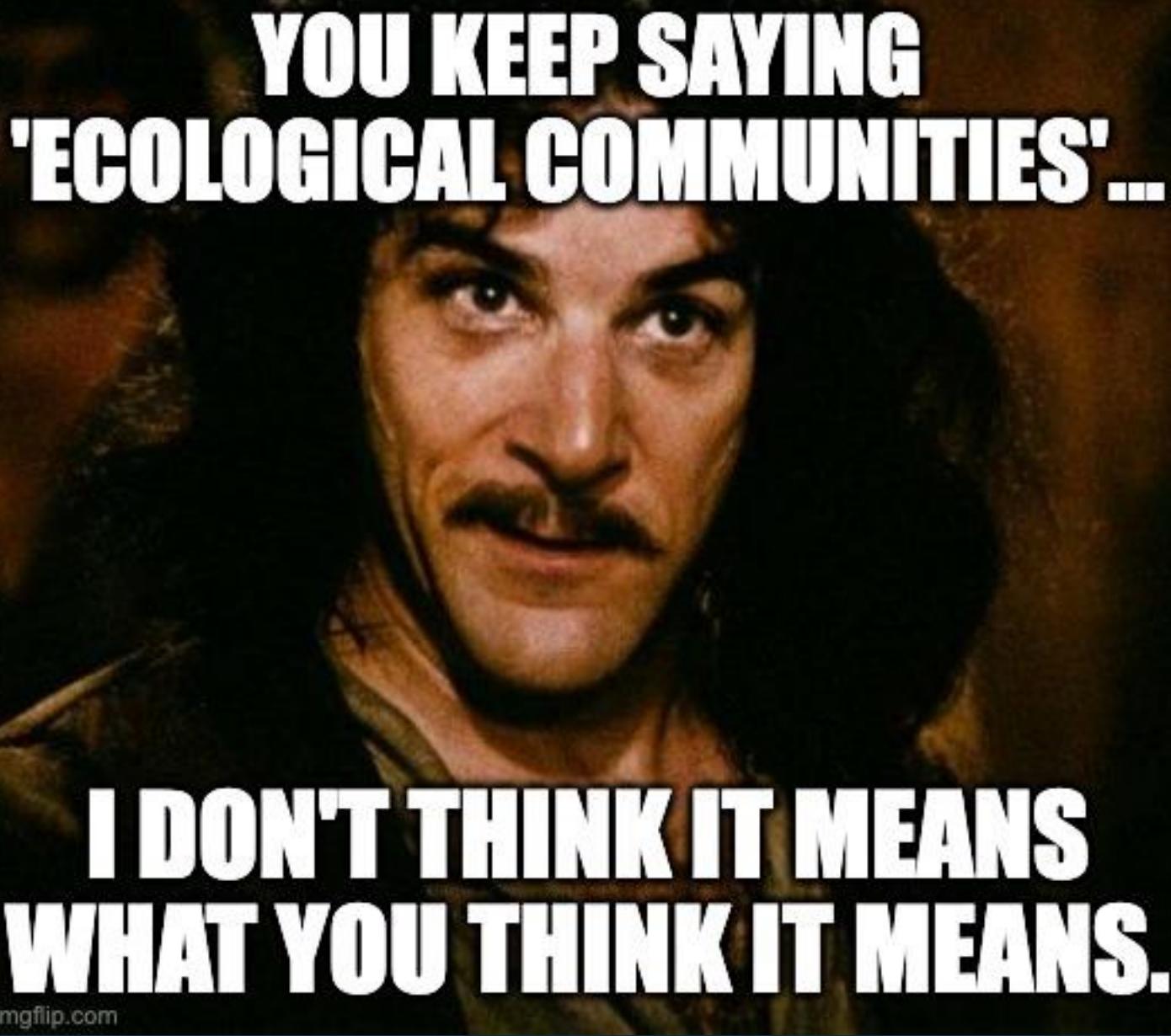
## What does that mean for marine community ecology?

- Largest, most interconnected biome on Earth
- Inaccessible habitats
- Lack of knowledge about basic processes
- Sparse theoretical concepts to provide general guidance
- Empirical evidence is from different ecosystems



The background of the slide is a dark, moody photograph of a body of water, likely the ocean at dusk or dawn. The surface is slightly textured with small waves, and the horizon line is visible in the distance under a dark sky.

# ECOLOGICAL COMMUNITIES

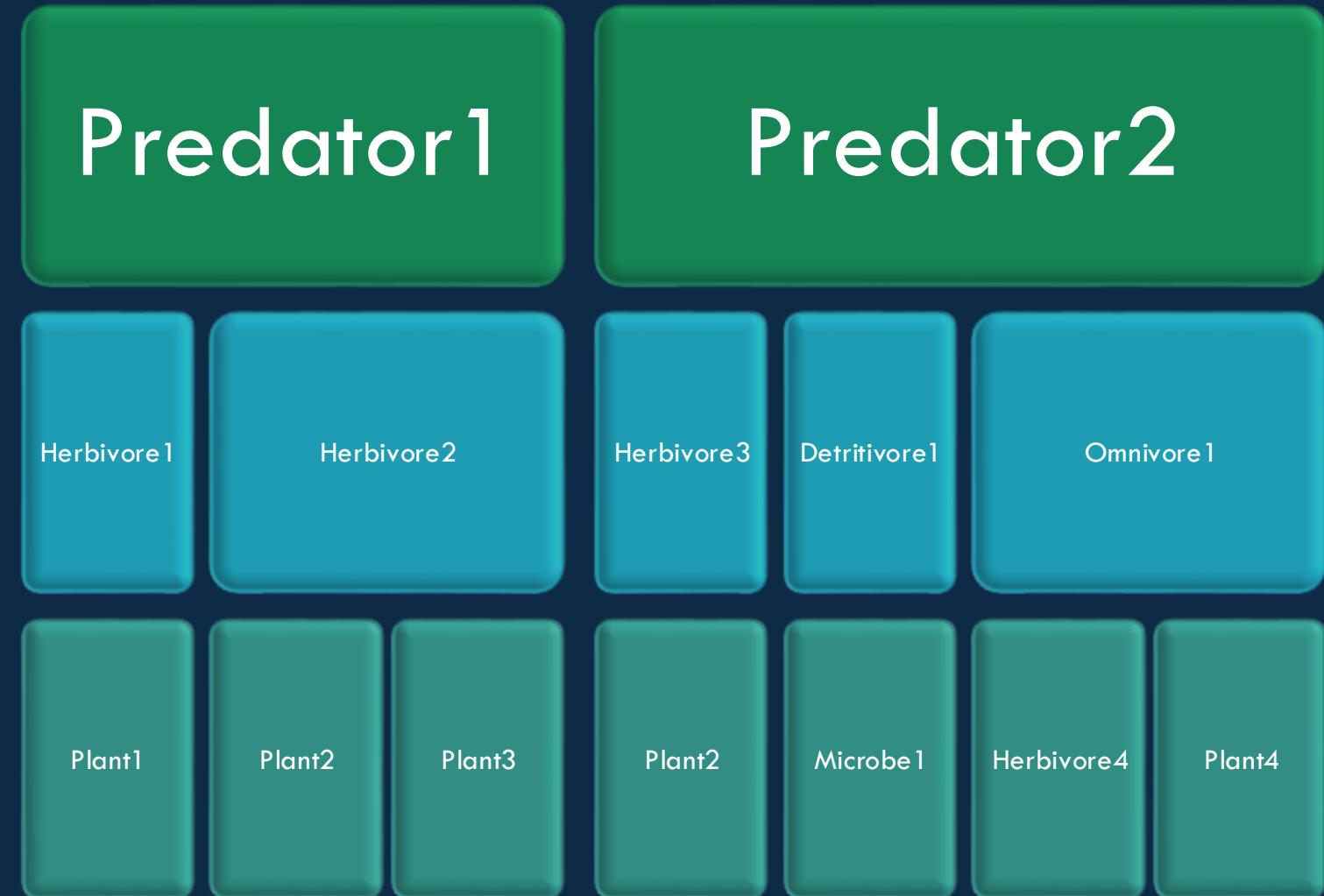


**YOU KEEP SAYING  
'ECOLOGICAL COMMUNITIES'...**

**I DON'T THINK IT MEANS  
WHAT YOU THINK IT MEANS.**

# What is a community?

“the complete set of organisms belonging to all species (from viruses to microbes, plants, and animals) living in a particular place at a particular time”





Tony Sinatra Taylor

4,935,847,320



# What is a community?

a) Predator-prey interactions (including food webs)



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b) Mutualisms

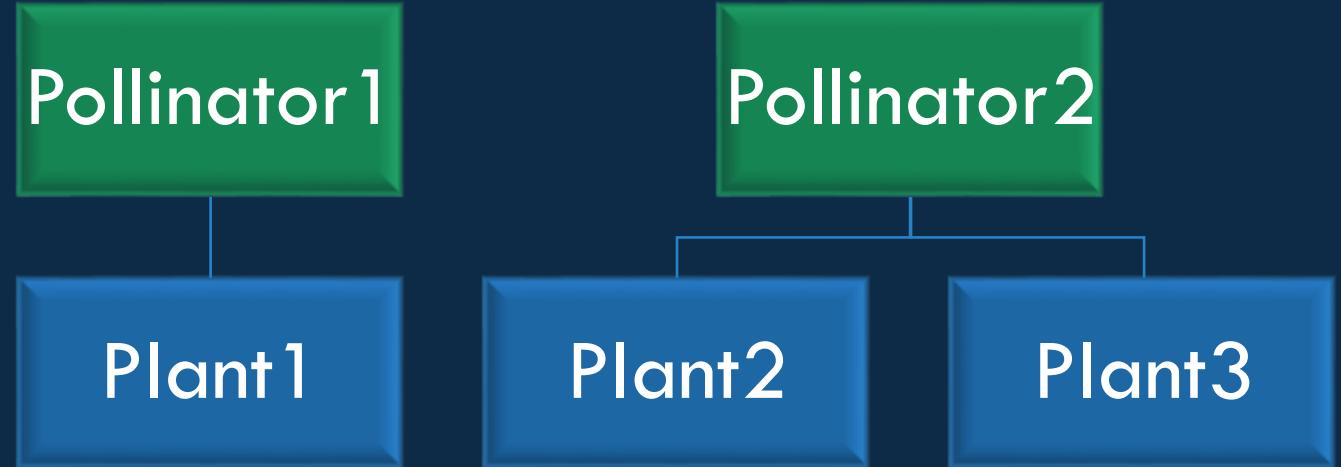


# What is a community?

a) Predator-prey interactions (incl. food webs)



b) Mutualisms





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# What is a community?

A set of species with similar ecology  
(Chesson 2000) or evolutionary history:

- “assemblage” (Fauth et al. 1996)
- “guild” (Root 1967)
- “horizontal community” (Loreau 2010)



# What is a community?

Ecological communities



Fish1

Fish2

Fish3

Fish4



Coral

Sponge

Bryozoa

Algae





# Homework 1

Due: Monday, 27 January, 9.00  
am

Draw an ecological community of choice.  
Write 3-4 sentences about what makes it an  
ecological community.  
Any medium or approach is fine, from stick  
figures to scientific illustrations.

Submit to Canvas.



# Homework 2

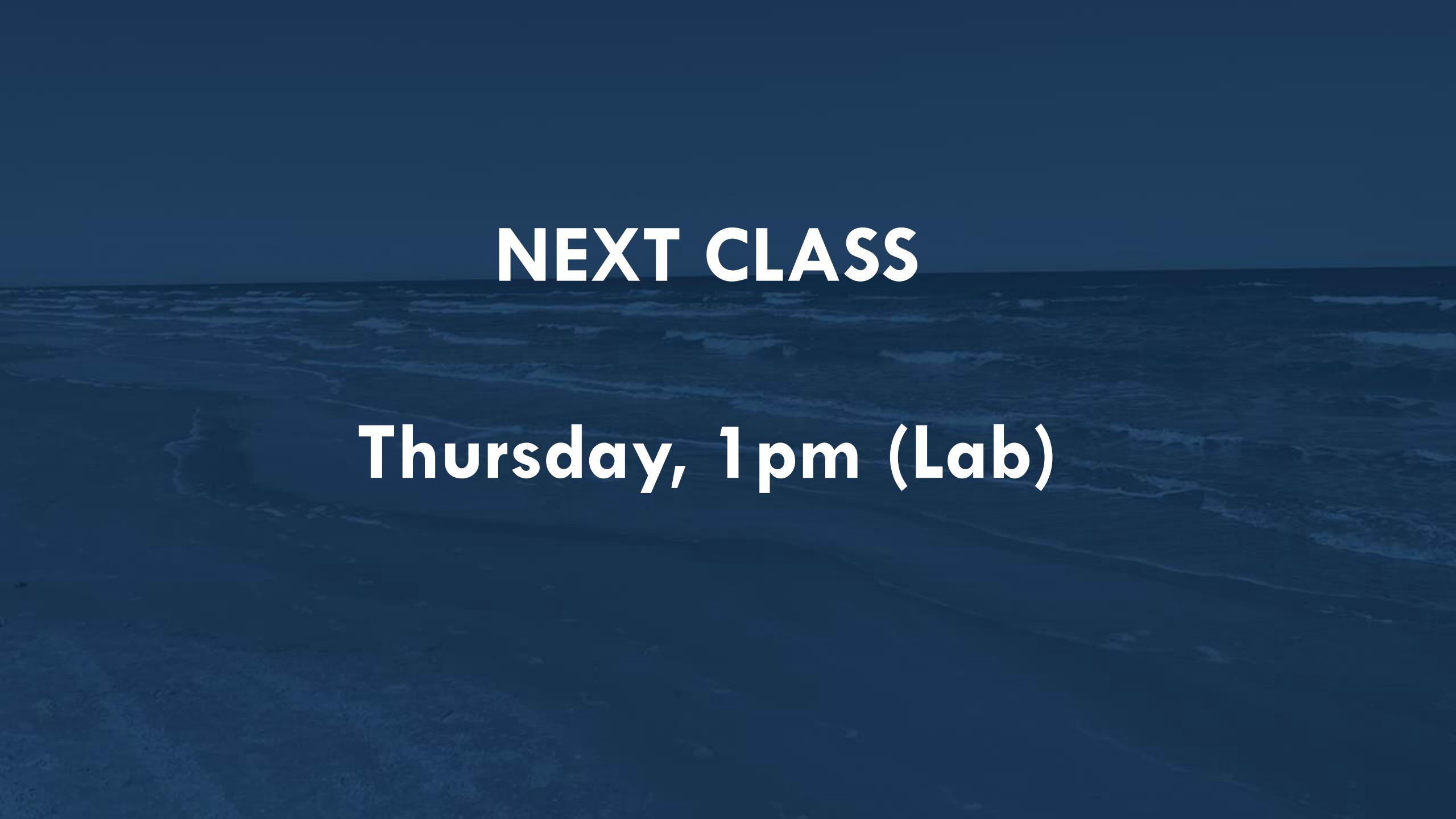
Due: Thursday, 16 January

R Overview Tutorial found here:

<https://simonjbrandl.github.io/marinecommunityecology/0-overview.html>

R Introduction Tutorial found here:

<https://simonjbrandl.github.io/marinecommunityecology/1-introduction.html>



# NEXT CLASS

Thursday, 1pm (Lab)

