

# \* INTRODUCTION TO MARINE SCIENCE

Fisheries Technology 193

Instructor: Lauren Bell



# \* Lauren Bell - Instructor

Research Biologist, Sitka Sound Science Center

- Born & raised in Homer, AK
- B.Sc. in Marine Biology from Stanford University 2011
- M.Sc. in Arctic Marine Biology from University of Alaska Fairbanks 2015
- Work as deckhand, guide, fisheries technician, diver, marine biologist
- Work in Alaska around Homer, Kodiak, Sitka, Arctic Seas. Also in Monterey Bay, CA, and Sea of Cortez, Mexico.



Chantal Cough-Schulze



Fall Semester 2015



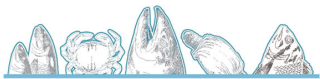
# Careers in Marine Science

Wednesdays, 5-6pm  
UAS Sitka Campus  
Distance Delivered  
1 credit



Interested in a marine-  
related job in Alaska?  
What are your options?  
How do you get there?

Learn how you can start down  
the path to an exciting career,  
straight from those who have  
gone before you



Fisheries Technology





NOAA Fisheries



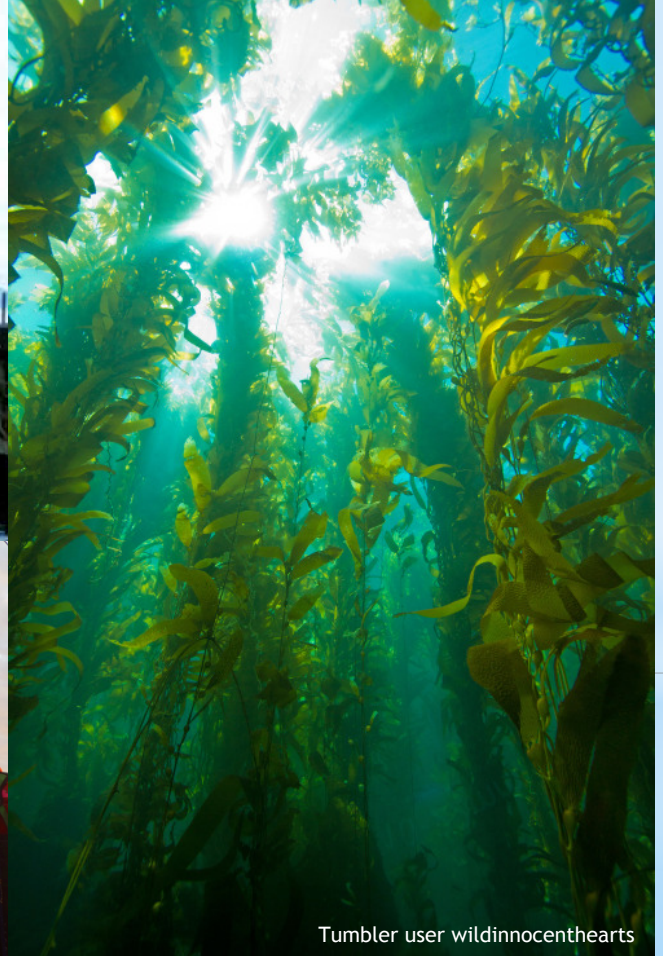
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USFWS



J.M. Olson - NOAA



Tumbler user wildinnocenthearts



Suzanne Guldemann





# \*Topics

## Oceanography

- Ocean as a setting for life
- Motion of the ocean! Global vs. local

## Marine Ecology

- Ecosystems
- Community processes

## Biology of Marine Species

- Intro to marine plants and critters
- Physiological adaptations

## Fisheries

- Fisheries in Alaska
- Fisheries management
- Human dimensions

## Changing Ocean

- Warming, acidification, overfishing, etc.
- Research needs and future directions



# \* Grading

100 pts - Midterm

150 pts - Final (cumulative)

100 pts - Critical issue presentation & debate

150 pts - Class participation (attendance, reading discussions, discussion posts)

# \* Readings

No textbook, weekly readings

Blackboard discussion topics

Summarize in class, apply to week's topic



# \* Critical Issue Assignment

8-10 minute presentation on:

**the most important issue currently facing  
Alaska's marine ecosystem**

- your choice, but you've got to back it up with research
- choose your topic by **November 2<sup>nd</sup>**
- keep topic in mind throughout the semester!

Presentations right before Thanksgiving break - **November 23<sup>th</sup>**  
Followed by informal debate!

- Convince a millionaire philanthropist (me!) that your topic deserves funding over all others
- Explain issue, why important specifically to Alaskan marine ecosystem and Alaska's people
- In debate - question each other's arguments (you will know their topics ahead of time), make case for yours (think of biological, cultural, aesthetic, economic impacts)

## **SPECIFIC INFORMATION AND EXPECTATIONS**

### **How to Begin**

1. Read your **Getting Started Packet** (sent by US Mail), return required forms
2. To access the class you will need to set up a UAS user name and password. To do this follow the instructions at: <https://uascentral.uas.alaska.edu/elmo>. Make sure to write down your user name and password for future reference. If you have difficulty with the on-line format, remember that the help desk is available as are several tutorials. Contact the help desk for more information: toll free 1-877-465-6400 or local 796-6400; e-mail: [helpdesk@uas.alaska.edu](mailto:helpdesk@uas.alaska.edu)

### **Help Resources**

**Sitka Campus:** [sitka.distance@uas.alaska.edu](mailto:sitka.distance@uas.alaska.edu), 800-478-6653 or 907-747-7700 (x = phone extension)

- You can start here with questions about *any* aspect of our course, including technology.  
If we don't know the answer we will find someone who does
- eLearning Support: Kim x7709, Eric x7757, Emy x7721, Amy x7726, Randy x7701
- UAS Sitka Facebook and Twitter [www.uas.alaska.edu/sitka](http://www.uas.alaska.edu/sitka).

**UAS Technology Help Desk:** 877-465-6400, <http://www.uas.alaska.edu/helpdesk/>



### **Approaching the course**

This course is meant to provide a comprehensive overview of a very broad set of topics, which means we will be stuffing a lot of information into this short semester. I encourage you to review the learning objectives for the course as well as for each lecture, as these will guide how I will assess your knowledge on midterms, the final, and in your presentation. I would encourage you to avoid memorizing specific details and numbers and focus more on understanding the broader concepts and processes we discuss in this course. I am happy to schedule a time to sit down and chat outside of class time if you are having trouble with a particular topic or would like to know more detail.

### **Attendance, lectures, and exams**

Attendance is required and factors into the final course grade under “class participation”. If you are unable to attend class, please contact the instructor prior to class. It is the responsibility of the student to get information missed in class. All class lectures are archived in UAS online home site for the course, and we will go over finding these the first night of class.

Exams will be sent to pre-arranged proctors. Students residing in Sitka, Juneau and Ketchikan will take exams at UAS learning centers. I will give you the better part of a week to take the exams. It is the responsibility of each student to find an appropriate exam proctor. Please contact me early in the semester if you have questions about this. In rural areas, schools, libraries or places of employment have been used for this purpose. No notes, books or other resources are to be used in the exam room.



## **Technology**

Expect to face some technology issues as part of this course – the technology is imperfect, as are the people using it (namely, me). Poor internet access can put you at a disadvantage. We will try to accommodate any issues that come up as they come up during class. Hopefully we can troubleshoot most issues and become familiar with the interface during the first class, but please do not hesitate to contact me if you are continuing to experience issues in future classes. If you are having trouble connecting to the class at a regularly scheduled meeting time, you may call or text my number listed at the top of this syllabus.

## **Web Meetings**

Feel free to interrupt me at any time. Use the “raise your hand” function to be sure I see you. Off-topic chatting is distracting to everyone, so keep text messages on topic. Collaborate sends all messages to the instructor, even if you send only to another student.

Respectful communication is expected at all times. Vast distances may separate us, but we are all in this course together. You will have many opportunities to work with classmates. I encourage you to get into the habit of contacting me (or using other help options) at least once a week to clear up questions.



## **Incomplete Policy**

Incomplete grades may sometimes be negotiated when circumstances such as illness or family emergency interfere with completion. To qualify for consideration of an incomplete a student must have completed the majority of coursework, earned a C or better on the midterm, and participated fully and consistently through out the class. Incomplete grades will not be given in cases of non-participation or failure to communicate with the instructor. Students who are unable to participate in coursework for a significant amount of time during the semester should plan to re-register for the course at a later date rather than take an incomplete grade.

## **Important dates**

1 <sup>st</sup> day of class	August 31
Labor Day holiday (no class)	September 7
Last day to withdraw from the class without a grade and 100% refund:	September 15
Last day to change from credit to audit or vise-versa	September 15
Last day to withdraw from class with a “W”	November 20
Thanksgiving holiday	Nov 26 – 29
Finals week	Dec 7 – 12



### **Academic Honesty**

Academic integrity is expected at all times. **It is the student's responsibility to be familiar with the relevant sections in the UAS catalog and the UAS student handbook.** Academic dishonesty of any type, including plagiarism and inappropriate test conduct, will typically result in the most serious consequences provided for by UAS policy. Test misconduct or plagiarism of a written or image-based assignment (including Open Book Tests, Disease Team posts and Labs) will result in a zero for the assignment or a failing grade for the course. Students are required to view the presentation on avoiding plagiarism at our website before starting assignments. See tutorial at: <http://www.uasplus.com/ssc/lo/508plagiarism/>

### **Student ratings of Instruction**

During the last three weeks of class, you will have an opportunity to complete an on-line rating questionnaire on course instruction, how the course aided in your skill development, effectiveness of technology and equipment used, and adequacy of library resources and services used during the course. You will receive notification in your UAS email account when the rating questionnaire is available. Please make use of this opportunity to provide feedback on what worked for you and what did not. Your input is used to assess methods and services in order to provide the best educational experience possible.

# \* WebMeeting

Blackboard Collaborate – FT193-7D1 Fall-2015

File Edit View Tools Window Help

AUDIO & VIDEO

Talk Video

PARTICIPANTS

Lauren Bell  
Moderator

MAIN ROOM (1)

Lauren Bell  
Moderator (You)

CHAT - Supervised

- You joined the Main Room. ( 3:17 PM ) -  
- Your chat permission has been enabled. ( 3:17 PM )

Room Moderators

## \* Critical Issue Assignment

8-10 minute presentation on:

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File Edit View Tools Window Help

AUDIO & VIDEO



Talk

Video



New Page

Delete Page

PARTICIPANTS



Lauren Bell

Moderator



MAIN ROOM (1)



Lauren Bell

Moderator (You)



Crit


8-10 m


- your
- choo

▼ CHAT - Supervised



- You joined the Main Room. ( 11:22 AM ) -
- Your chat permission has been enabled. ( 11:22 AM ) -

 Room

 Moderators





▼ Fall-2015 FT193-T03 / FT193-TD1 

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UAS Syllabus

Getting Started

**Course Content**

Critical issue assignment

Discussions

WebMeeting

Classlist

ePortfolio

UAS Resources

Egan Library

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## Announcements

### Welcome to FT93 - Introduction to Marine Science!

Posted on: Wednesday, August 12, 2015 5:56:52 PM AKDT

Hi everyone,

The course syllabus is now up! Once you get into Blackboard or UAS Online, click into the FT193-Intro to Marine Science course. The syllabus has been posted under "UAS Syllabus" and additional information is posted under the "Getting Started" tab.

In the next week or so I will post the module associated with our first class day, which will include some material you will need to work through prior to our meeting on Aug 31. I'll send out another announcement when that goes up.

In the meantime, feel free to shoot any questions my way, but mostly....keep enjoying the summer! Looking forward to meeting you soon.

Cheers,

Lauren



▼ Fall-2015 FT193-T03 / FT193-TD1



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## Course Content



### **Module 1: Introduction to class / The Ocean as a Setting for Life!**

Please work through this module before the first day of class





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- [In this module.....](#)
- [Specific objectives](#)
- [Readings](#)
- [Discussion](#)
- [Blackboard Collaborate](#)
- [Final note](#)

## In this module.....

Welcome to FT 193 Introduction to Marine Sciences. You have arrived at the "module" is the online collection of materials to introduce and accompany the lecture. In this week's module we will spend most of our time working through stuff like going through the syllabus and talking about course expectations. We will discuss your current understanding of distance learning tools like the Discussion programs like Adobe Presenter. Hopefully we will even have time to start talking about the marine world. Each module will be laid out similar to this one with a general overview of "what we are going to cover" followed by specific objectives and then reading assignments that need to be done prior to our class meeting.

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- In this module.....
- Specific objectives**
- Readings
- Discussion
- Blackboard Collaborate
- Final note

## Specific objectives

By the end of this module you will:

1. recognize (electronically) your instructor and fellow students for course
2. identify the expectations and requirements for FT 193
3. practice the use all of the distance learning tools for FT 1934.
- 
4. recognize the spatial dominance of marine systems on Earth
5. describe how the attributes of water molecules result in the physical characteristics of the world's oceans
6. state the two characteristics that determine water density

▼ **Fall-2015 FT193-T03 / FT193-TD1** ↑

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Success: Forum 1. Introductions created.

## Discussion Board

Forums are made up of individual discussion threads that can be organized around a particular subject. Create Forums to organize discussions. [More Help](#)

Create Forum

Search

Delete

<input type="checkbox"/>	Forum	Description	Total Posts	Unread Posts	Total Participants
<input type="checkbox"/>	Questions	A forum for posting questions (and getting answers!) about anything course-related. Feel free to contact instructor directly if you don't want your question to be seen in this public forum.	0	0	0
<input type="checkbox"/>	Critical Issue	Any time prior to Nov. 2nd, please post the "critical issue" topic you would like to focus on for your presentation and debate. Please see the <i>Critical Issue Assignment</i> tab for further explanation.	0	0	0
<input type="checkbox"/>	1. Introductions	Please write a few sentences introducing yourself and why you are interested in marine science. Include a photo - doesn't have to be of yourself - that represents you or something within marine science and you are excited to learn more about.	0	0	0

Fall-2015 FT193-T03 / FT193-TD1



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COURSE MANAGEMENT



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## Forum: 1. Introductions

*Organize Forum Threads on this page and apply settings to several or all threads. Threads are listed in a tabular format. The T by clicking the column title or the caret at the top of each column. [More Help](#)*

**Create Thread**

**Subscribe**

*No items found.*



# Create Thread

A Thread is a series of posts related to the same subject. Threads provide an organizational structure within a Forum for users to share posts on similar topics. Creating a thread posts the first message. [More Help](#)

\* Indicates a required field.

Cancel Save Draft **Submit**

## FORUM DESCRIPTION

Please write a few sentences introducing yourself and why you are interested in marine science. Include a photo - doesn't have to be of yourself - that represents you or something within marine science and you are excited to learn more about.

## MESSAGE

\* Subject

Message

Rich text editor toolbar with options for bold, italic, underline, font face (Arial), font size (3 (12pt)), text color, list, link, unlink, and other tools. Below the toolbar is a large text area for the message content. At the bottom of the text area, it shows "Path: p" and "Words:0".

## ATTACHMENTS

**Attach File** Browse My Computer Browse Course

- Fall-2015 FT193-T03 / FT193-TD1
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- Control Panel
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  - Users and Groups
  - Customization
  - Packages and Utilities
  - Help



A photograph of a vast blue ocean under a bright blue sky with large, fluffy white clouds. The horizon line is visible in the distance.

# \* OCEAN AS A SETTING FOR LIFE

Lecture 1 - Aug 31, 2015

Intro to Marine Science

Instructor: Lauren Bell

# \* Learning objectives

After this lesson, you will be able to:

- Recognize the spatial dominance of marine systems on Earth
- Describe how the attributes of water molecules result in the physical characteristics of the world's oceans
- State the two characteristics of water that determine water density
- Identify the five world oceans by relative size and depth
- List the major oceanic and benthic subdivisions and how they are differentiated



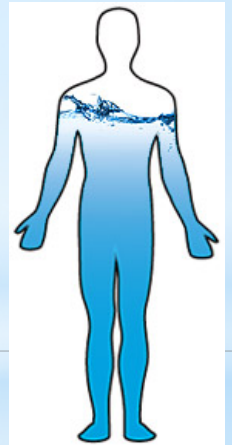
# \*The blue planet



71% water

97% of that  
= saltwater

\*\*water makes  
up 55% to  
78% of you!



What's so great about  
water, anyways?

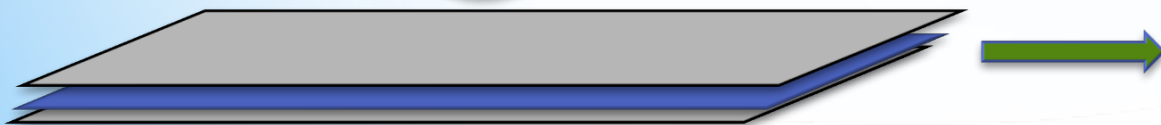


# \*The unusual world of water

"Water is the most extraordinary substance!  
Practically all its properties are anomalous...'

~ Albert Szent-Georgi, 1893-1986

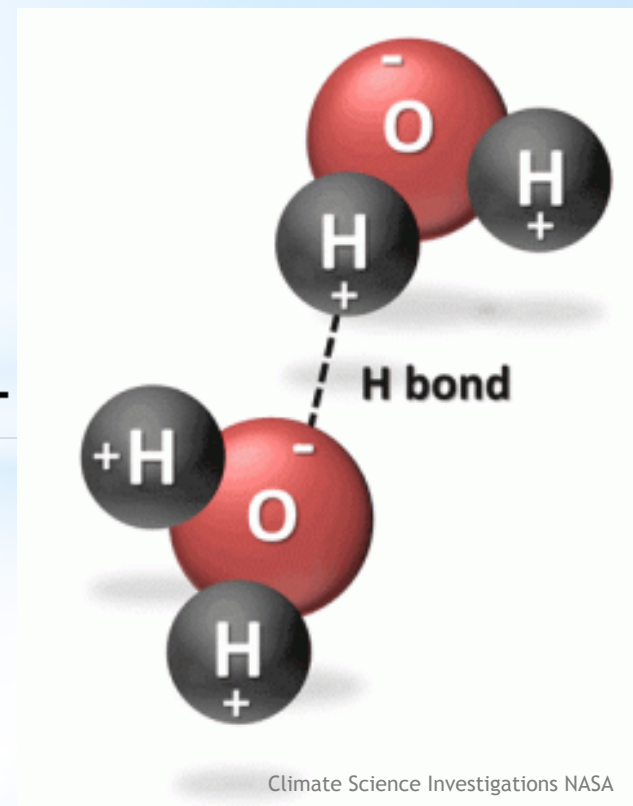
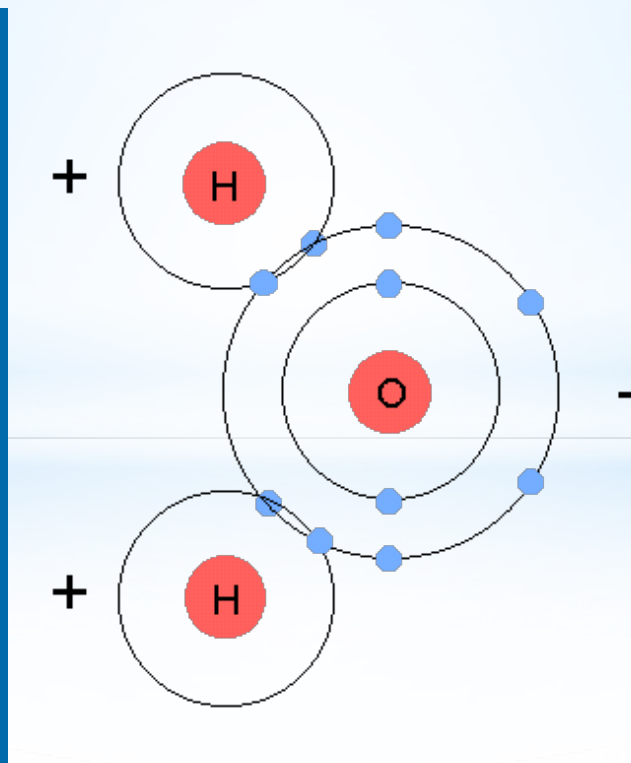
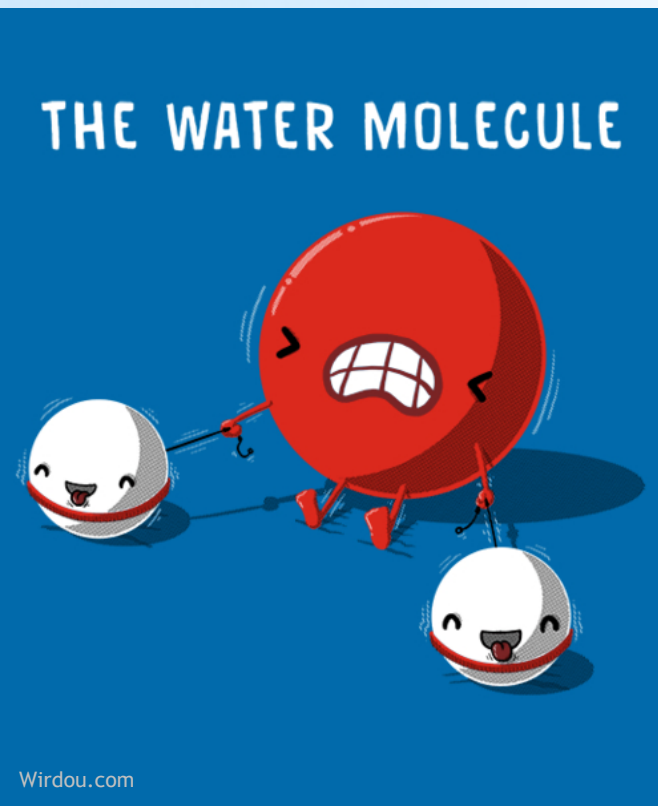
- Only material on earth found commonly as a solid, liquid, and gas
  - as a gas: one of the lightest known
  - as a liquid: much denser than expected
  - as a solid: much lighter than expected
- The “Universal Solvent”
- Great conductor of heat, but doesn’t readily change temperature or state
- Simultaneously “sticky” and “slippery”



Why?

# \*Water - elegant simplicity

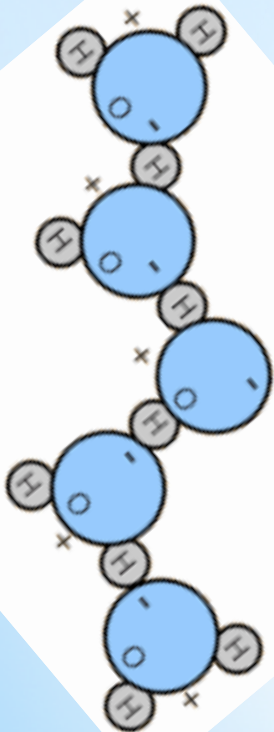
- $\text{H}_2\text{O}$  = Highly polarized: oxygen (-) vs. hydrogen (+)
  - ✧ Can share hydrogen atoms between molecules
  - ✧ Results in hydrogen bonds
  - ✧ Depending on temperature,  $\text{H}_2\text{O}$  can form chains



# \* Water - elegant simplicity

- Chain-forming

- ✧ If didn't form chains, water would freeze at  $-150^{\circ}\text{C}$  ( $-238^{\circ}\text{F}$ ) and boil at  $-100^{\circ}\text{C}$  ( $-148^{\circ}\text{F}$ )!!
  - ✧ Causes high **surface tension** = wants to 'hold together'
  - ✧ Surface tension allows wind to "grip" the water
- ↪ surface waves!





# \*Water as a “heat buffer”

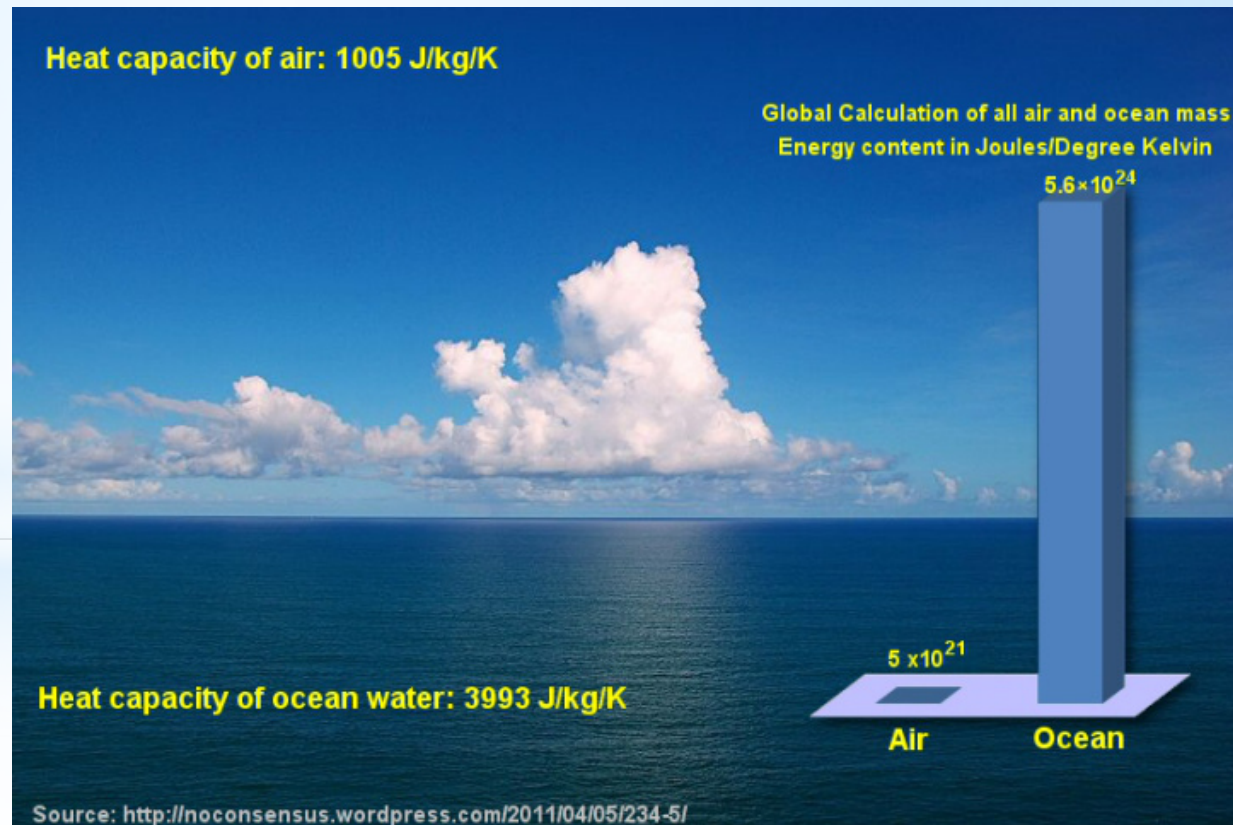
**Specific heat capacity** = amount of energy needed to change the temperature of water by a certain amount

Water has a very high specific heat capacity

=

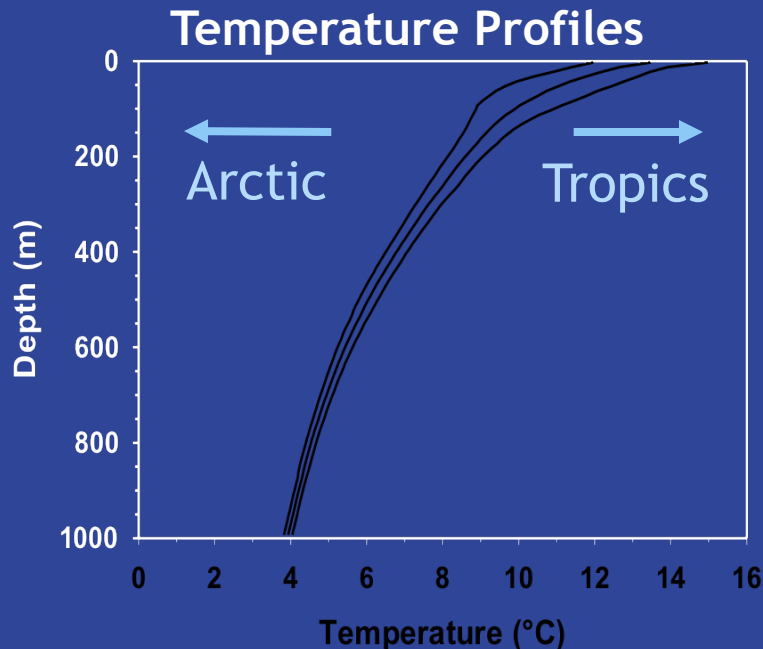
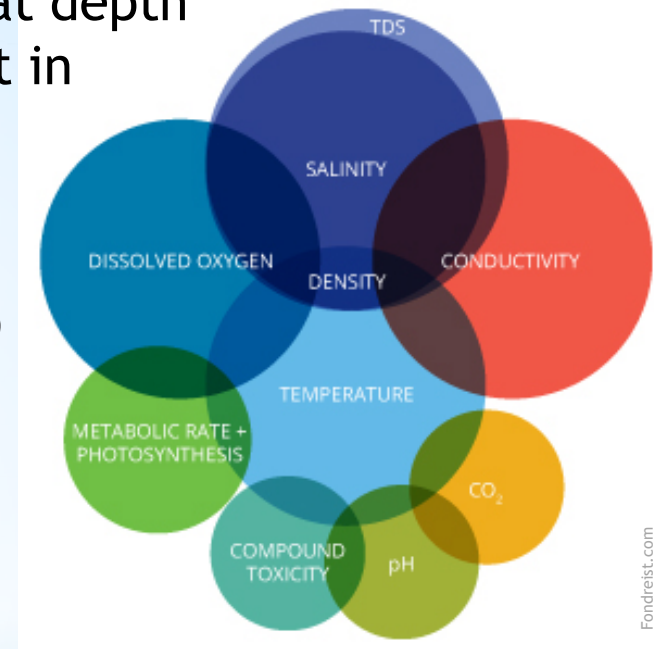
takes a LOT of energy to raise and lower the temperature of water

What does this mean for the world’s oceans and marine critters?



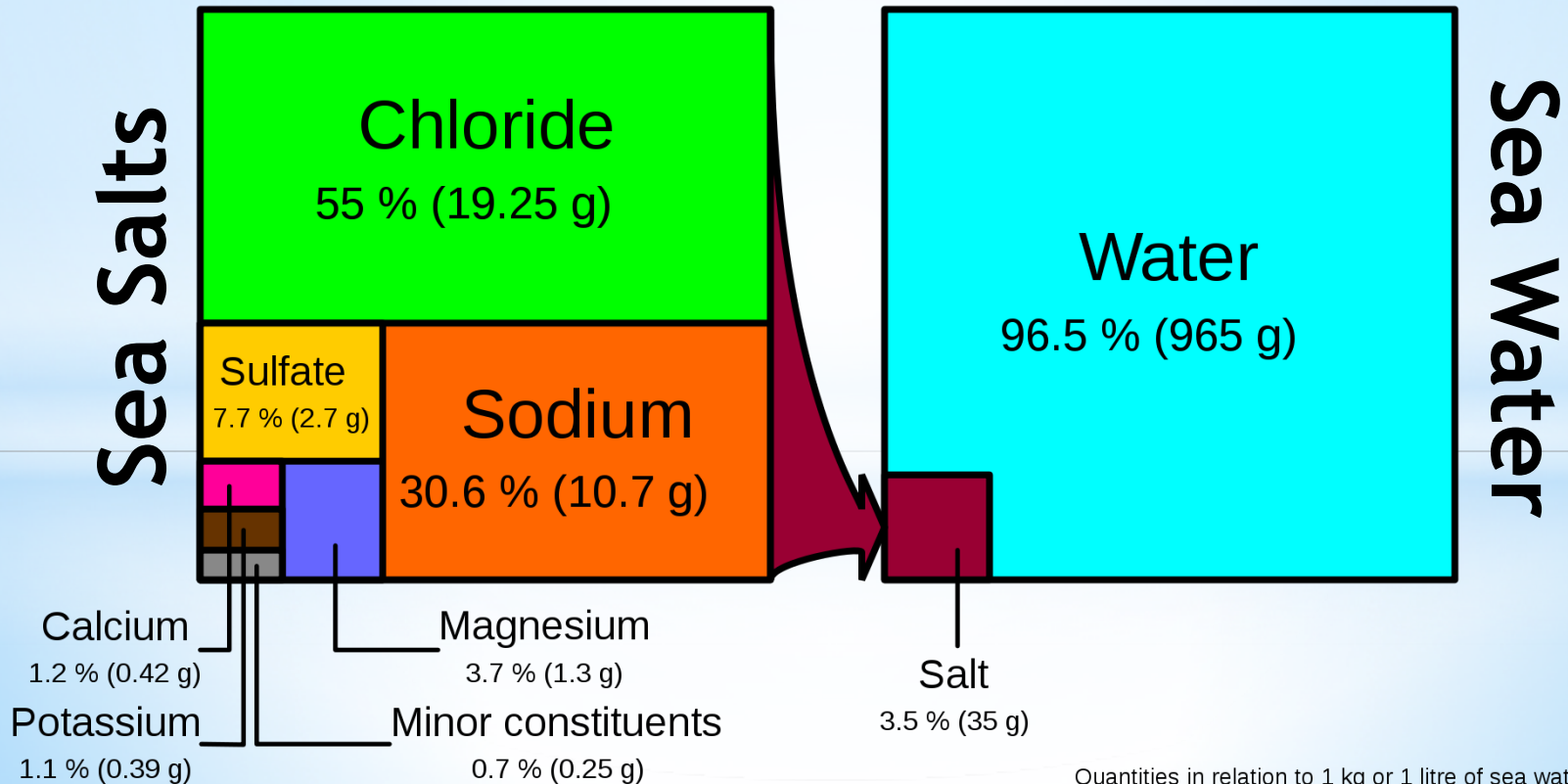
# \* Water as a “heat buffer”

- The value of temperature stability
  - ✧ Resistant to big temperature swings, esp. at depth
    - ↳ Maximum 30°C (86°F) except in very shallow enclosed pools
  - ✧ Most marine organisms are **poikilotherms** (“cold-blooded”)



# \* Seawater chemistry

- Polarity of  $\text{H}_2\text{O}$  = very high dielectric constant (i.e. the ability for molecules to align themselves in an electric field)
  - ✧ Liquids with high dielectric constants = great solvents
  - ✧ The reason why we have such a salty ocean!!



Quantities in relation to 1 kg or 1 litre of sea water.



# \* Solubility of gases

- Gases dissolve in water easily, too!
  - ✧ Gas solubility: goes down as temperature and salinity increase  
goes up as pressure increases
  - ✧ Varies between different gases

Gas	% in dry air	% in surface seawater	Water/Air	Solubility
Nitrogen	78	63	0.8	Lowest
Oxygen	21	34	1.6	Intermed.
Carbon Dioxide	0.03	1.6	>50	Greatest
Ar, H, Ne, He	1	1.4	1.4	Intermed.

biologically inert

availability for marine organisms; super-saturation of waters

reacts to form bicarbonate

needed for photosynthesis

oceans as CO<sub>2</sub> reservoirs!!

# \* What determines seawater density?

(density = mass/volume)

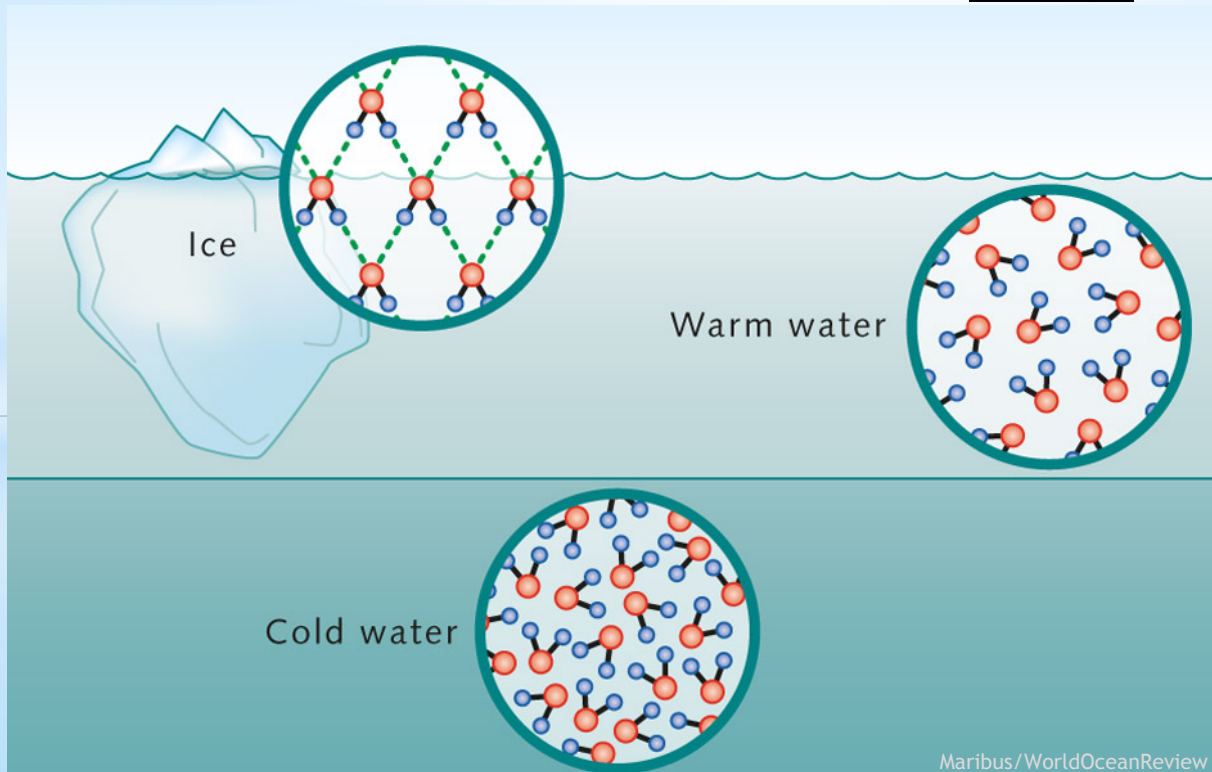
## TEMPERATURE

↑ temp = molecules spread apart  
= ↓ density

## SALINITY

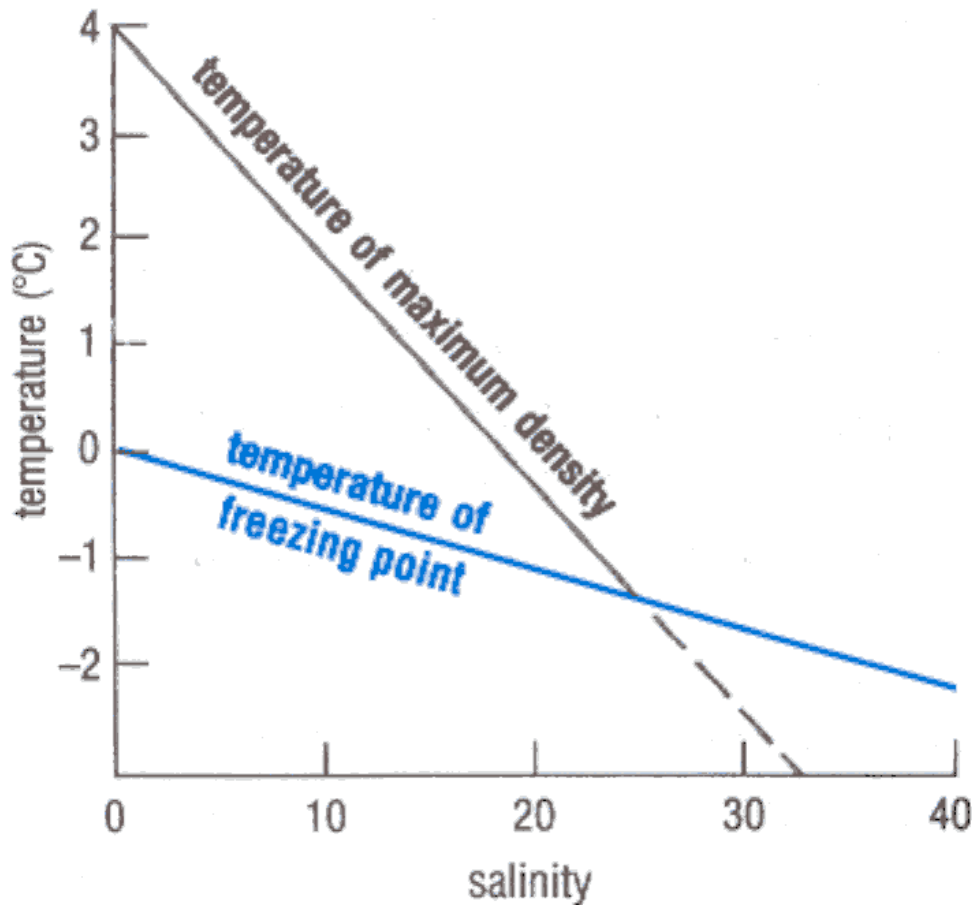
↑ salt content = ↑ mass  
= ↓ density

\*also, under great pressures: DEPTH



Buoyancy  
requires  
that lighter  
water floats  
on top of  
denser  
water

# \* Saltwater vs. freshwater



Why don't freshwater lakes freeze completely solid in the winter?

- Fundamental difference in relationship between temperature and density when salinity changes
- In FW, ice insulates 4°C water below it
- SW just keeps cooling below 0°C



# \* Dynamic world ocean



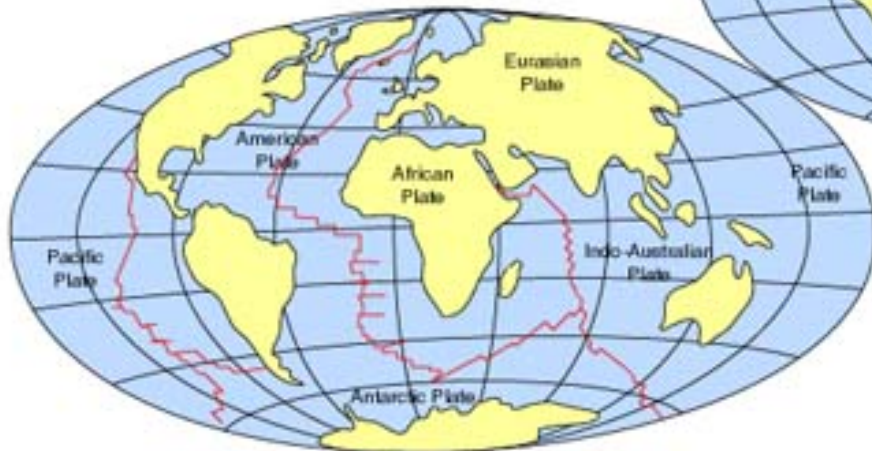
200 million years ago



135 million years ago

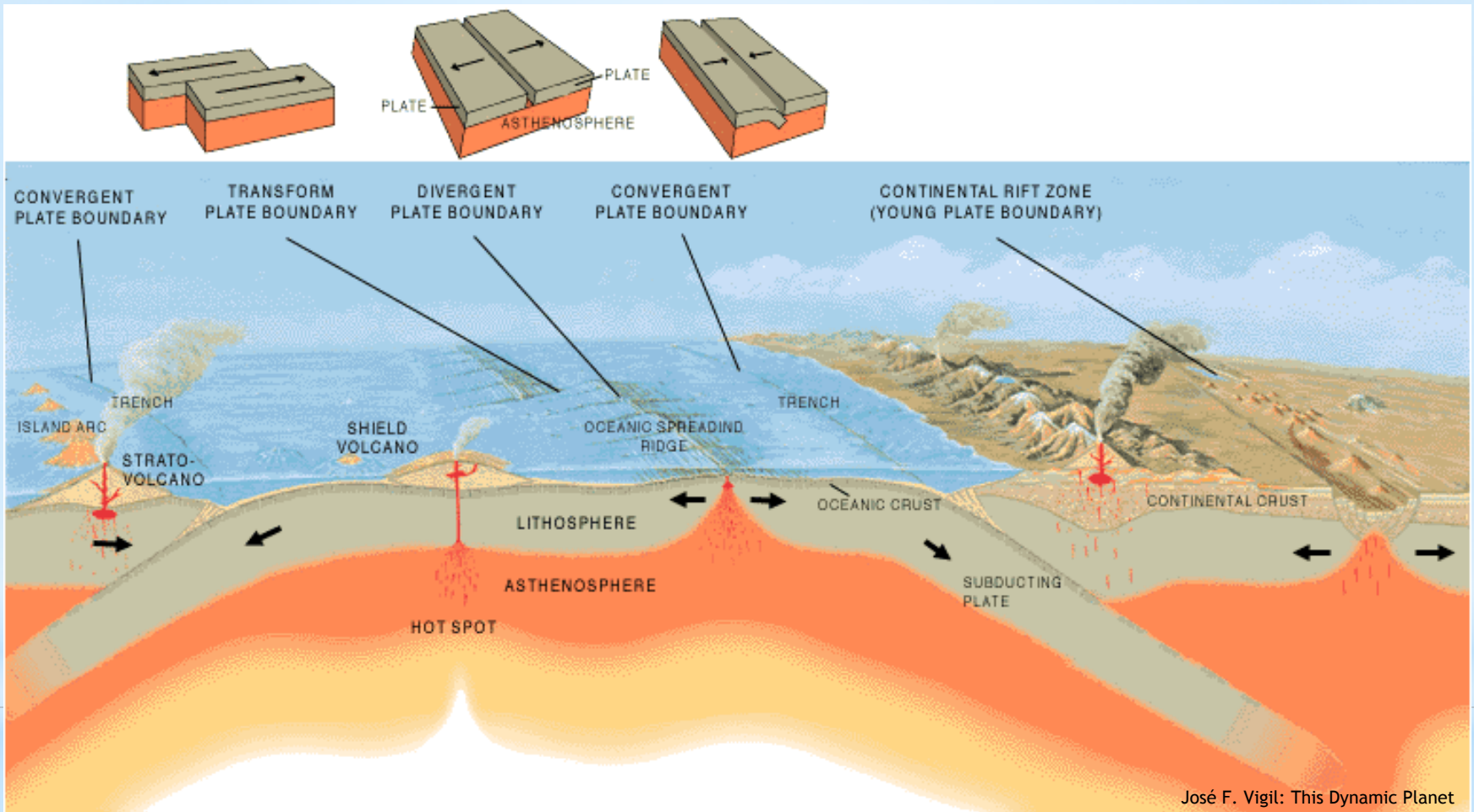


35 million years ago



Present day

# \*Types of plate boundaries



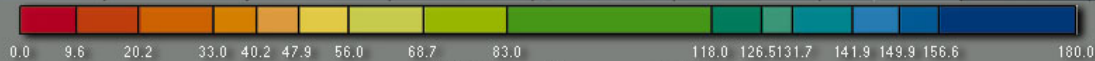
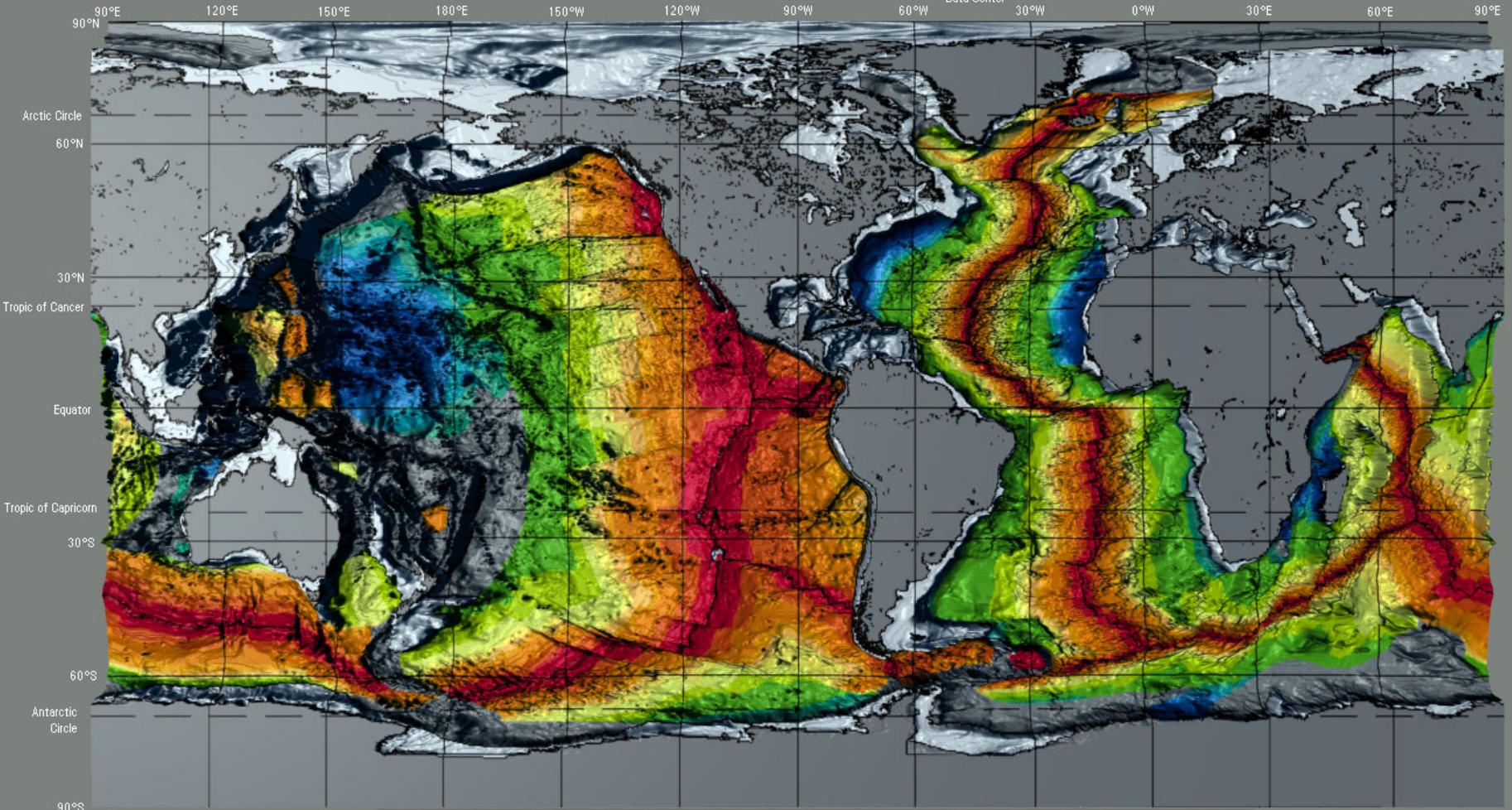
- Lead to some very interesting underwater features (to be continued...)



# Crustal Age



National Geophysical  
Data Center



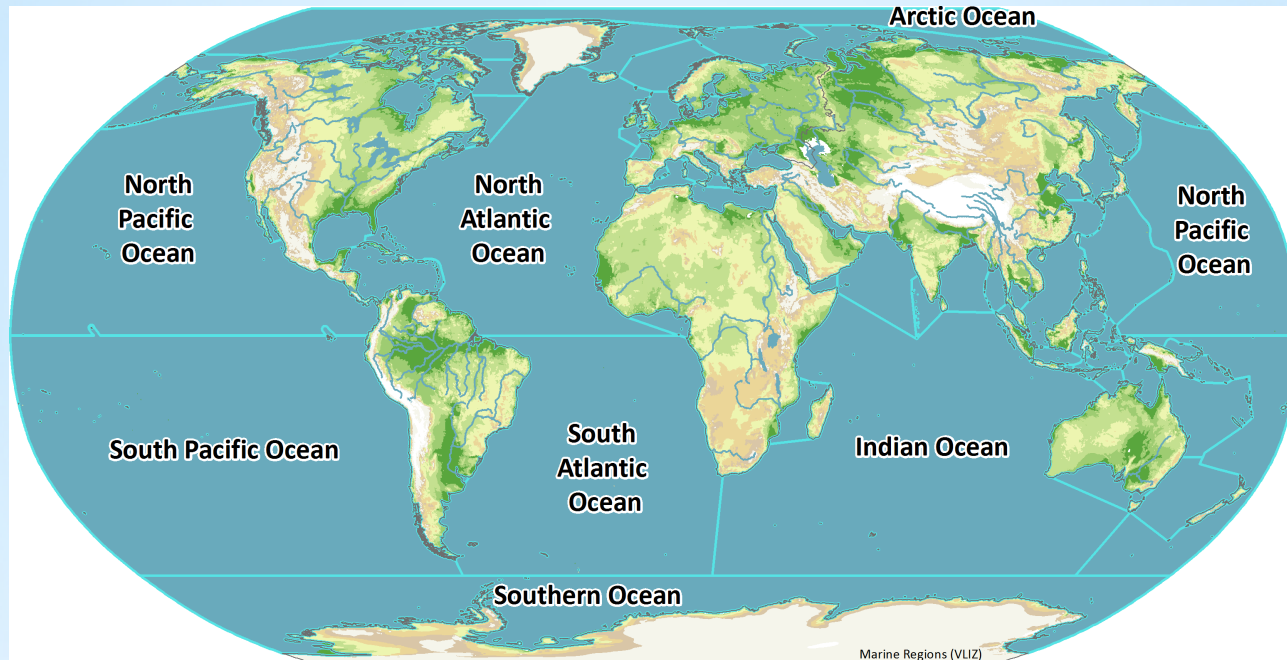
Million Years B. P.

Data for the image from "Digital Age Map of the Ocean Floor" by Müller, Roest, Royer, Gahagan, and Schlater, Scripps Institution of Oceanography Ref. Series No. 93-30

For information on this and other images produced by NGDC's Marine Geology and Geophysics Division, contact Peter Sloss at [psloss@ngdc.noaa.gov](mailto:psloss@ngdc.noaa.gov)

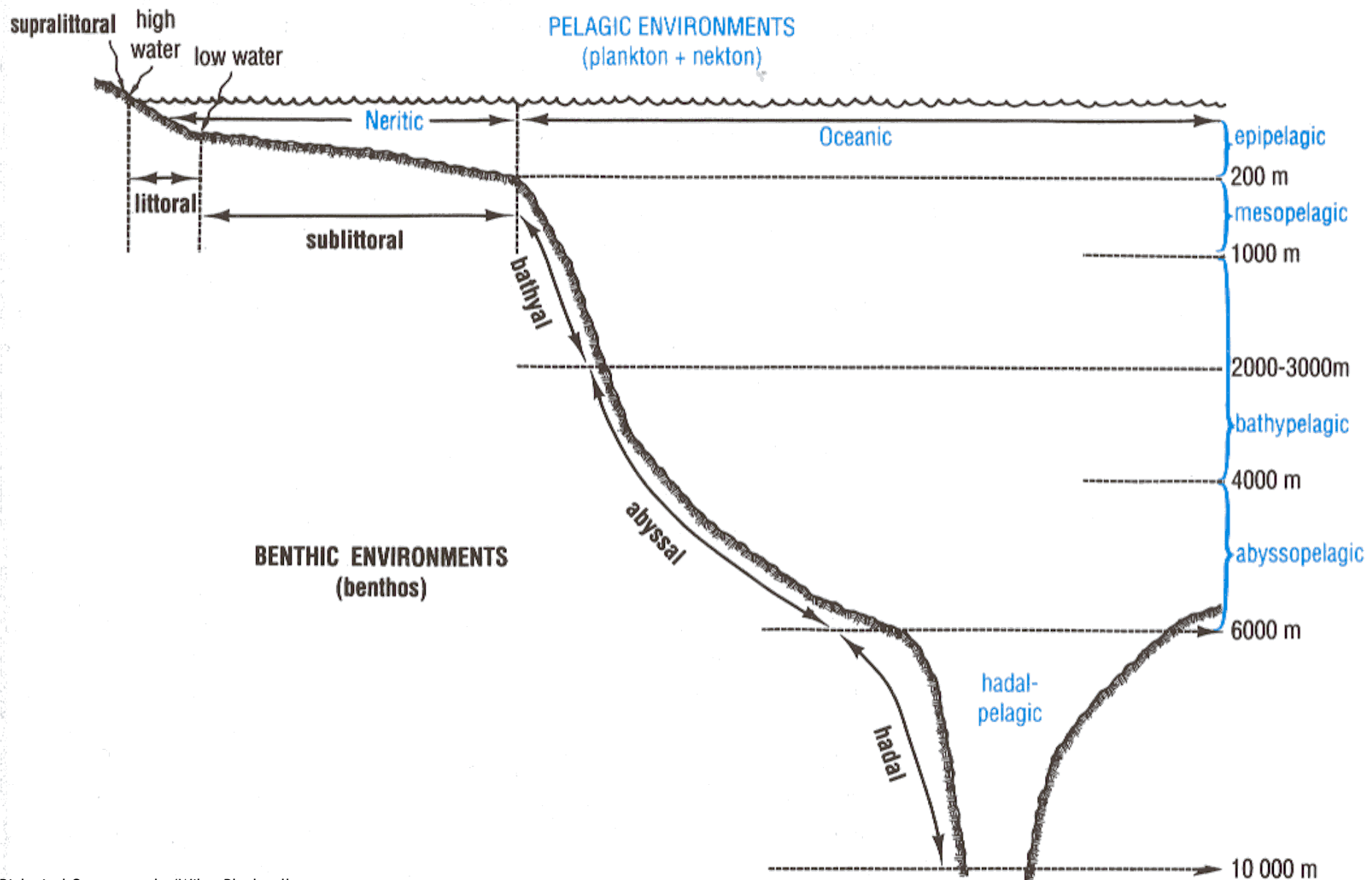


# \* Major modern-day ocean basins

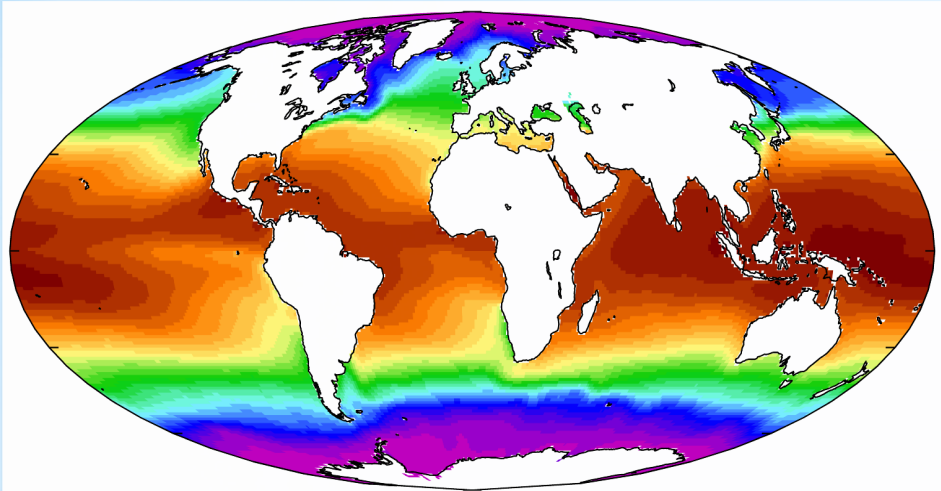


Ocean	% Earth's total surface	Area (millions of km <sup>2</sup> )	Avg. Depth (meters)
Pacific	30.5	166.2	4,188
Atlantic	15.1	86.5	3,736
Indian	13.4	73.4	3,872
Southern	4.0	20.3	~4,500
Arctic	2.8	9.5	1,330

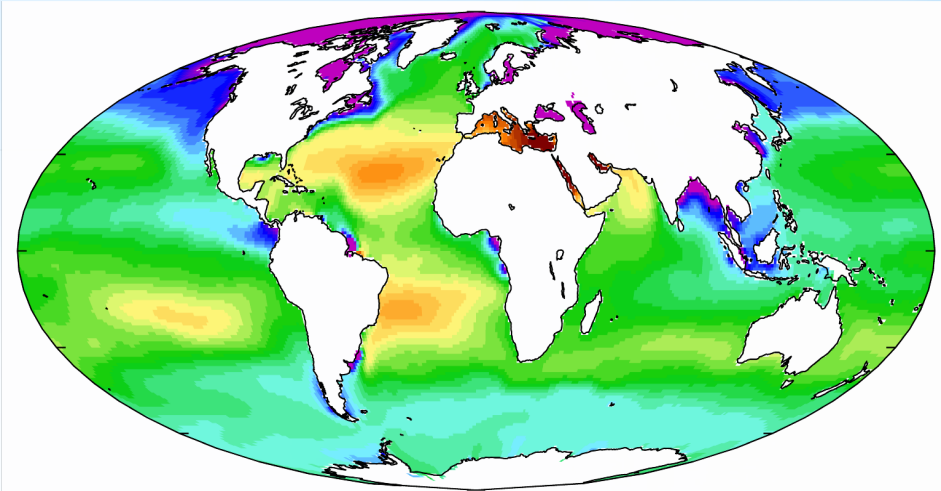
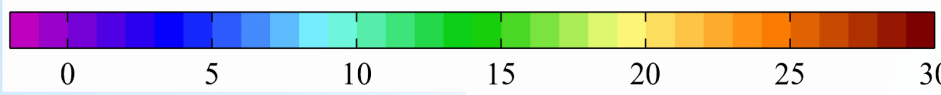
# \* Oceanic divisions



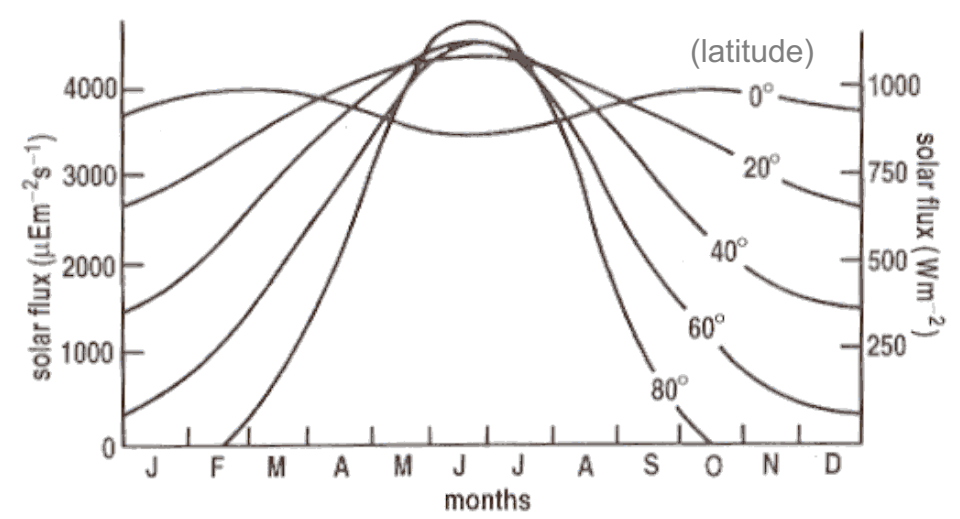
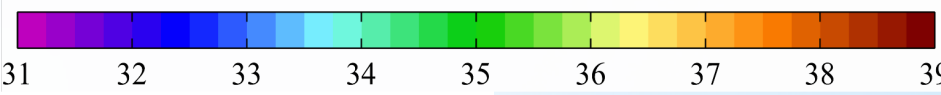
# \* All ocean basins not created equal...



Sea-surface temperature [ $^{\circ}\text{C}$ ]

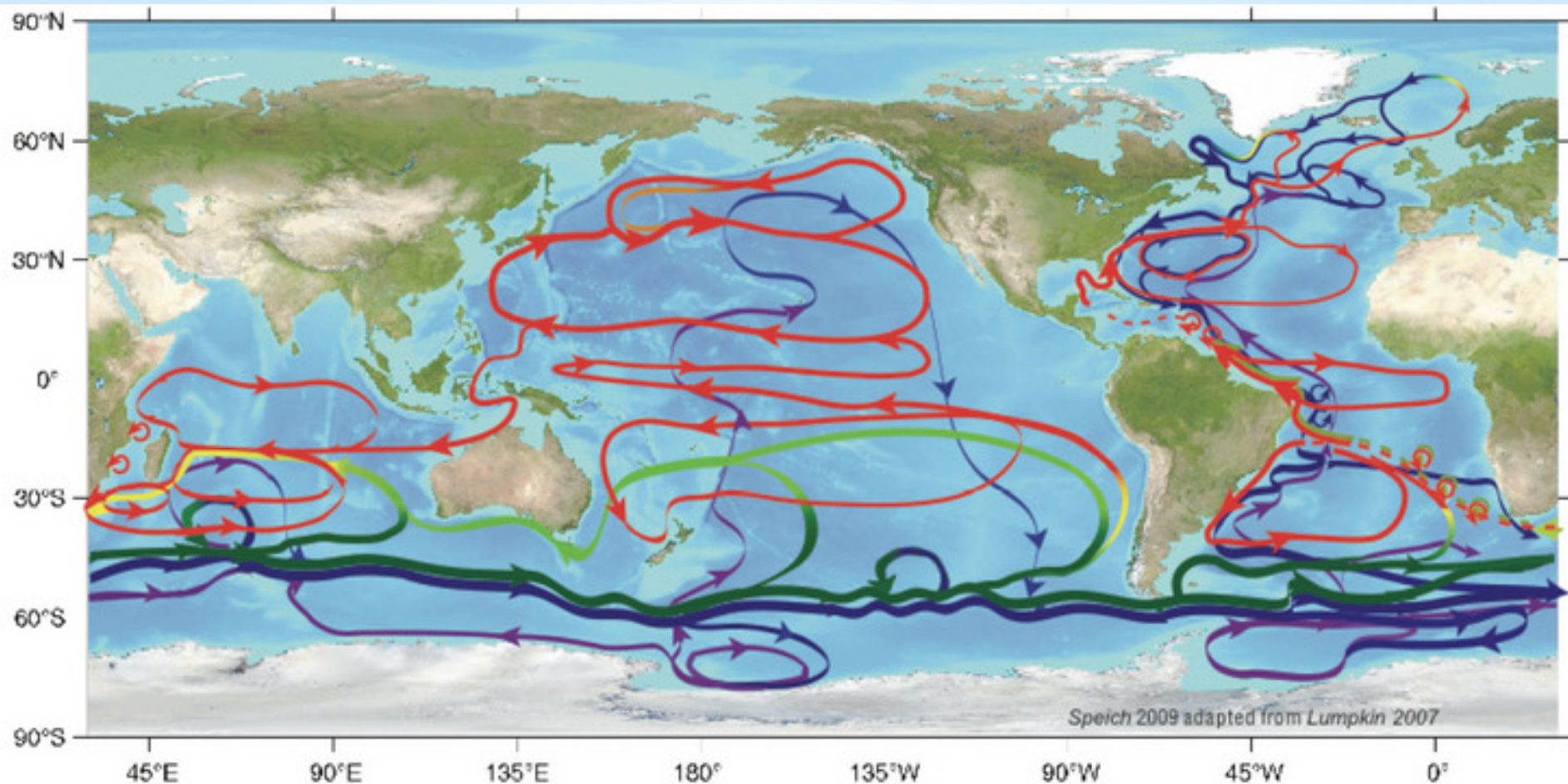


Sea-surface salinity [PSU]





# \* How are heat/nutrients distributed???



next time....



**\*Where/how does marine science happen???**



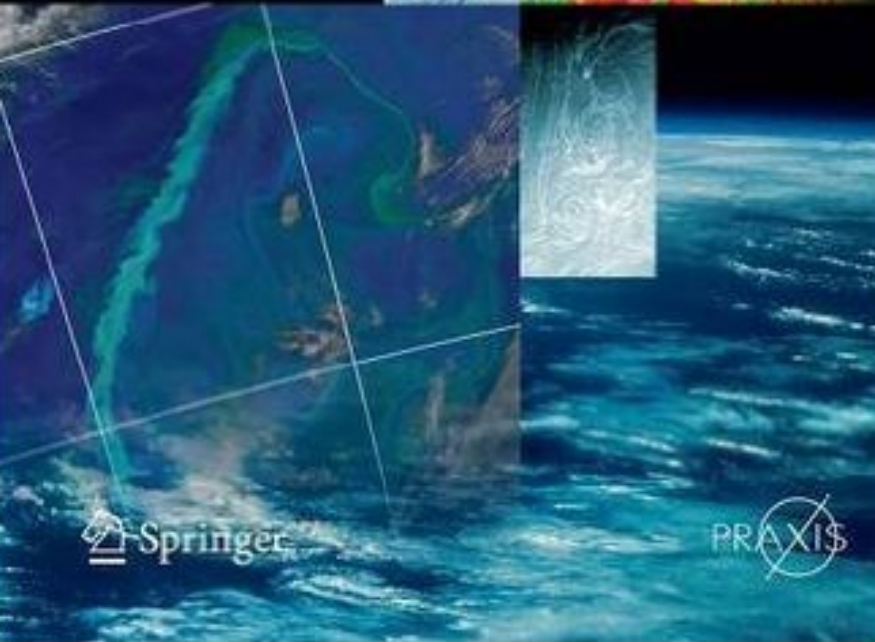
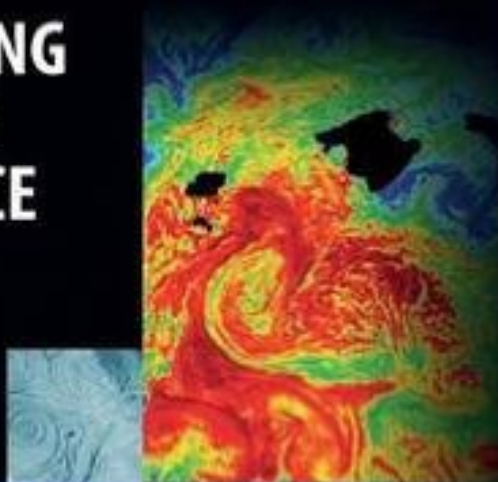




Ian S. Robinson

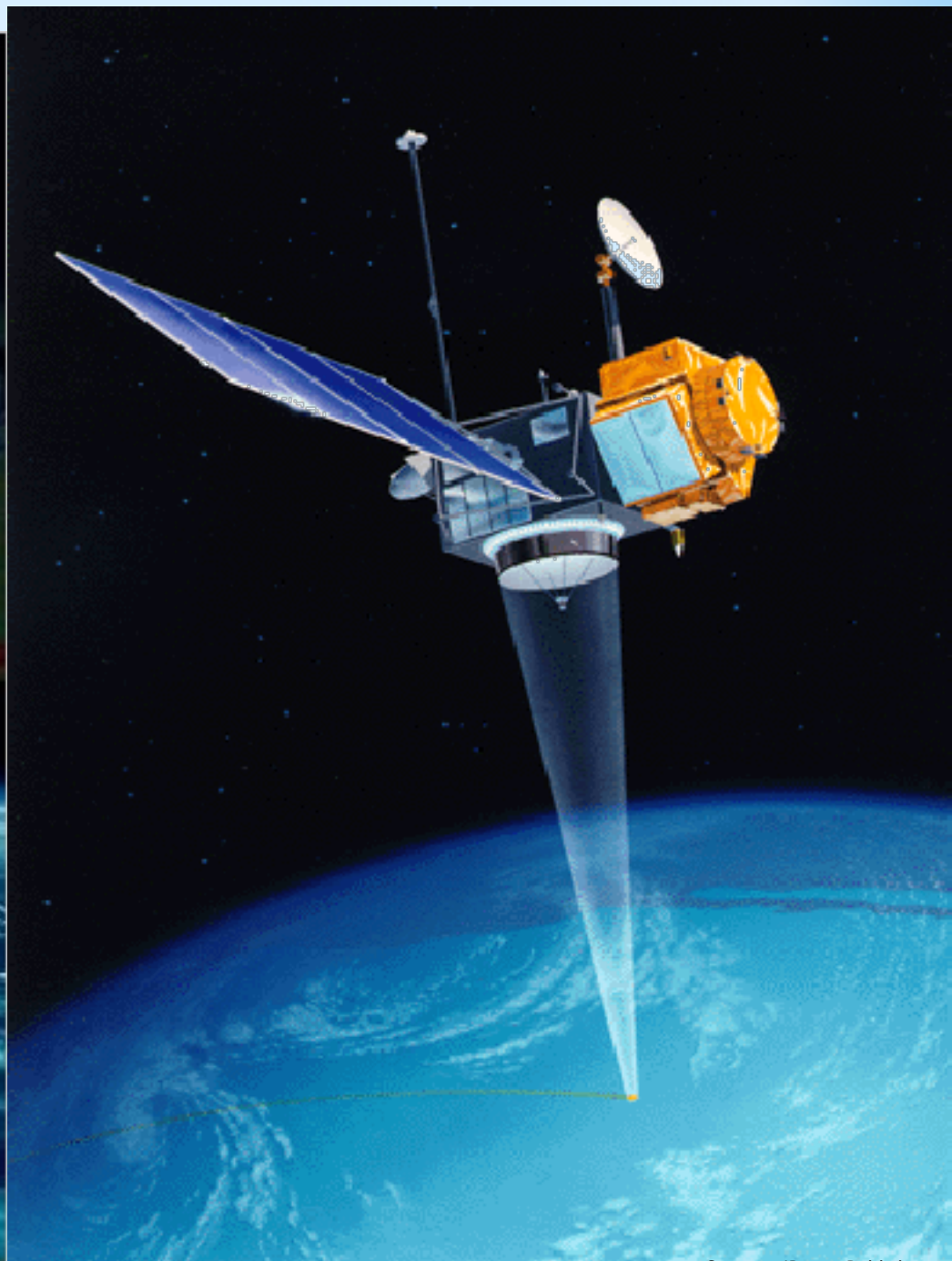
# DISCOVERING THE OCEAN FROM SPACE

The unique  
applications  
of satellite  
oceanography



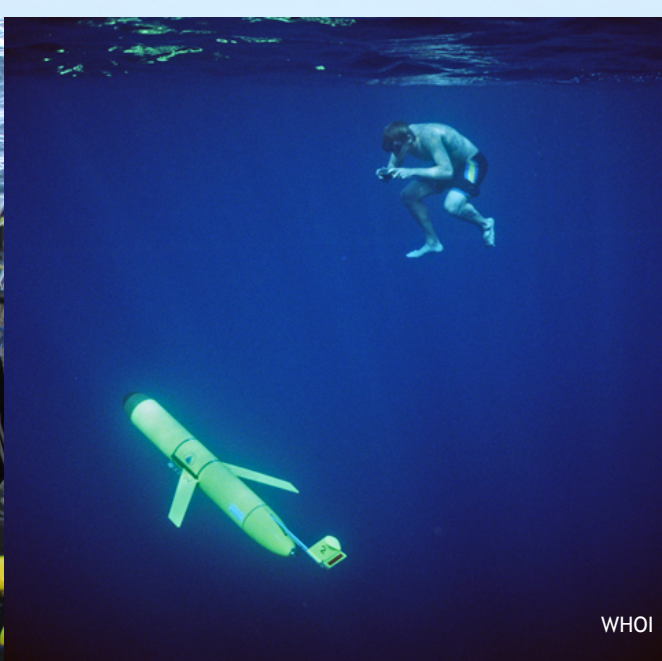
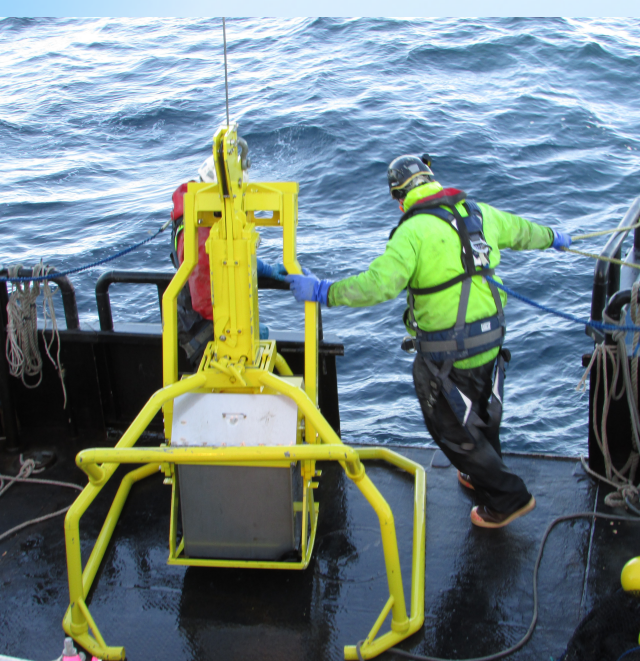
 Springer

 PRAXIS









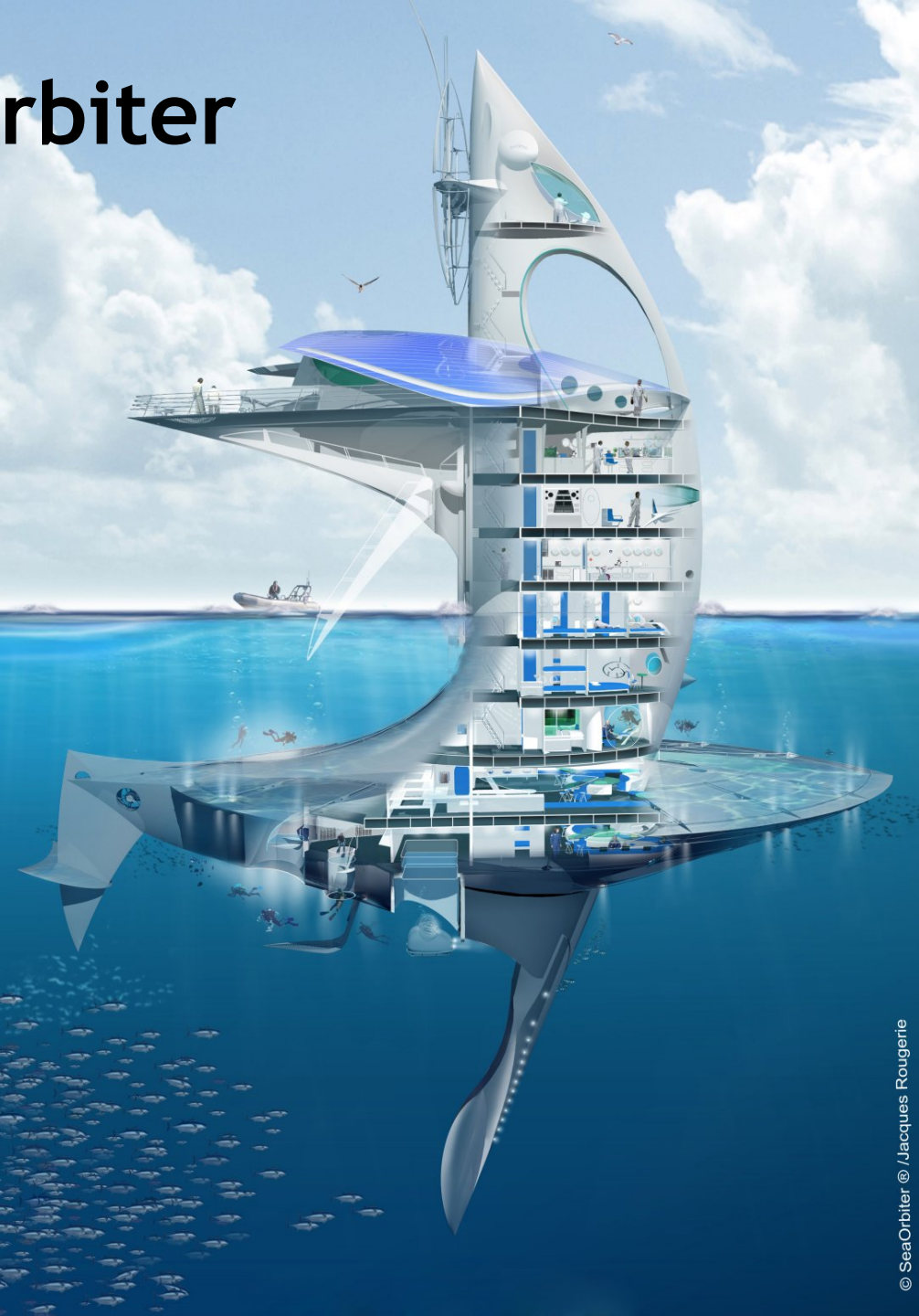
WHOI

Stemination.org





# The SeaOrbiter







- Depth limit for (most) science by SCUBA : 60 m (200 ft)





# Challenger Deep - 2012

<http://www.deepseachallenge.com>

- Human (millionaire James Cameron) reaches deepest point of world's oceans

**THE DEEPEST SCUBA DIVE: 1,044ft**

**BLUE WHALE: 3,000ft**

**DEEPEST MILITARY SUBMARINE: Soviet submarine K-278 Komsomolets, 4,265ft**

**MOUNT EVEREST (29,029ft):** If it was put into the Mariana trench it would still fall short of sea level by 7,000ft

**Water pressure comparable to three Land Rovers resting on a toe - sub shrank by three inches under the pressure.**

**CHALLENGER DEEP 35,994ft**

**36,000ft**

**FACTFILE**

- Height: 24ft
- Weight: 12 tons
- Made from a specialised glass foam
- It took two hours and 36 minutes to reach a depth of 35,736 feet, a rate of 500 feet per minute. He rose to the surface in 70 minutes

**8ft high wall of LED lights**

**Stabiliser fin**

**Batteries**

**Directional thrusters**

**Cockpit: 43 inches wide**

**3D cameras**

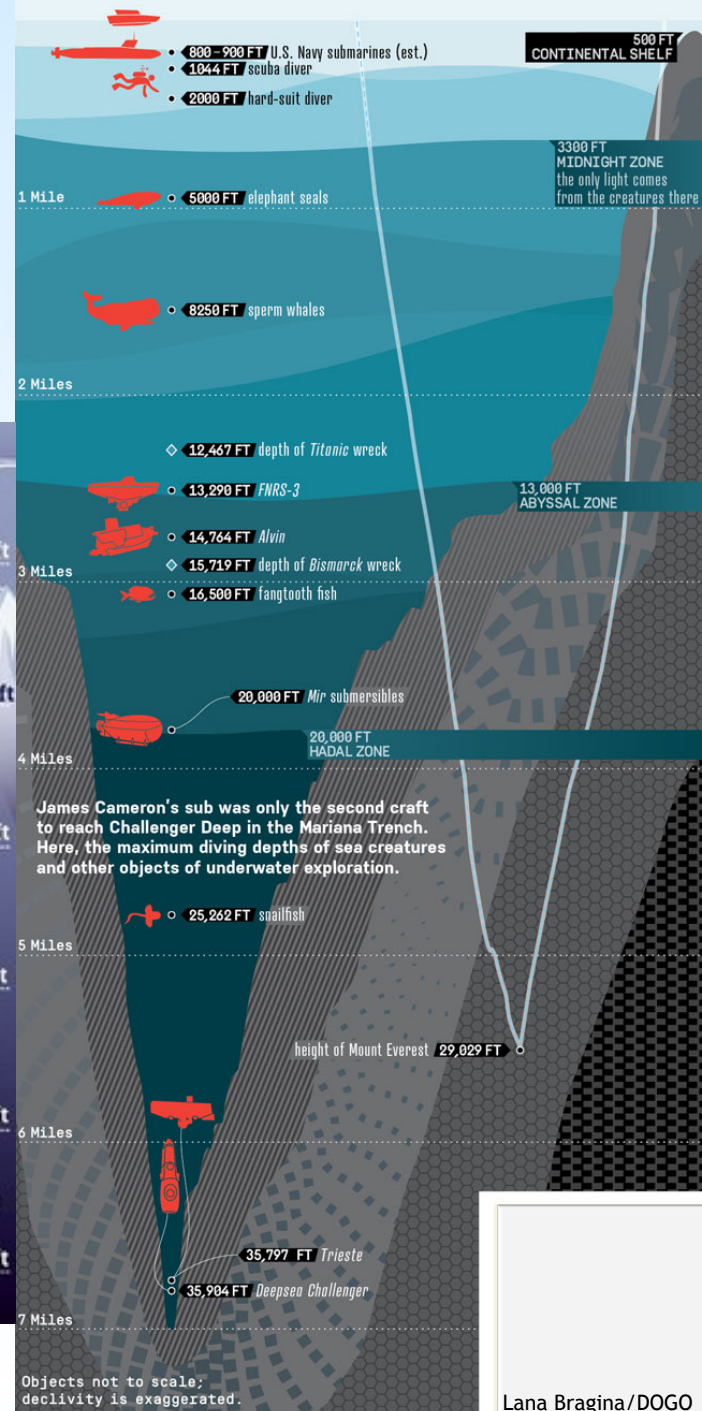
**Robot arm**

**1,100lb of ballast drops off to ascend**

**SUCCESS: James Cameron on his return to the surface**

**Mariana Trench Challenger Deep Pacific Ocean**

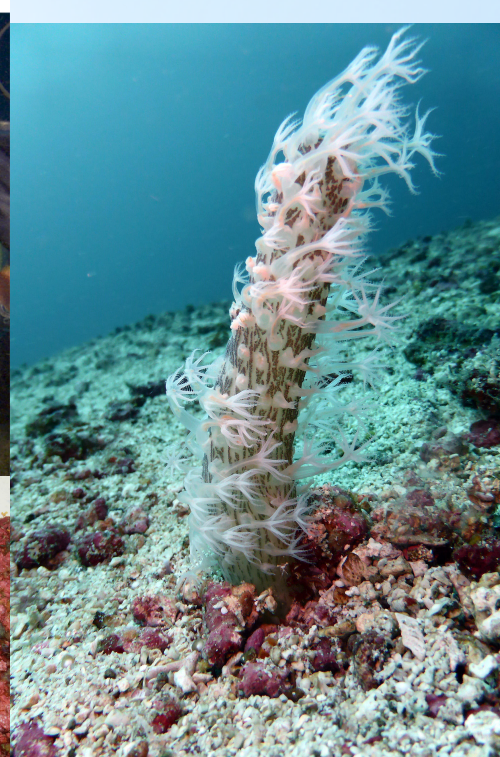
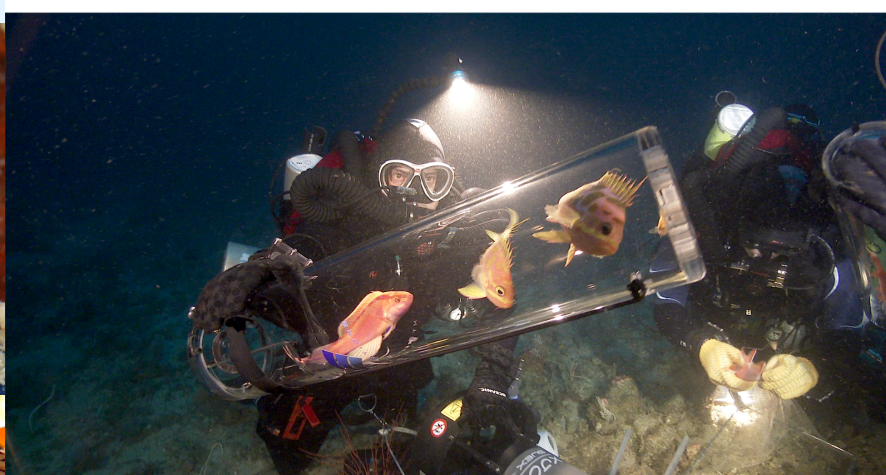
**NatGeo**





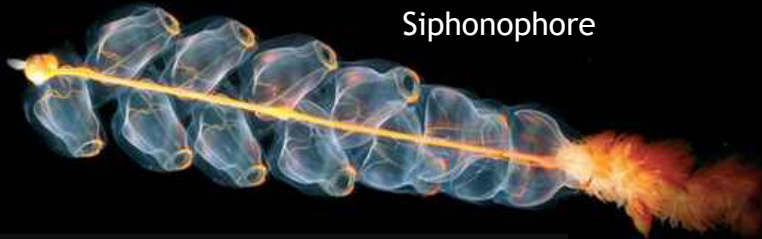
# \*To date, we have explored less than 5% of the ocean

- ✧ Discovering >2,000 new marine species per year
- ✧ Some estimates that up 500,000+ species yet to be discovered
- ✧ Not just deep-sea, a trip this year to Philippines found 100 new species in 7 weeks at technical SCUBA-accessible depths





# ...and there seems to be some weird stuff out there...



Siphonophore



Goblin Shark



Salp



Yeti crab



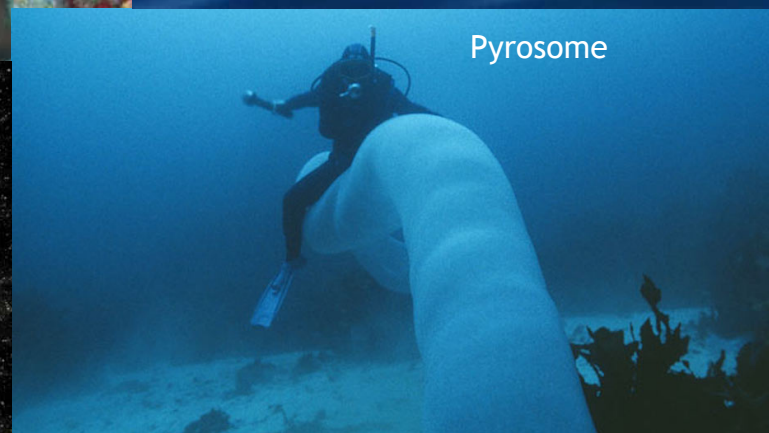
Red-lipped batfish



Dumbo octopus

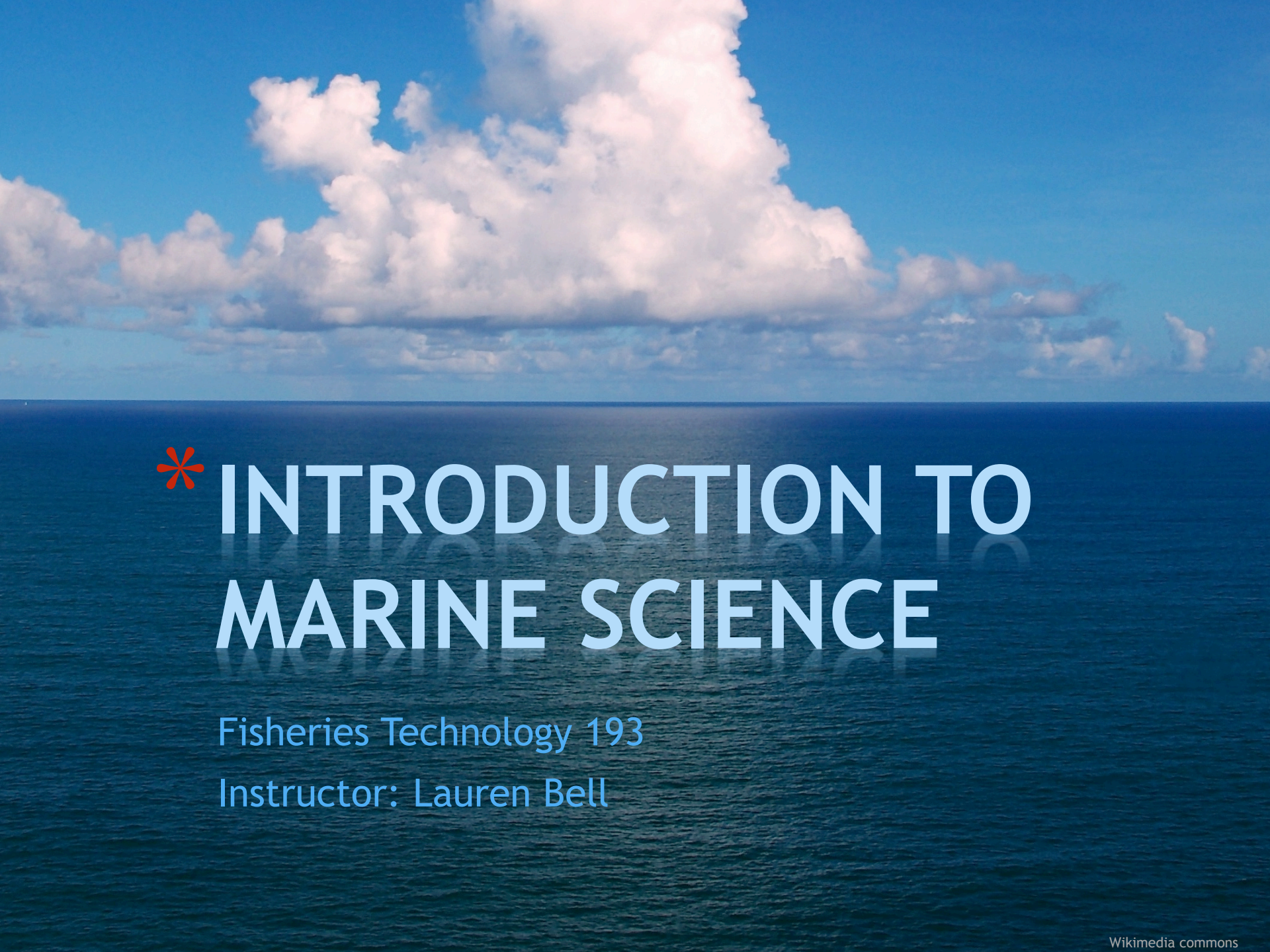


Sea cucumber



Pyrosome





\* **INTRODUCTION TO  
MARINE SCIENCE**

Welcome to class!

See you again on Sept 14

Keep tabs on Blackboard for upcoming module