Oregon Marine Scientist and Educator Alliance Capstone Event

Today’s Agenda

ORSEA Overview

ORSEA Team Presentations

Open House: Social With Resource Tables

NOAA Research Ship Tour, Visitor Center and Guin Library Exploration, STEM Hub Resource Trailer Materials, Interpretive Estuary Exploration

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

ORSEA is Funded by Oregon Sea Grant, the Oregon Coast STEM Hub and the National Science Foundation through OSU's Regional Class Research Vessel Project.

ORSEA brings together educators and marine researchers around important ocean issues, career-connected learning, and effective science communication practices.

ORSEA educator and scientist teams create and pilot lessons centered around marine-related phenomena that incorporate real data.

Sea Grant Oregon
OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE
NSF
RCRV Regional Class Research Vessels

New Regional Class Research Vessels

R/V *Taani*

Oregon State University

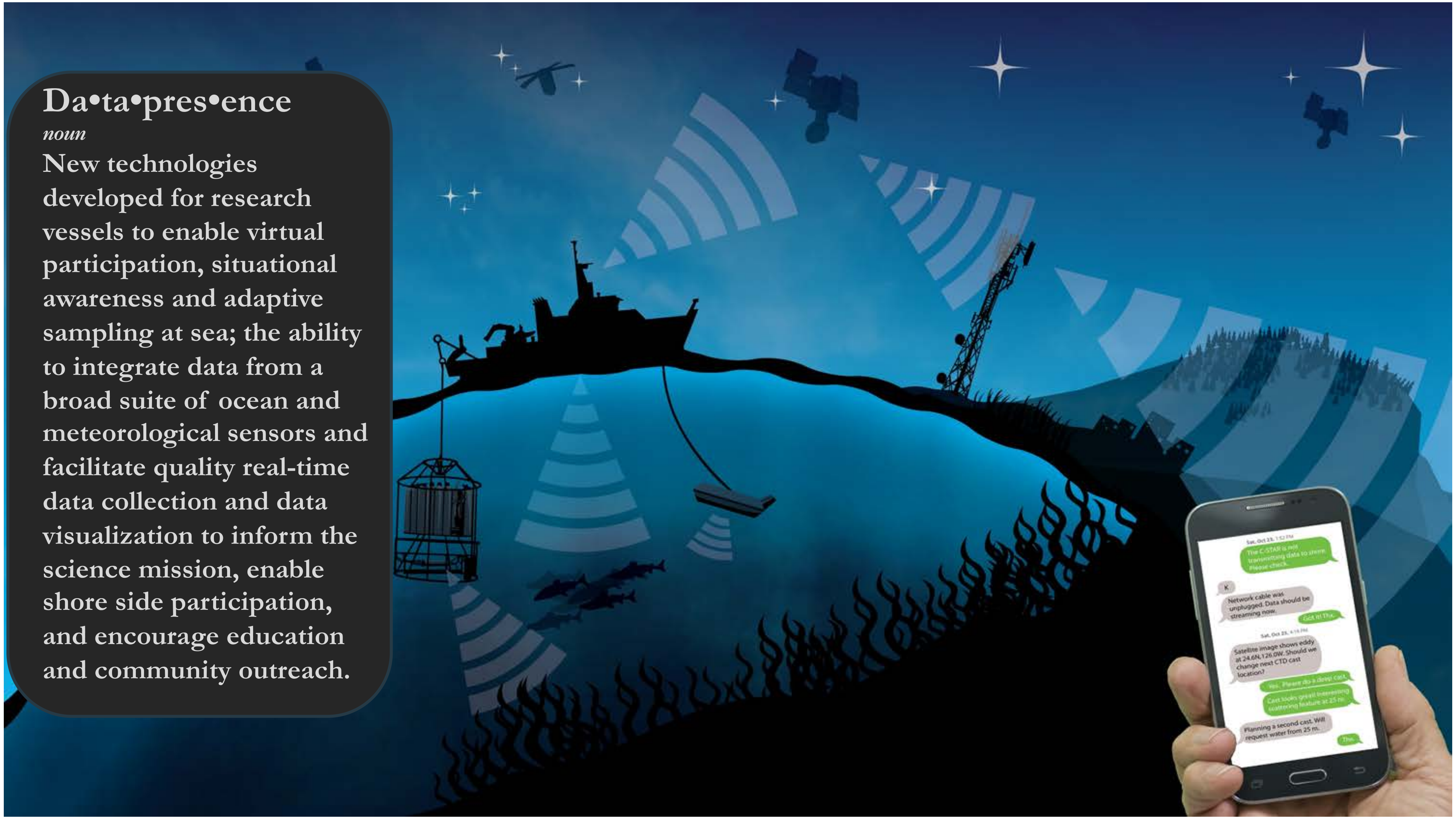
R/V *Narragansett Dawn*

EAST COAST OCEANOGRAPHIC CONSORTIUM
ECOC 2018
UNH • URI • WHOI

R/V *Gilbert R Mason*

GULF-CARIBBEAN OCEANOGRAPHIC CONSORTIUM

National Science Foundation
WHERE DISCOVERIES BEGIN


Da•ta•pres•ence
noun
New technologies developed for research vessels to enable virtual participation, situational awareness and adaptive sampling at sea; the ability to integrate data from a broad suite of ocean and meteorological sensors and facilitate quality real-time data collection and data visualization to inform the science mission, enable shore side participation, and encourage education and community outreach.

RCRV Outreach & Education Goals

Design and build interactive exhibits for public audiences of all ages at Oregon State University's Hatfield Marine Science Center.

Provide trainings on effective outreach and engagement for researchers including datapresence and outreach tools, as well as best practices for effectively communicating science to a variety of audiences.

Develop curricula, videos and other resources for educators and students that show how scientific observations made at sea are the crux of understanding, discovering, tracking and predicting natural and human-impacted processes.

ORSEA Goals

- Co-create integrated math and science curriculum with a marine-themed anchoring phenomena that builds scientific and data literacy.
- Increase teacher and student understanding and interest in marine science research practices and related careers.
- Provide opportunities for researchers to improve their science communication skills.
- Establish a sustainable network of Oregon educators and marine science researchers.

Sea Grant Oregon

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

NSF

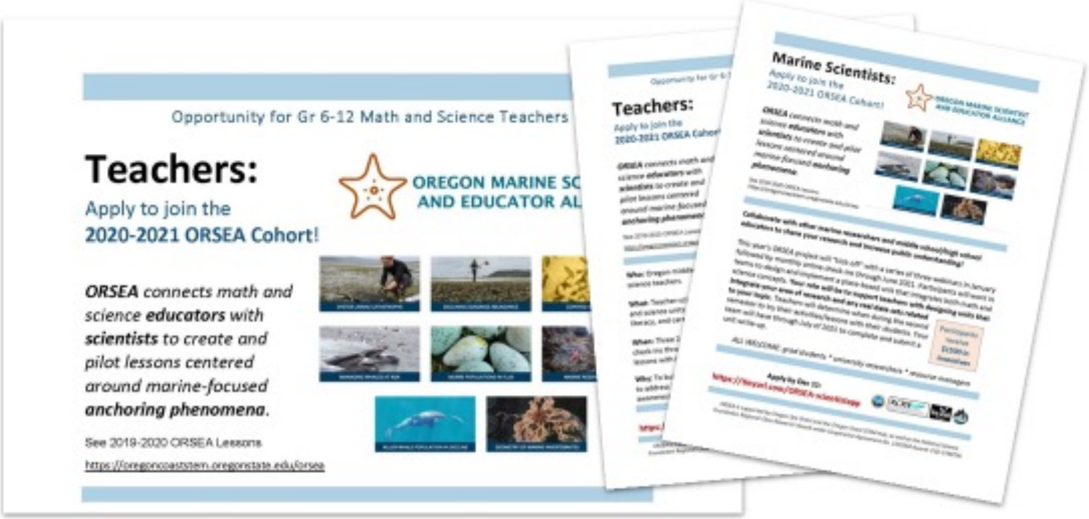
RCRV Regional Class Research Vessels

Cohort Recruitment

Karen Lohman @Karen_E_Lohman · 1h

Highly recommend this for any Oregon marine researchers! My teachers were fantastic & totally game to bring my research project to their classrooms. We had high schoolers calculating allele frequencies! 🤯

> **Oregon Sea Grant** @OregonSeaGrant · 1h
>
> Are you a marine scientist in Oregon? Want to earn $1,500 & help middle & high school teachers create lessons that use your research? @OregonSeaGrant is accepting applications from master's & PhD students, postdocs, research assistants & profs thru Dec 11. bit.ly/3lyEqQT



$1500 Stipends for teachers and graduate students

Competitive Application Process

Kickoff Event

Teams formed that include a math teacher, a science educator, and a researcher

Multi-day Professional Development

Scientist and Teacher Poster Presentations

Online Interest Survey

Training Science Communication

NGSS, Anchoring Phenomena, 5-E Model

Sea Grant Oregon

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

NSF

RCRV Regional Class Research Vessels

ORSEA Communities of Practice

Monthly team meetings

Meetings facilitated via Zoom

Teams provided templates

Dedicated time for teams to identify resources, develop lessons and receive feedback

Lesson: Declining Seagrass Abundance

Download the Lesson Plan

Links to the materials included in the lesson plan

- **Teacher Guide:** Overview and timeline
- **Slide Presentation:** Seagrass Beds at Valino Island [2.1MB]
- **Background**
  - Seagrass Reading - for students
  - Reading Comprehension Questions and Answer Key
- **Activity:** Quadrat Sampling
  - Quadrat Sampling Worksheet (to print) and Answer Key
- **Activity:** Quadrat Sampling at Home
  - Quadrat Sampling at Home Worksheet (to print)
- **Activity:** Data Analysis
  - Basic Level - Data Analysis 1
  - Intermediate Level
    - Data Analysis 2
    - Eelgrass Data 2

LESSON OVERVIEW

Anchoring Phenomenon

Declining Seagrass Abundance

Driving Question

Why has seagrass abundance declined in some Oregon estuaries?

Grade Level

Oregon Marine Scientist and Educator Alliance

Declining Seagrass Abundance

Why has seagrass abundance declined in some Oregon estuaries?

Overview

Photographic evidence collected over the past decade indicate that seagrass abundance at Valino Island in South Slough National Estuarine Research Reserve has declined over recent time. Is seagrass wasting disease the culprit, and what are the ecological impacts of reduced seagrass abundance?

Learning Goals

Students will learn the following:

- *Seagrass communities provide important ecosystem services.*
- *Researchers use quantitative methods to determine whether there are changes in seagrass abundance over time.*
- *Seagrass wasting disease is caused by a protist and is causing changes in seagrass abundance in at least one Oregon coastal estuary.*

Introduction

Seagrasses are flowering plants that have evolved to live in seawater, and estuarine seagrass communities are one of the most productive and dynamic ecosystems in the world. Eelgrass (*Zostera marina*) is the most prevalent type of seagrass found on the U.S. West Coast. While providing habitat and nursery grounds for many marine organisms, seagrasses also stabilize substrates, contribute organic matter to estuarine food webs, and filter or buffer nutrients and chemical inputs. The health of seagrass communities is widely considered to indicate the overall health of an estuary.

In recent years, seagrass researchers from Oregon State University's Hatfield Marine Science Center have noticed a decrease in seagrass abundance at their Valino Island

Authors

Christina Geierman
North Bend High School
Jennifer Hampel
North Bend High School
Ryan Mueller
Oregon State University

Grade Level
9-12

Anchoring Phenomenon
Declining Seagrass Abundance

Driving Question
Why has seagrass abundance declined in some Oregon estuaries?

Time
Engage 15 min
Explore 45 min
Explain 20 min
Elaborate 45 min
Evaluate 20-60 min
Teacher Guide and Overview

ORSEA resources available on website as links or in an integrated downloadable lesson plan

ORSEA Capstone Event

Sea Grant Oregon

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

Plastic Pollution Presents Prodigious Problems

Can we trace the plastic pathways to beaches and coastal waters to minimize the impact of these pollutants?

RESEARCHER BIO:

Samreen Siddiqui
Post doctoral Scholar, OSU
Bio: I am an aquatic ecotoxicologist with research focus on estuarine model species with pesticide and plastic exposures along the salinity gradient. I have an interdisciplinary background including big data analysis, modelling using R, and Arc GIS.

TEACHER BIOS:
Jim Grano – teacher, 33 yrs; 12 yrs post-retirement Watershed Studies Education Program Coordinator; former OCSTEM-Hub mentor teacher; currently Siuslaw Watershed Council VP & Education/Outreach chair.

Eva Ahumada- 8th grade math teacher at Taft high school 7-12 for 5 years. Major in Mathematics, Masters in Math Education and Curriculum and Instruction

Classroom:
The classes piloting these lessons are in Ahumada's 8th grade math class as an end of the year enrichment activities. Taft is a Title 1 public school, with >95% of students qualifying for free and reduced lunch.

Explanation of Anchoring Phenomenon
Plastics are everywhere in our daily lives, especially single-use plastic products, and we frequently observe them as marine debris. We must understand their pathways to our beaches and coastal waters to in order to minimize the volume of these harmful pollutants in our marine and terrestrial ecosystems.

This marine research matters because:
Plastic pollution has become an eco-crisis with the increasing use of plastic in our everyday lives, especially single-use products. Recent research demonstrates the negative impacts of plastic on aquatic organisms' growth, behavior and physiology. There is a crucial need to raise awareness and take action on this issue.

Learning Plan Components

Lesson 1:
History of Plastics

Lesson 2:
Impacts of micro and nano plastics on marine organisms

Lesson 3:
The effects of plastics on humans

Lesson 4:
The search for solutions: Community Solutions and Actions

Extensions
- Awareness Poster
- Beach Clean-Up
- Letter to local government

Because of ORSEA:

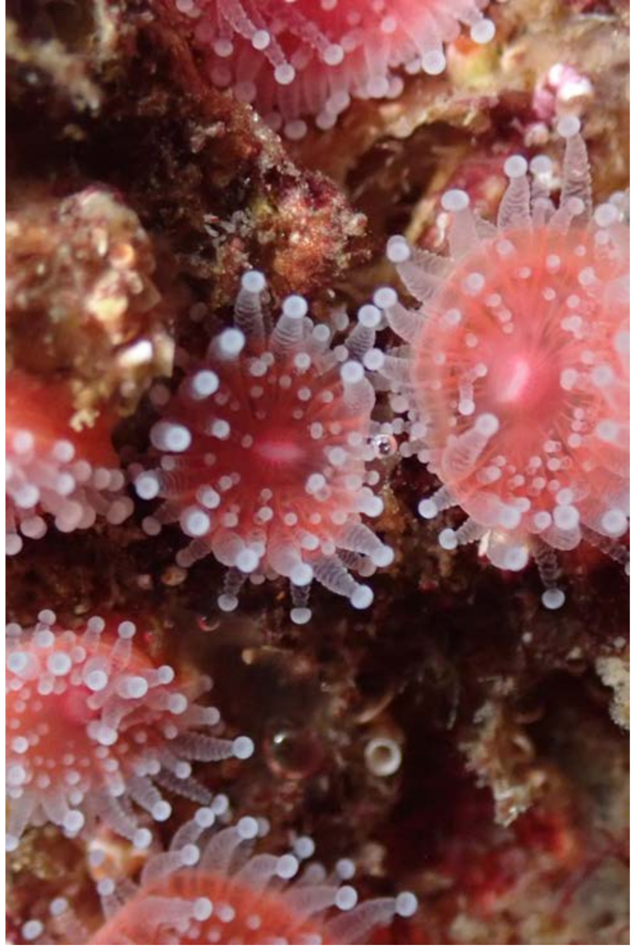
We collaborated as professionals to produce a ready-to-teach comprehensive four lesson unit on plastic pollution and it's effects on the marine environment.

Acknowledgments: This project is based upon work supported by Oregon Sea Grant and the Oregon Coast STEM Hub, as well as the National Science Foundation Regional Class Research Vessels under Cooperative Agreement No. 1333564 Award: OCE-1748726. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Teams share their work through presentations followed by Q&A

Audience of peers and future ORSEA applicants






TEAM ALGALS

2022 ORSEA Capstone Presentation

Photos by Kaitlyn Tonra

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

OUR TEAM

Kaitlyn Tonra
PhD Student
Oregon State University
Department of Integrative Biology

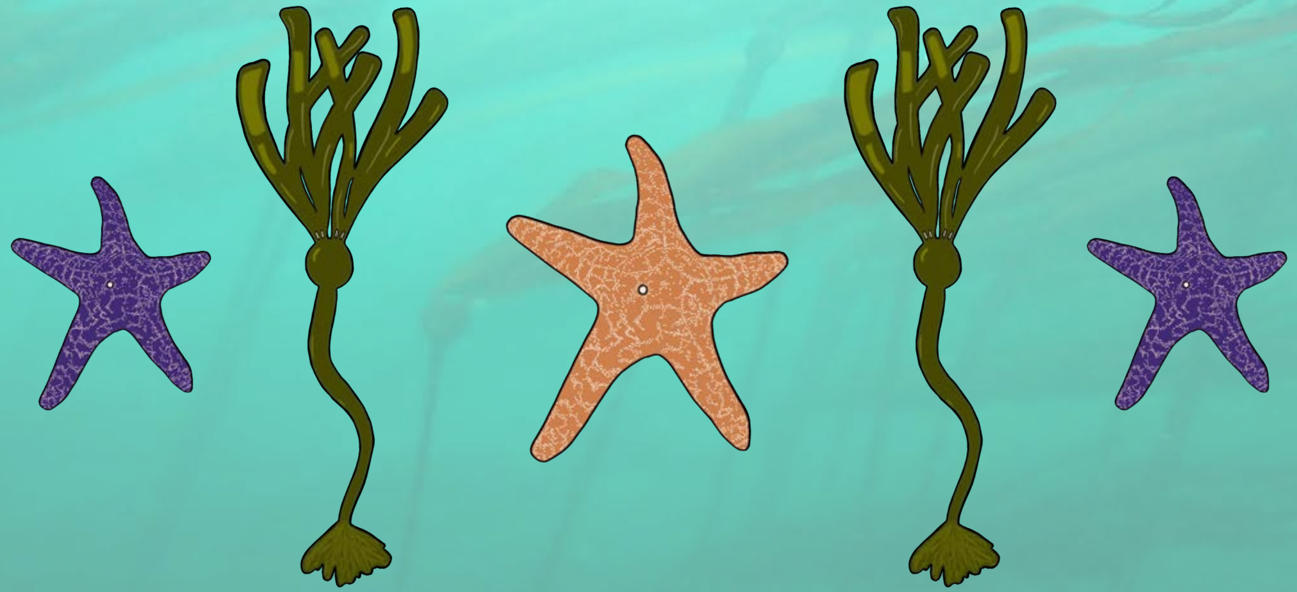
Kim Abraham
Science Teacher
Early College High School
Salem Keizer School District

Emily Parent
Science Teacher, North High School
Salem Keizer School District

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

Anchoring Phenomenon:

West Coast kelp forests support high levels of biodiversity.



Driving Question:

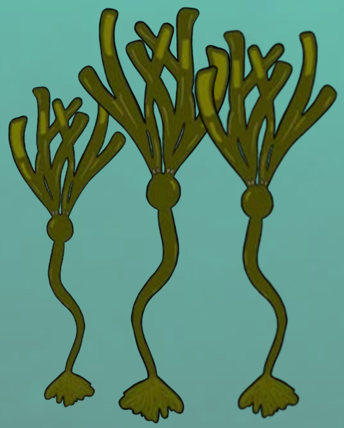
What factors affect biodiversity and community structure?

OREGON MARINE SCIENTIST
AND EDUCATOR ALLIANCE

CURRICULUM OBJECTIVES

Major concepts:

- Basics of **marine ecology**
- How **food webs** shape ecosystems
- The importance of ocean **biodiversity**
- Methods for conducting **research** underwater



Students will learn to:

- **Collect data** from seafloor photos
- **Identify patterns** of species distribution
- Formulate **scientific questions** about biotic and abiotic factors
- **Analyze** and **interpret** data to explain natural pattern

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

CORE TEACHING STANDARDS

Science

NGSS Performance Expectation:

HS-LS2-2

- Use **mathematical representations** to support and revise explanations based on **evidence** about factors affecting **biodiversity** and populations in **ecosystems** of different scales.

Math

Common Core Math Standards:

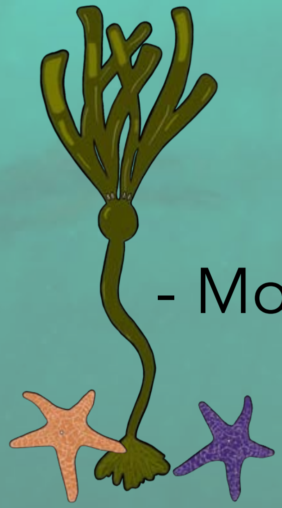
CCSS.MATH.CONTENT.HSF.LE.B.5

- Interpret the parameters in a linear or exponential function in terms of a context.

Math Practices:

CCSS.MATH.PRACTICE.MP4

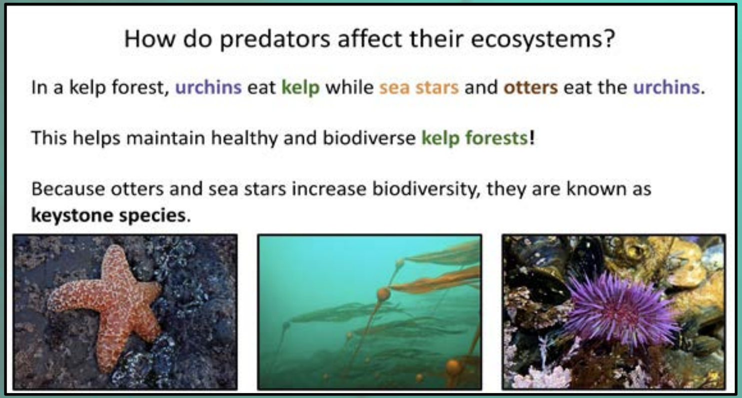
- Model with mathematics.



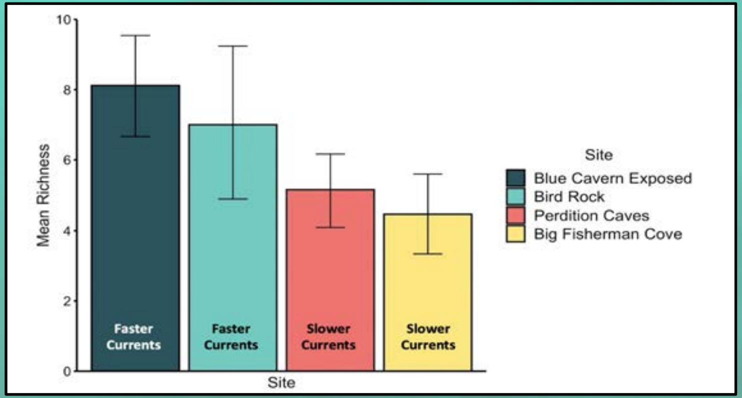
5-E LESSON MODEL AND ACTIVITIES

E1: Engage
Video introduction and class discussion about west coast kelp forest research and conservation

E2: Explore
A guided investigation of transect photos taken along the sea floor ecosystem where observations and patterns are recorded

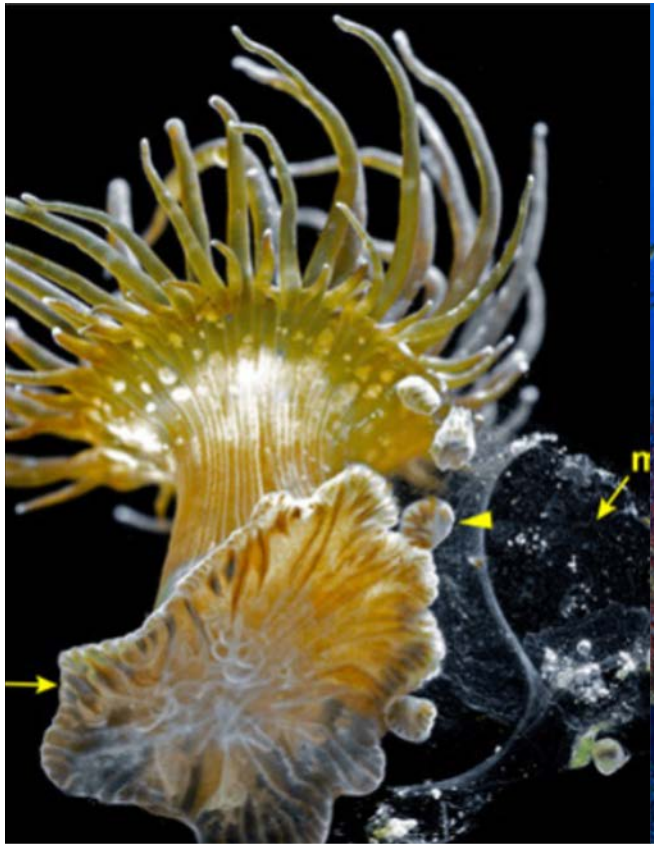


E3: Explain
Species social activity, constructing a food web, and lessons on abiotic and biotic factors



E4: Elaborate
Analyze real data in Google Sheets to explore patterns of biodiversity in Catalina Island kelp forests

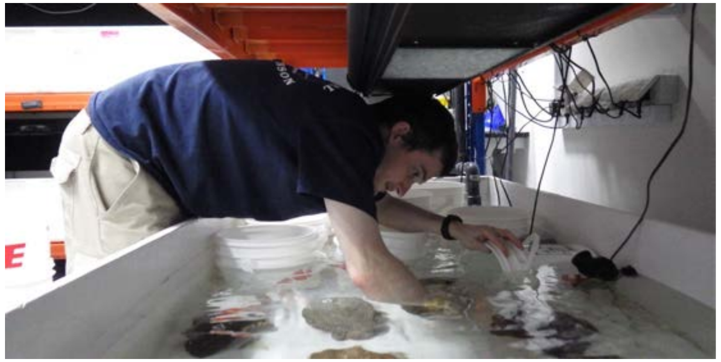
E5: Evaluate
Use evidence from lessons and the data analysis project to answer: What factors affect biodiversity in kelp forests?



TEAM Anemone: Can an Aquarium Pest Save Coral from Bleaching?

2022 ORSEA Capstone Presentation

OUR TEAM



Nate Kirk

Integrative Biology, OSU

Andy Bedingfield

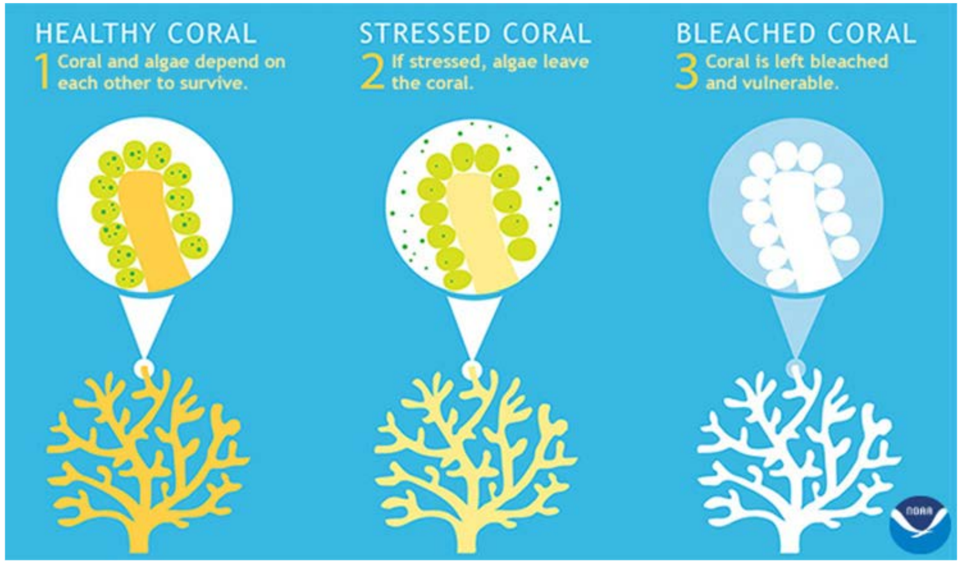
Science Teacher Taft 7-12, Lincoln City OR

Nick Gezon

Science Teacher Brookings- Harbor High School, Brookings OR

ANCHORING PHENOMENA / DRIVING QUESTION

Anchoring phenomena: Coral Reef Bleaching: When coral reefs get stressed by heat or pollution, they turn white and lose one of their major sources of food.



Driving question: Aiptasia as Model Organisms to Study Coral Reef Bleaching: What can we learn about coral reef biology from aiptasia, a sea anemone that is much easier to grow in a lab aquarium than coral polyps?

EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

Science

HS-LS2-3 Ecosystems: Interactions, Energy, and Dynamics

Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

Math

CCSS.MATH.CONTENT.HSS.IC.A.1

Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

English Language Arts

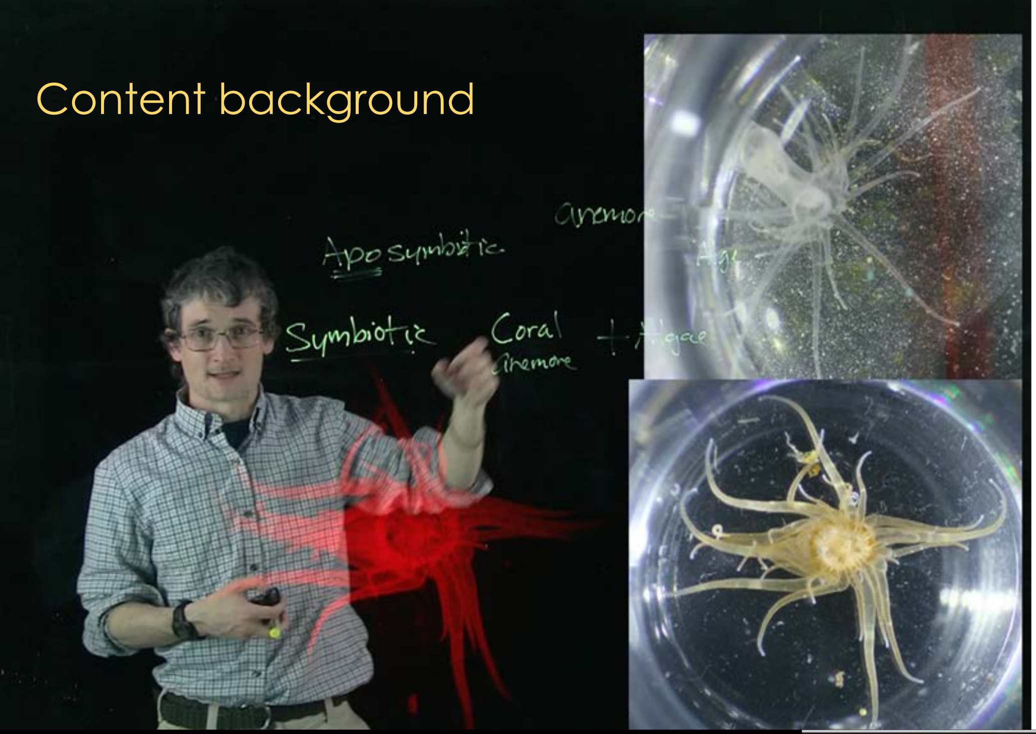
CCSS.ELA-LITERACY.RH.11-12.2

Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

5-E	Overarching Essential Questions	Activities
Engage	Why are coral reefs important?	• Quizizz Practice and Tests • Edpuzzle Videos • Reading/Writing Assignments • Personal EQs • Group EQs • Jamboard Discussions • Live Animal or Article Review Research Projects • Full List of Activities
Explore	How can we use aiptasia as a model organism to study coral reef bleaching?	
Explain	How does the symbiotic relationship between algae and cnidaria work?	
Elaborate	Who controls whom, the anemone or the algae?	
Evaluate	Can you use your knowledge and skills to analyze data published in a peer reviewed paper?	• Summative Performance Assessment (SuPA)

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

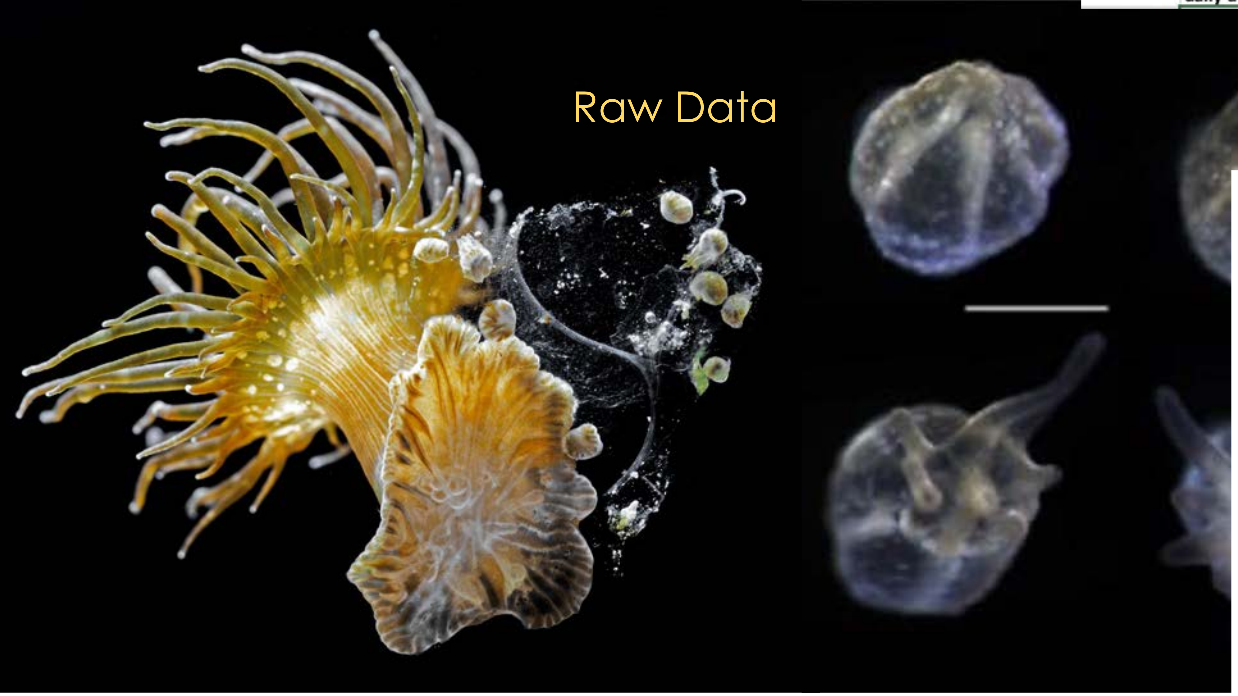


Content background

Choose your own adventure pathway:

	Days	1	2	3	4	5	6	7	8	9	
	Daily tentacles counts										
Naturally formed pedal lacerates (8 different animals)	Nat_01	0	0	0	0	0	8	8	8	8	
	Nat_02	0	0	0	0	0		8	8	14	
	Nat_03	0	0	0	0	0		12	12	12	
	Nat_04	0	0	0		6	8			10	
	Nat_05	0		6	8	10	10	10	10	10	
	Nat_06	0	0		6	8	8	8	8	8	
	Nat_07	0	0	0	0	1				8	
	Nat_08	0	0	0	0	2				8	
	daily averages of	0	0	0.85714286	2	3.375	8.5	9.2	9.2	9.75	
Artificially formed pedal lacerates (8 different animals)	Cut_01	0	0	0	0	1	6	8	8	8	
	Cut_02	0	0	0	0	1	6	8			
	Cut_03	0	0	0	0	1	4	10			
	Cut_04	0	0	0	0	0	4	10			
	Cut_05	0	0	0	0	0	0	11			
	Cut_06	0	0	0	0	1	8	0			
	Cut_07	0	0	0	0	1	1	6			
	Cut_08	0	0	0	0	0	1	7			
	daily averages of	0	0	0	0	0.625	3.75	7.5	8	8	1

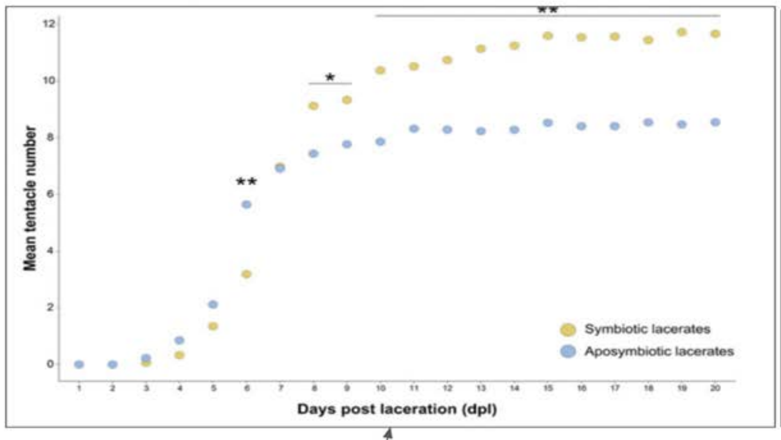
Raw Data



Data set to graph/ test hypotheses

[Link to Source]

Analyze the Data



- This graph shows the mean (average) number of tentacles that the aiptasia grew every day
- Symbiotic lacerates (the brown dots) are baby aiptasia that have their symbiotic algae and can get food from photosynthesis
- Aposymbiotic lacerates (the blue dots) are baby aiptasia that don't have symbiotic algae and can only get food by eating food

TEAM Foram'able Observations

2022 ORSEA Capstone Presentation

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

OUR TEAM

Will Millard

Tillamook High School

Kelsey Lane

OSU graduate student

Kerry Zambrano

Benson Polytechnic High School

ANCHORING PHENOMENA / DRIVING QUESTION

Tiny Plankton as Storytellers: Living Thermometers of the Massive Ocean 'Blob'

- What does sea surface temperature tell us about what's happening in the ocean?
- How does sea surface temperature impact ocean life?
- How do forams record the story of the past ocean climate as well as current phenomena like the 'Blob'?

EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

Science

HS-LS-2.2 Use mathematical representations to support and revise explanations based on evidence of how factors affecting biodiversity and populations in ecosystems on different scales.

HS-LS-2.6 Evaluate claims, evidence and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers, but changing conditions may result in new ecosystems.

Cause & Effect: Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Stability & Change: Much of science deals with constructing explanations of how things change and how they remain stable

Math

S-ID Interpreting Categorical and Quantitative Data

Summarize, represent, and interpret data on a single count or measurement variable

N-Q Quantities

Reason quantitatively and use units to solve problems.

Math Practices:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

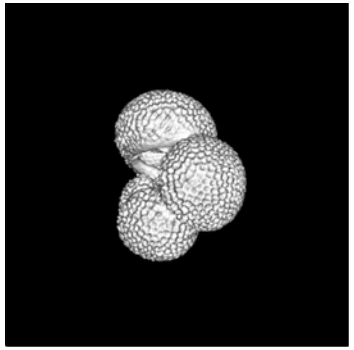
5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

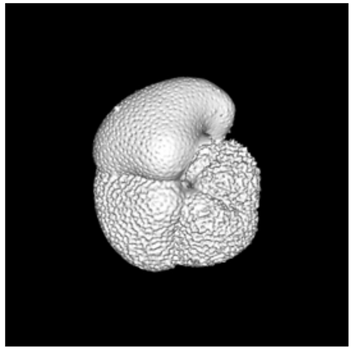
Engage

What is a marine heatwave and why do we care?

Explain

How do ocean conditions affect foram abundances?



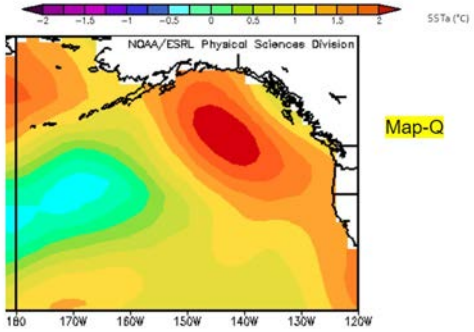


Evaluate

Make an edible sediment core

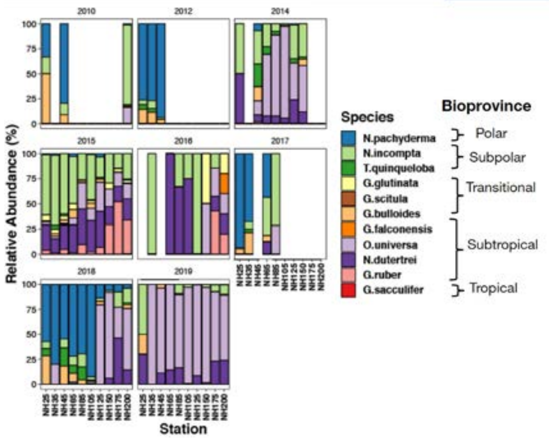
Explore

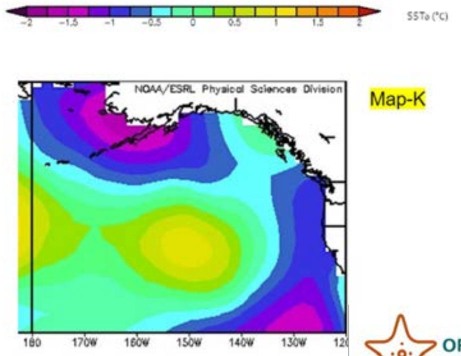
How do marine heatwaves impact the marine creatures?



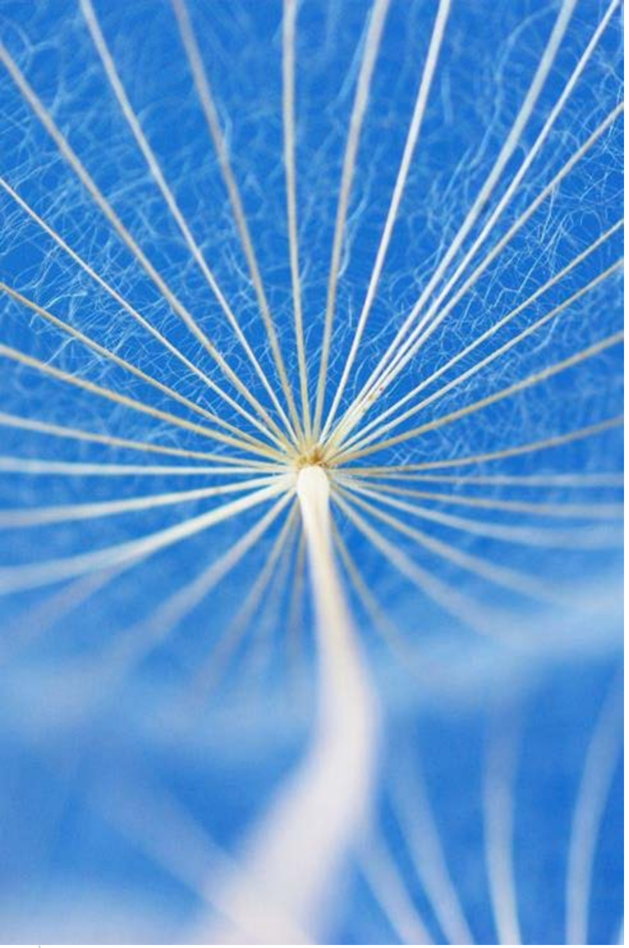
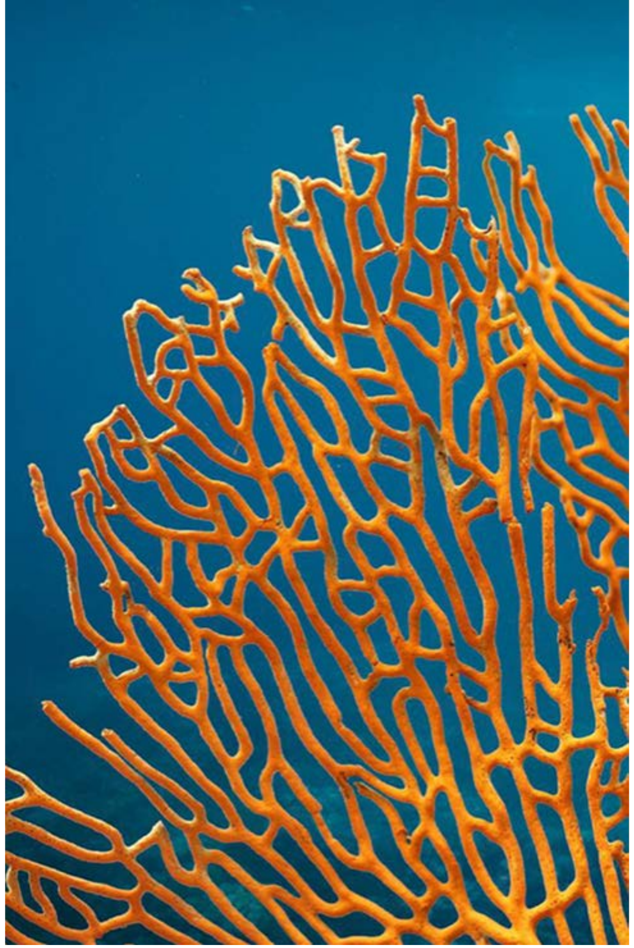
Elaborate

What patterns do we notice in the foram and environmental data?





OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE



TEAM Green Crab

2022 ORSEA Capstone Presentation

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

Team Green Crab

Shon Schooler
Research Coordinator

Stephanie Austin
Teacher

Trent Hatfield

Teacher

ANCHORING PHENOMENA / DRIVING QUESTION

Invasion of the crabs!

Are green crabs invading Oregon estuaries and causing harmful impacts?

EDUCATION GOALS, OBJECTIVES, AND STAN DARDS ADDRESSED

Learning Goals

1. Green crabs are an invasive species that we accidentally introduced from western Europe.
2. Invasive species can harm native species and our environment.
3. We monitor green crabs to measure the abundance through time.
4. We can use basic statistics to understand and summarize the green crab invasion.

Science standards

NGSS Performance Expectation(s):

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.]

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

Math Standards

HS.DR.C Analyze, summarize and describe data

HS.DR.C.8 Identify appropriate ways to summarize and then represent the distribution of univariate and bivariate data with graphs and or tables. Use technology to present data that supports interpretation.

HS.DR.D Interpret data and answer investigative questions

HS.DR.D11 Use statistical evidence from analysis to answer statistical investigative questions and communicate the findings in a variety of formats to support informed data-based decisions.

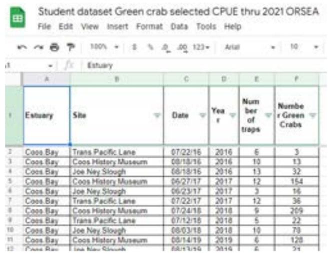
5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

Variety of videos are used to facilitate discussion of invasive native and species, ecological concepts and societal issues.

Explore

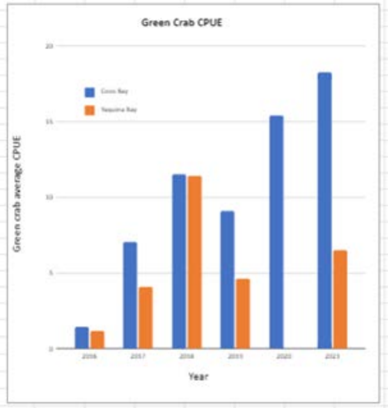
Using magazine articles and data sets students degin to ask and answer questions about crab populations and spatial variation.


Student dataset Green crab selected CPUE thru 2021 ORSEA

Estuary	Site	Date	Year	Number of traps	Number Green Crabs
Coos Bay	Trans Pacific Lane	07/22/16	2016	6	3
Coos Bay	Coos History Museum	08/18/16	2016	10	13
Coos Bay	Joe Ney Slough	08/18/16	2016	13	32
Coos Bay	Coos History Museum	06/27/17	2017	12	154
Coos Bay	Joe Ney Slough	06/23/17	2017	3	16
Coos Bay	Trans Pacific Lane	07/22/17	2017	12	36
Coos Bay	Coos History Museum	07/24/18	2018	9	209
Coos Bay	Trans Pacific Lane	07/12/18	2018	5	22
Coos Bay	Joe Ney Slough	08/03/18	2018	10	78
Coos Bay	Coos History Museum	08/14/19	2019	6	128

Explain

Students dig deeper into two data sets for two estuaries and look for relationships.



Elaborate

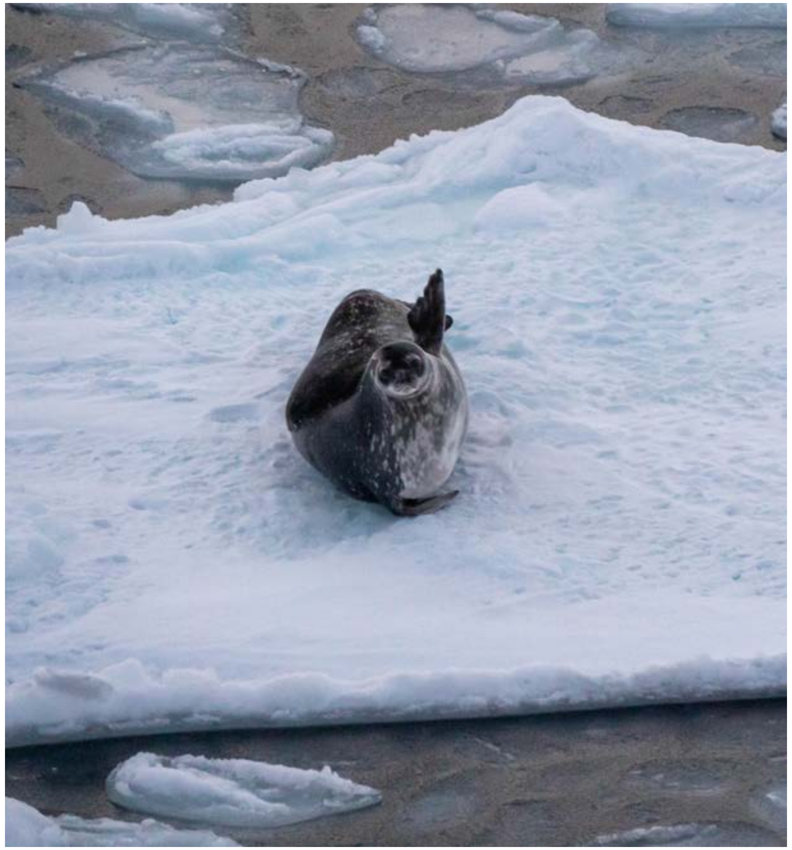
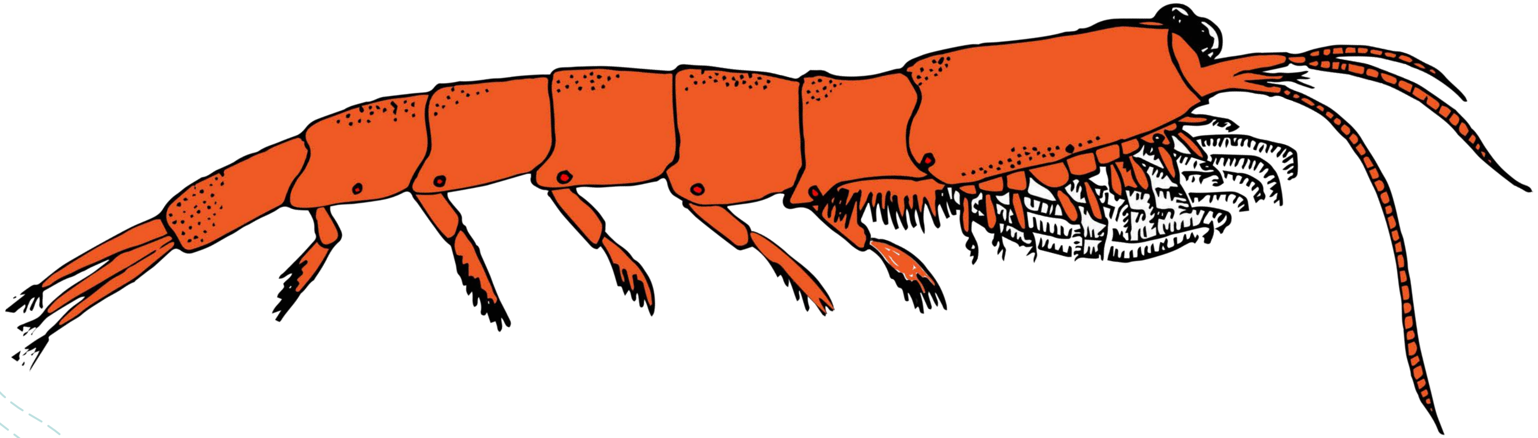
Students expand to proposing ways to study green crab population effect on other population, design better traps,or propose solutions to mitigate effects of green crabs.

Evaluate

Students create presentation posters for citizen scientist to identify invaders or present scientific analysis of data sets.

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE



TEAM KRILLIN' IT

2022 ORSEA Capstone Presentation

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

OUR TEAM

Kirsten Steinke
PhD Student

Ryley Hartzell
Middle School Math Teacher

Julia Scolari
Middle School Science Teacher

ANCHORING PHENOMENA / DRIVING QUESTION

Environmental change in polar ecosystems, as experienced by Antarctic krill.

- What are Antarctic (polar) ecosystems and why are they important?
- What kinds of animals live in the Antarctic?
- Why are Antarctic krill a keystone species?
- What is causing temperatures to rise?
- How does your carbon footprint contribute to rising temperatures?

EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

Science

- Core Standard: MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- Science & Engineering Practices: Constructing Explanations and Designing Solutions
- Disciplinary Core Ideas: ESS3.C: Human Impacts on Earth's Systems
- Crosscutting Concepts: Cause and Effect & Influence of Science, Engineering, and Technology on Society and the Natural World
- Secondary Standard: MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
- Science & Engineering Practices: Asking Questions and Defining Problems
  Disciplinary Core Ideas: ESS3.D: Global Climate Change
- Crosscutting Concepts: Stability and Change

Math

- Common Core Math Standards: SP.1 Will be covered in the first less, SP.2 and MP.4 will mainly happen in last 3 lessons.
- 7.SP.1 Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
- 7.SP.2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
- MP. 4 Model with Mathematics
- Math Practices:
  - Mean, median and mode in data (6th/7th)
  - Developing and using models (6th/7th)

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

What are polar (Antarctic) ecosystems?

Students will build background around polar and ocean ecosystems, focusing specifically on the Antarctic ecosystems and the animals that live there. This will be done through a documentary. They will also be introduced to the idea of collecting data and producing random samples through an interactive slideshow.

Explore

How have temperatures affected different species and animals?

Students will obtain the temperature of objects around the classroom and talk about why they are different. Students will also compare temperatures from 20 years ago to today using dot plots.

Explain

How have temperatures affected different species and animals?

Students will research different animals and share their findings in a jigsaw activity. Students will analyze the effects temperature has had on krill populations using a box and whisker plot.

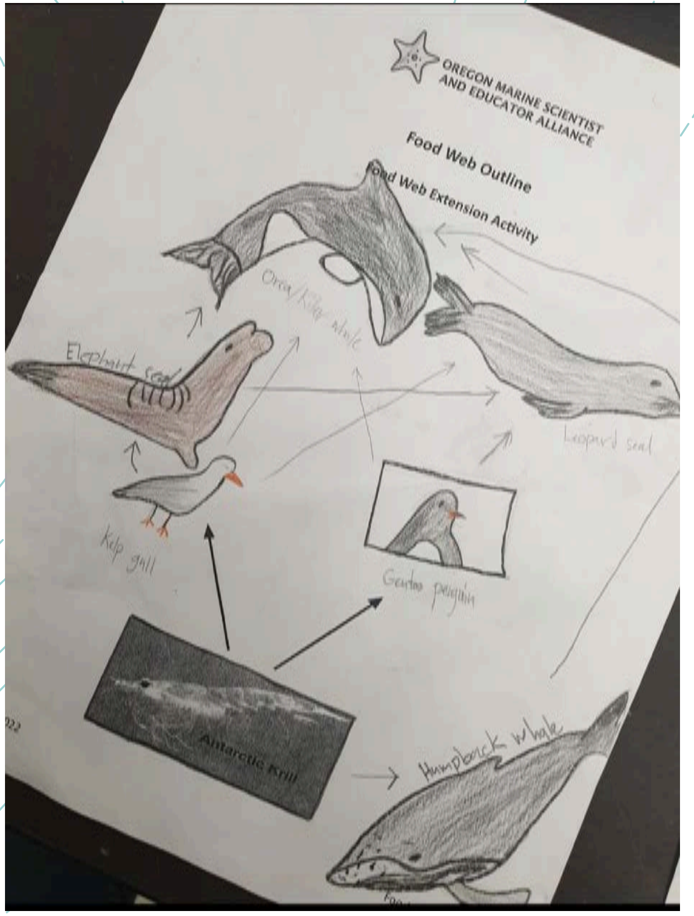
Elaborate

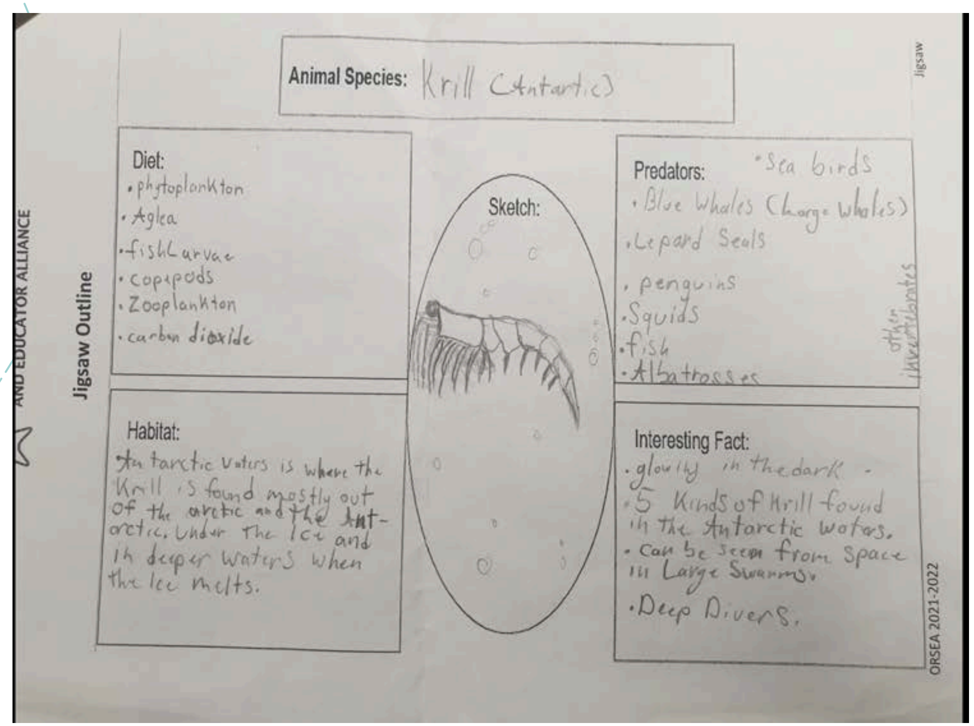
Why are temperatures rising?

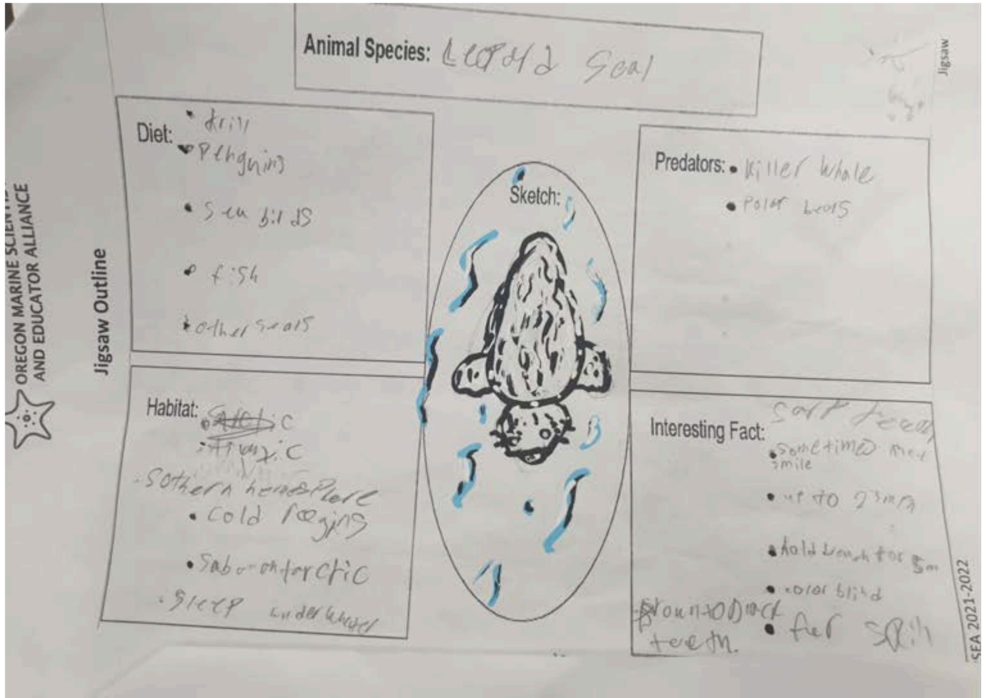
How are you going to monitor an aspect of yours or others carbon emissions? Students will do a greenhouse effect video/activity. Students will collect data on their carbon emissions and learn how they contribute to rising temperatures.

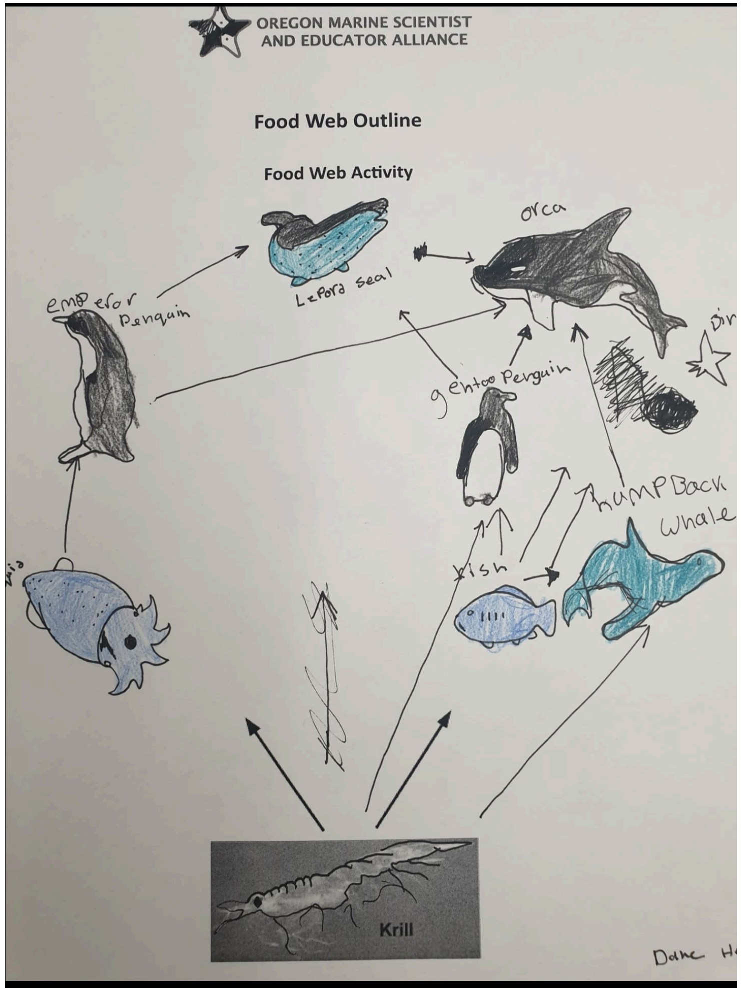
Evaluate

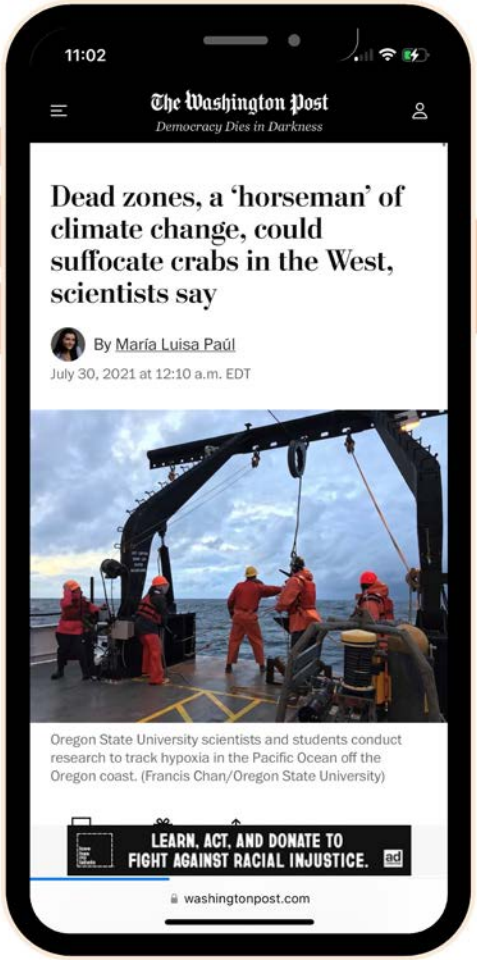
Students will complete an exit ticket on how they can help monitor the impact of carbon emissions. Students will generate a random sample of their peers' carbon emissions and create a plot to visually analyze the average carbon emissions in their grade level.


OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE
Food Web Outline
Food Web Extension Activity
Orca/Killer whale
Elephant seal
Leopard seal
Kelp gull
Gentoo penguin
Antarctic Krill
Humpback whale


Animal Species: Krill (Antartic)
Diet:
• phytoplankton
• Aglea
• fish Larvae
• copepods
• Zooplankton
• carbon dioxide
Sketch:
Predators:
• Sea birds
• Blue Whales (Large whales)
• Lepard Seals
• penguins
• Squids
• fish
• Albatrosses
Habitat:
Antarctic waters is where the Krill is found mostly out of the arctic and the Antarctic, Under the Ice and in deeper waters when the Ice melts.
Interesting Fact:
• glow in the dark
• 5 Kinds of Krill found in the Antarctic waters.
• can be seen from space in Large Swarms.
• Deep Divers.
Jigsaw Outline
AND EDUCATOR ALLIANCE
Jigsaw
ORSEA 2021-2022


Animal Species: Leopard Seal
Diet:
• krill
• Penguins
• Sea birds
• fish
• other seals
Sketch:
Predators:
• Killer Whale
• Polar bears
Habitat:
• Southern hemisphere
• cold regions
Interesting Fact:
OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE
Jigsaw Outline
Jigsaw
SEA 2021-2022


OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE
Food Web Outline
Food Web Activity
orca
Lepord seal
emperor Penguin
gentoo Penguin
humpBack whale
fish
Krill



11:02

The Washington Post
Democracy Dies in Darkness

Dead zones, a 'horseman' of climate change, could suffocate crabs in the West, scientists say

By María Luisa Paúl
July 30, 2021 at 12:10 a.m. EDT

Oregon State University scientists and students conduct research to track hypoxia in the Pacific Ocean off the Oregon coast. (Francis Chan/Oregon State University)

washingtonpost.com

TEAM MICROBE

2022 ORSEA Capstone Presentation

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

OUR TEAM

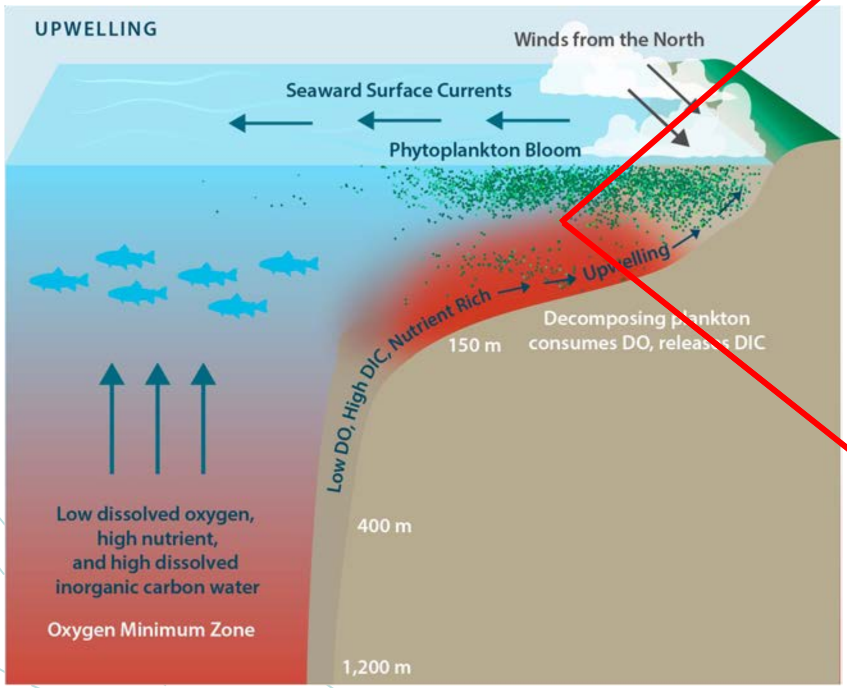
Sarah Wolf
PhD Candidate, Department of Microbiology
Oregon State University

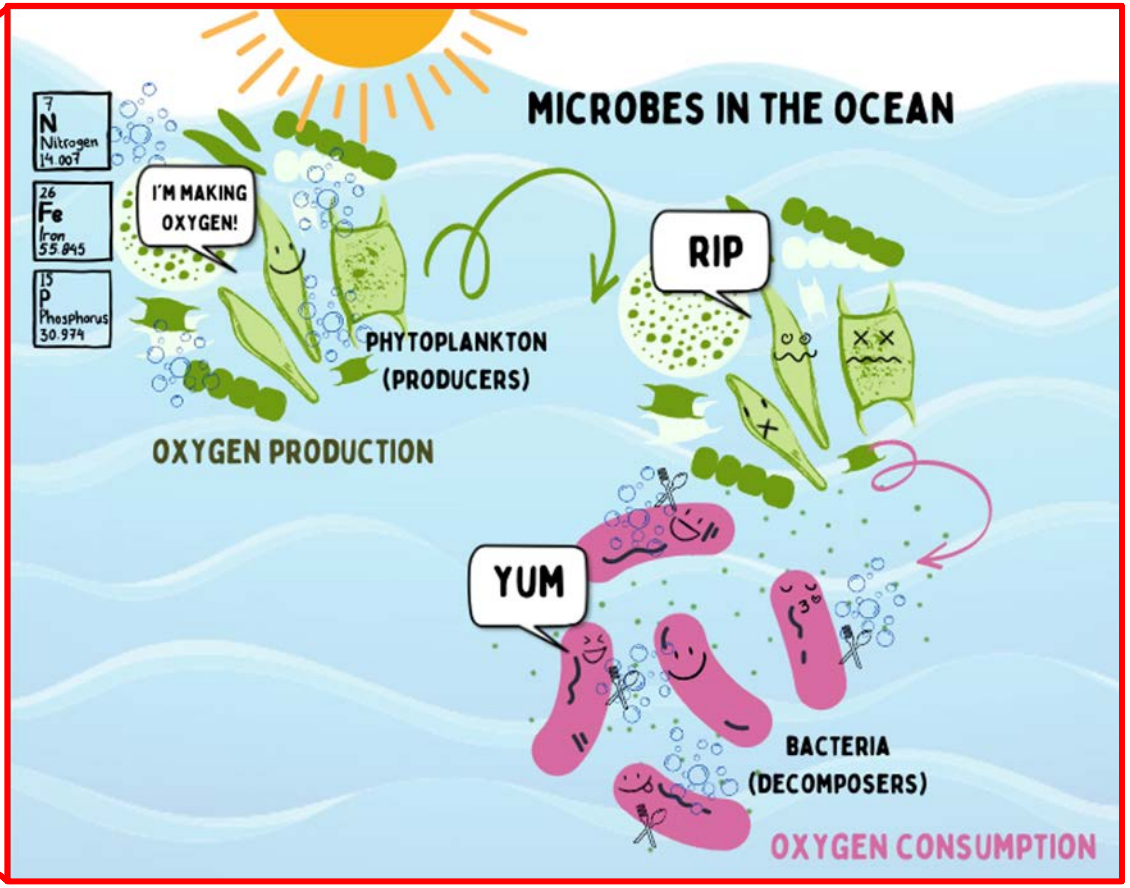
Laura Norman
Warrenton Middle School

Amber Horn
Sauvie Island Middle School

ANCHORING PHENOMENA / DRIVING QUESTION

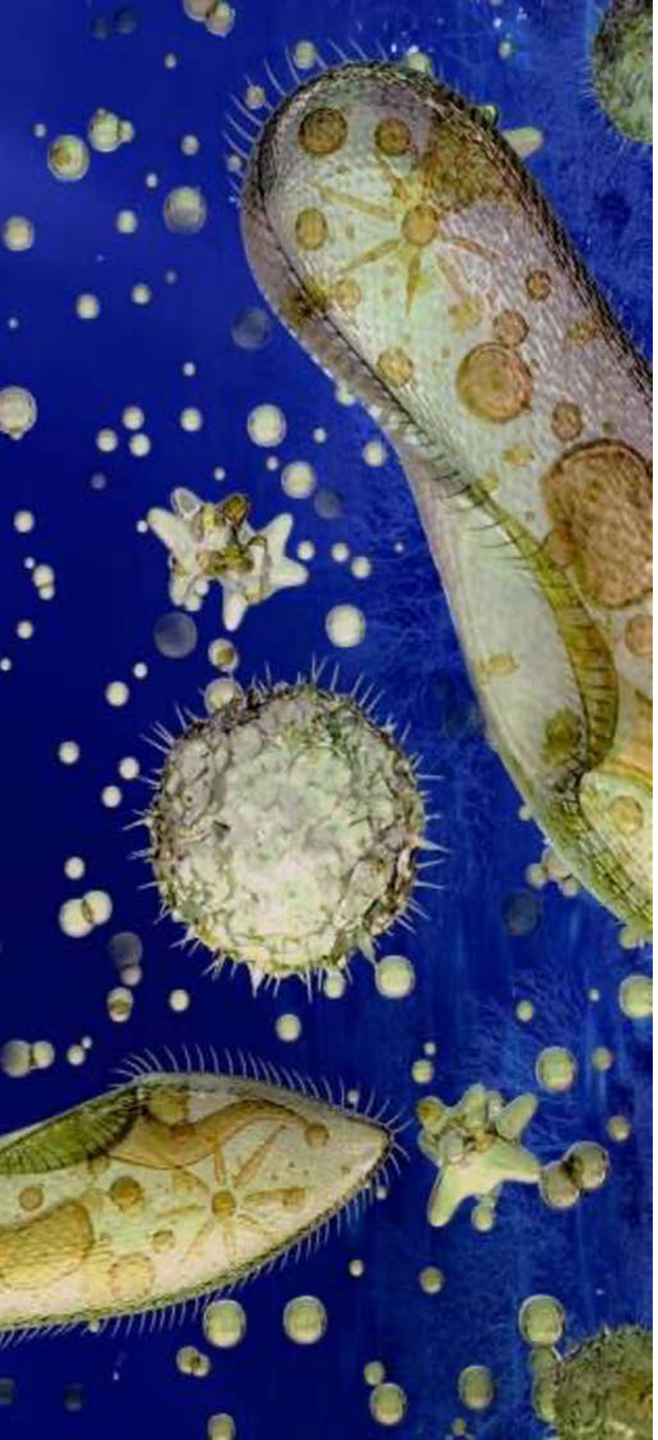
Microbial influence on ocean oxygen





1. What role do microbes play in ocean ecosystems?
2. What is coastal upwelling and how does it contribute to deoxygenation on the Oregon Coast?
3. How does climate change contribute to coastal deoxygenation and impact communities?

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE



EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

Science

NGSS Performance Expectation(s):

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem

DCI

LS1.C: Organization for Matter and Energy Flow in Organisms

LS2.A: Interdependent Relationships in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

ETS1.B: Developing Possible Solutions

Math

Common Core Math Standards: 6. EE .C 9

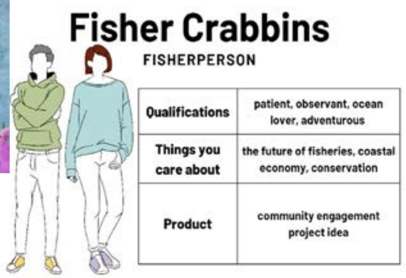
Math Practices: Use variables to represent two quantities in a real-world problem that change in relationship to one another;

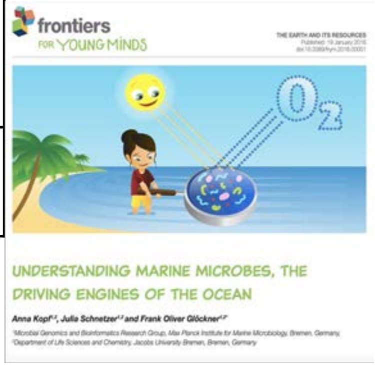
Write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable.

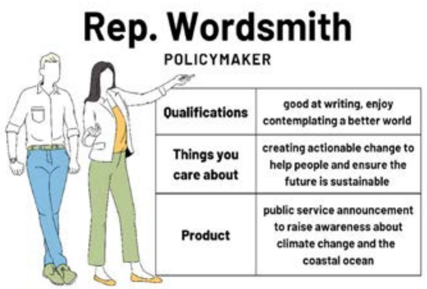
Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

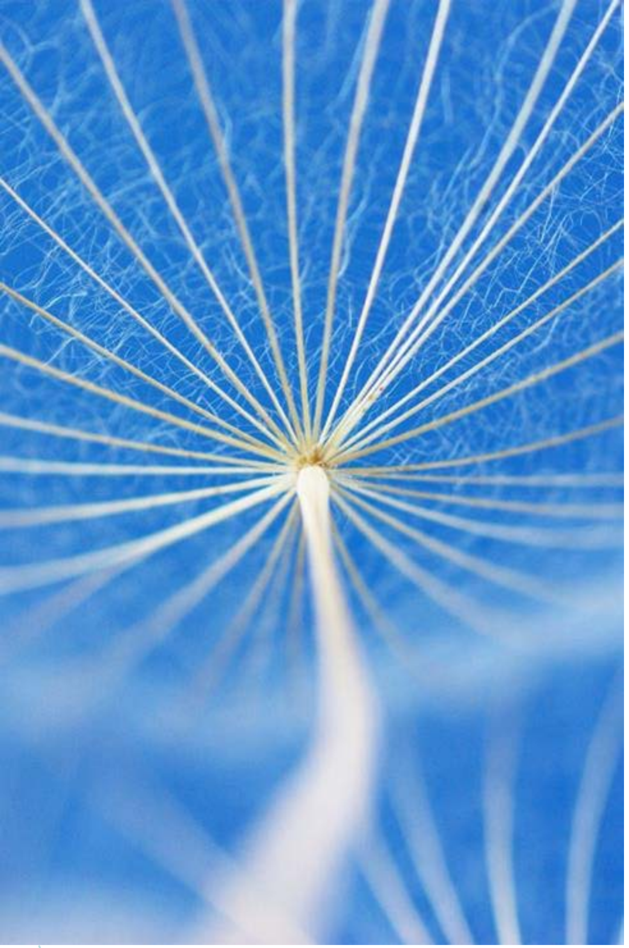
	#	Station	Activity
Engage	1 A	Introduction	Choose role
Explore	1 B	Crab fisheries	Calculate + graph crab landings and $ per lb by year
Explore	2	Marine microbes	Frontiers for Young Minds (FYM) article: marine microbes, quiz Q's
Explain	3	Coastal dynamics	Continental shelf drag + drop, videos, quiz Q's
Explain	4	Ocean oxygen	Oxygen crossword, "Hipoxia" video game, FYM article: Ocean Oxygen
Elaborate	5	Forming hypotheses	Hypothesis formation, produce creative products for communication + community engagement
Evaluate	6	Solutions	Discussion + webquest for climate solutions and positive climate news

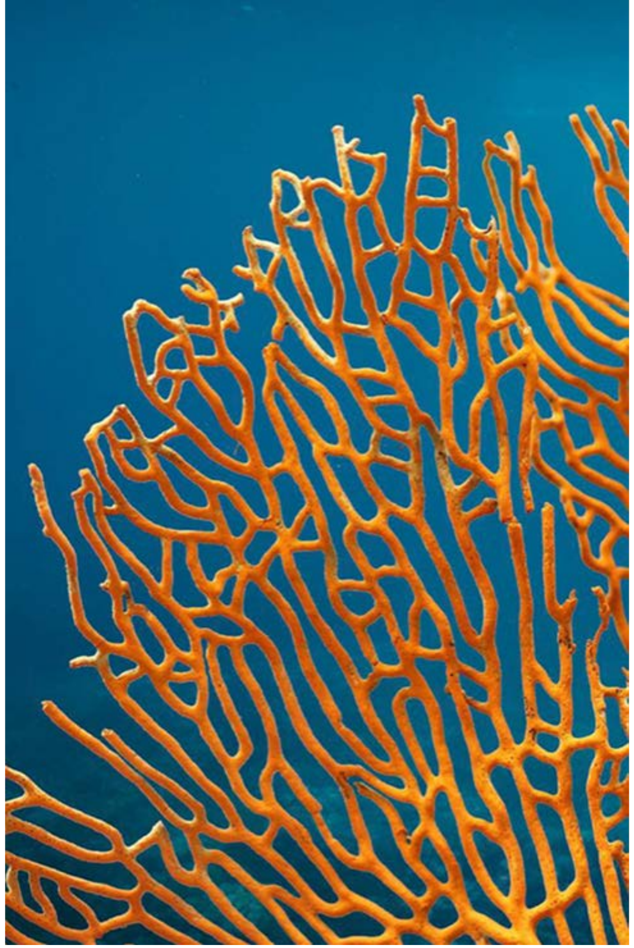






OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE





TEAM Muddy Waters: A Tale of Two Sloughs

2022 ORSEA Capstone Presentation

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

OUR TEAM

Molly Keogh

Wetland Geologist,
Department of Earth Sciences
University of Oregon

Jackie Gooch

Science Teacher, North Bend Middle School

ANCHORING PHENOMENA / DRIVING QUESTION

Our Data Collection Sites

What factors influence an urban estuary to make it different from protected South Slough?

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

EDUCATION GOALS, STANDARDS, and OBJECTIVES

Learning Goals

1. Water quality is an indicator of estuary health.
2. Water quality parameters (including temperature, pH, turbidity, and dissolved oxygen) can be measured using straightforward tools.
3. Water quality is affected by both human land use in the watershed and by natural processes (tides, seasons).
4. Water quality affects what species live in the estuary.

Science Standards

MS-LS2-2 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Science & Engineering Practices:

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

Disciplinary Core Ideas:

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Crosscutting Concepts: Stability and Change Small changes in one part of a system might cause large changes in another part

Math Standard

MATH.CONTENT.8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. (Possible linear function to explore: water temperature vs. depth)

Learning Objectives

Students will be able to:

1. Collect water samples and analyze them for a variety of water quality parameters.
2. Use a spreadsheet program to develop data tables, input data for comparison, and create charts.
3. Compare water quality data from a local estuary with data collected in South Slough, observe similarities and differences, and formulate hypotheses about what makes them the same or different.
4. Discuss how people affect the water quality in an estuary, and propose ways to improve the water quality.

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

Think about the differences between Pony Creek and South Slough. What do you notice?
Kickoff the unit with a field trip to South Slough to learn about the flow of water from the mountains down to the bay and the natural water filtration processes. If an in-person field trip is not possible, consider obtaining water samples from the area and viewing the overview video of South Slough. Compare water samples from South Slough to your local urban watershed for sediment and water quality.

Explore

Students are scientists: collect data and compare/contrast results
To begin, students will complete a visual assessment of the urban estuary, noting what they can see (in person or through photos, Google Earth, etc.) before water quality tests begin. If students have previously visited the estuary, they may want to share stories.

Next, student scientists will begin collecting water quality data from the urban estuary and compare their findings to data from the Winchester Arm of South Slough (monitoring station SOSWIWQ). (We chose the Winchester Arm because data are available in real time and Winchester's salinity is close to that of our local estuary.)

Explain

Students meet a coastal scientist to learn what data they use and how they apply the data
As students begin collecting data locally and comparing them to South Slough data, it's a good time to revisit the water quality parameters and how they affect the ecosystem. This is where we introduced how sediment affects the aquatic ecosystem.

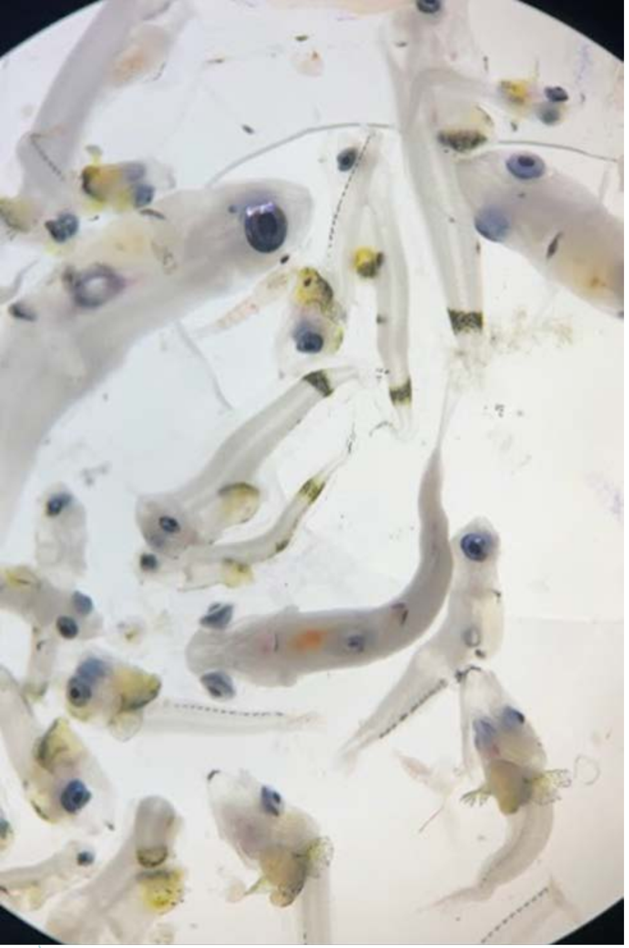
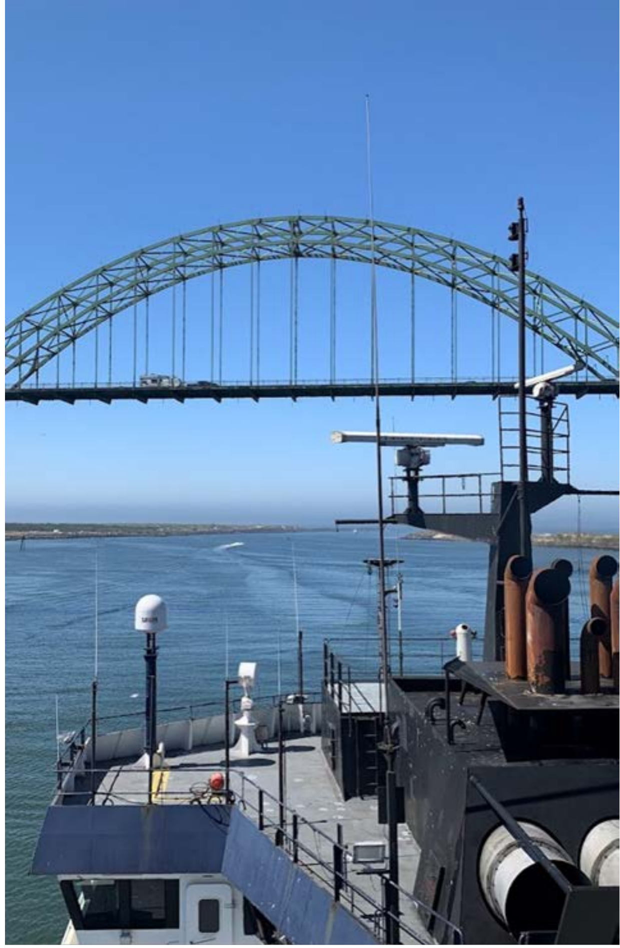
Note that Explore and Explain are not linear. You'll do a bit of looping.

Elaborate

Students will hypothesize why they got the results they did when comparing an urban estuary to South Slough
Students interact with and interpret the data: They learn how to develop a spreadsheet and create charts from their data. At this point, they can begin to establish relationships between parameters and hypothesize influences on the ecosystem. For instance, pH decreases when temperature increases, leaving our urban slough warmer and more acidic.

Evaluate

Student scientists share their interpretations of the data and propose improvements for the urban estuary
Opportunities for formative assessment are built-in throughout the project. There are several options for a summative assessment as well. For the final assessment, each student chooses two charts that they have created, interprets the data, and provides an explanation for the phenomena. The students compile formal reports that include a presentation with suggestions to amend the damage to the urban estuary. If time is limited, students can simply type their explanations and restoration ideas into the spreadsheet.



TEAM PLANKTON

2022 ORSEA Capstone Presentation

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

OUR TEAM

Carrie Averill

Science Teacher Tillamook Junior High School

Kim Norberg

Math Teacher Tillamook Junior High School

Luke Bobay

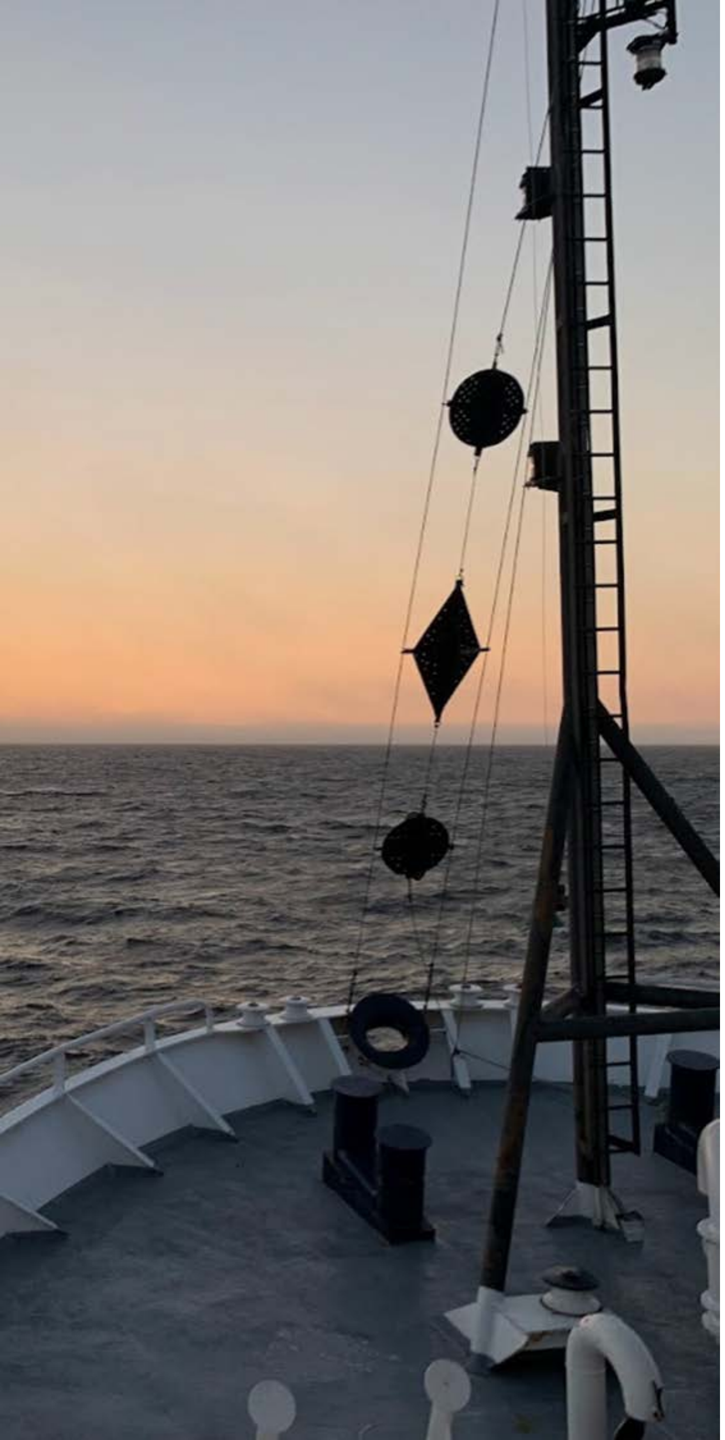
Graduate student, Oregon State University

ANCHORING PHENOMENA / DRIVING QUESTION

Anchoring Phenomena: Patchy Plankton

Driving Question: What factors contribute to spatial variability in plankton abundance?

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE



EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

Science

MS-LS2-1 - Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

*MS-ETS1-3 - Analyzing and Interpreting Data: Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis *Analyze and interpret data to determine similarities and differences in findings.*

Math

5.G.A.1 - Graph points on the coordinate plane to solve real-world and mathematical problems.

6.SP.A.1 - Develop understanding of statistical variability.

7.SP.A.1 - Use random sampling to draw inferences about a population

7.SP.B.3 - Draw informal comparative inferences about two populations.

7.SP.B.4 - Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations

8.F.B.5 - Use functions to model relationships between quantities.

8.SP.A.1 - Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

Videos are shown indicating the importance of plankton, plankton research, and plankton collection methods. By using a matching activity, students can see the

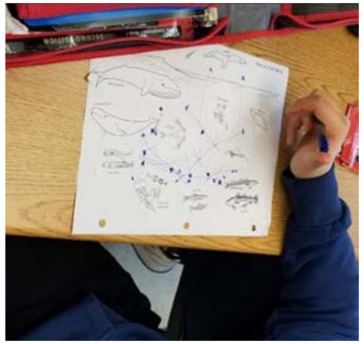
plankton in the ecosystem.

Explore

Simulate plankton sampling methods, exploring spatial variability in plankton abundance, graphing plankton distributions, and using a dichotomous key to explore the diversity of plankton taxa in samples or on slides under the microscope

Explain

Food web activity helps explain how plankton fit into the food web and which other animals depend on them.

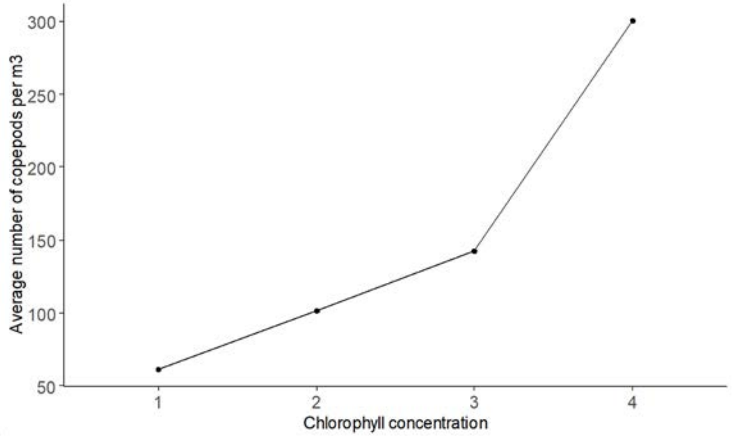


Elaborate

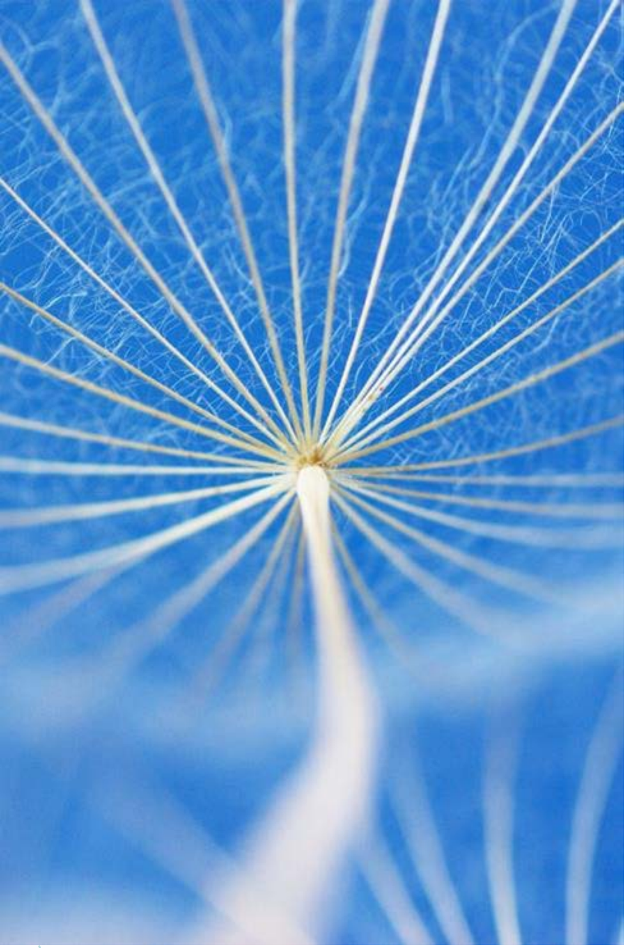
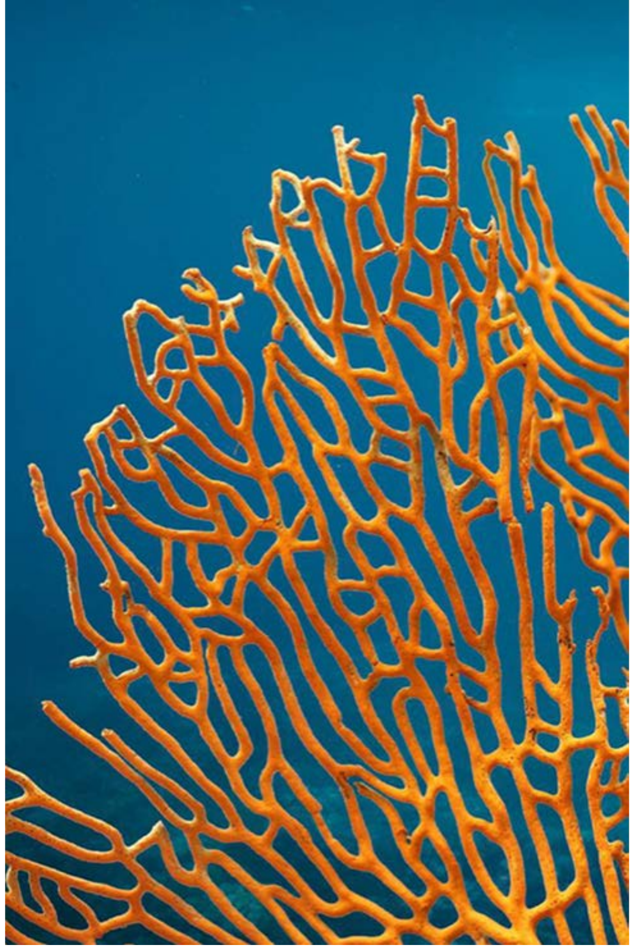
Students collect, graph, and analyze data from images. They will use the data distributions to support or refute their hypotheses about plankton abundance

Evaluate

Students will evaluate how algae abundance can impact zooplankton abundance and apply what they learn to evaluate nutrient pollution management options.



OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

TEAM SALMON STATS

2022 ORSEA Capstone Presentation

OREGON MARINE SCIENTIST
AND EDUCATOR ALLIANCE

OUR TEAM

Selina Heppell

Fisheries Scientist, Oregon State University

Ellen Pennell

Science Teacher at Chemawa High School

Math/Science Teacher at Toledo Jr/Sr High School

ANCHORING PHENOMENA / DRIVING QUESTION

Anchoring Phenomenon: Population fluctuations in salmon

Driving Question: Why can’t all salmon be managed in the same fashion?

Essential Questions:

1. How are the life cycles of different salmon species similar and different?
2. How can we use models to predict population changes?
3. How does the life cycle of a salmon impact the management of the species?

EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

Science

HS-LS2-2.

Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Disciplinary Core Ideas:

LS2.A: Interdependent Relationships in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Math

HS.NQ.B.4

Define, manipulate, and interpret appropriate quantities using rational and irrational numbers to authentically model situations and use reasoning to justify these choices.

Math Practices:

MP.2 Reason abstractly and quantitatively.

MP.4 Model with mathematics.

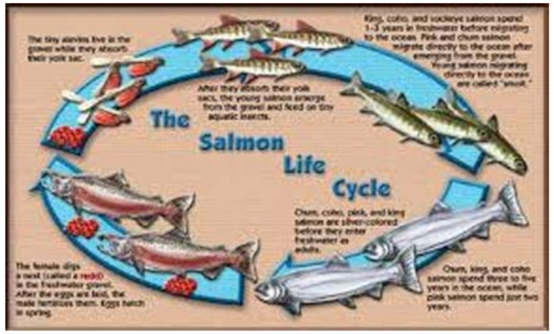
5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

Students discuss their connections to salmon and cultural importance of salmon.

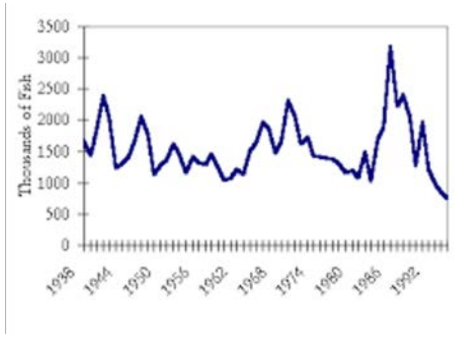
Explore

Students are introduced to reading a line graph and different life histories of salmon species.



Explain

Students use a statistical model to evaluate changes survivorship at different life stages.

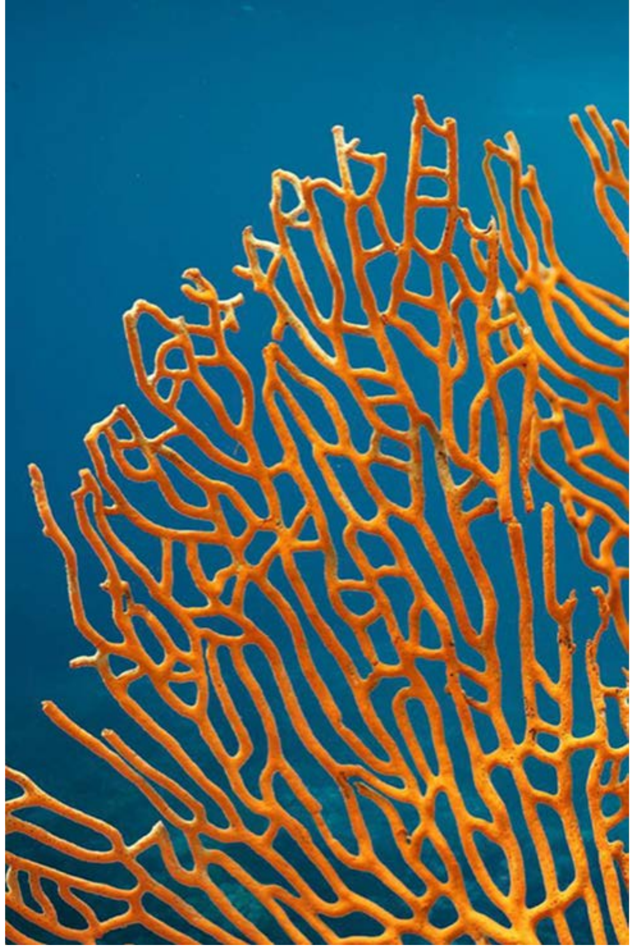


Elaborate

Students use salmon habitat information and possible threats to salmon to brainstorm population management strategies.

Evaluate

Students write an autobiographical story from the perspective of a salmon and write about obstacles they face at different life stages.

TEAM SANDWORM

2022 ORSEA Capstone Presentation

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

OUR TEAM

Risa Askerooth
Graduate student, Oregon State University, Department of Integrative Biology

Chuck Getter
Teacher, Lincoln City Career Tech High School

Amorette Drexler
Teacher, South Salem High School

ANCHORING PHENOMENA & DRIVING QUESTION

Hybrid beachgrass discovery

How does a newly-discovered beachgrass hybrid affect coastal dune ecosystems?

OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

ESSENTIAL QUESTIONS & STANDARDS

ESSENTIAL QUESTIONS

1. What ecosystem services do beachgrasses and dunes provide?
2. How do we identify and measure beachgrasses?
3. How does vegetation influence dune shape, and how does dune shape affect protection from climate change impacts?
4. How do hybrids form, and why are they important?

SCIENCE

NGSS HS-LS2-6:
Evaluate claims, evidence and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

MATH

MP.2 Reason abstractly and quantitatively
HSS-ID.A.1 Represent data with plots on the real number line.
HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
HSS-ID.B.6 Evaluate reports based on data.

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

Watch video +/- read article relating to movie "Dune" and discuss hybrids

Explore

Students research about dunes and have a discussion about pros and cons from different perspectives.

Students label a visual of a dune, then brainstorm about how to measure with tools given (constraints).

Explain

Students will learn background information for how to identify beachgrasses.

Presentation and discussion about dunes, ecosystem services, and management of ecosystems.

Elaborate

Field trip to coastal dunes to interact with beachgrasses (or digital data work). Workbook included for both options.

Evaluate

Students visualize field data, using data and a provided dune profile worksheet.

Students compare and contrast dunes with and without vegetation.