



OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE



Oregon State
University



Tracy Crews & Cait Goodwin, Oregon Sea Grant



OREGON MARINE SCIENTIST
AND EDUCATOR ALLIANCE



Today's Agenda

ORSEA Overview

ORSEA Team Presentations

Open House: Social With Resource Tables



- Oregon
- Career Day Investigations
 - Homeschool Days
 - Summer Day Camps
 - Hands-on Lab and Field Experiences
 - Other Special Programming
 - Growing Engineers and Marine Scientists
 - Oregon Coast Renewable Energy Challenge
 - Oregon Regional ROV Competition
 - Upward Bound Camps





OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE



Funded by Oregon Sea Grant and the National Science Foundation through OSU Regional Class Research Vessel Project.

ORSEA brings together MS & HS educators and researchers to focus on important ocean issues, career-connected learning, and science communication practices.

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



OREGON MARINE SCIENTIST
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New Regional Class Research Vessels



R/V Taani



R/V Narragansett Dawn



R/V Gilbert R Mason



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.



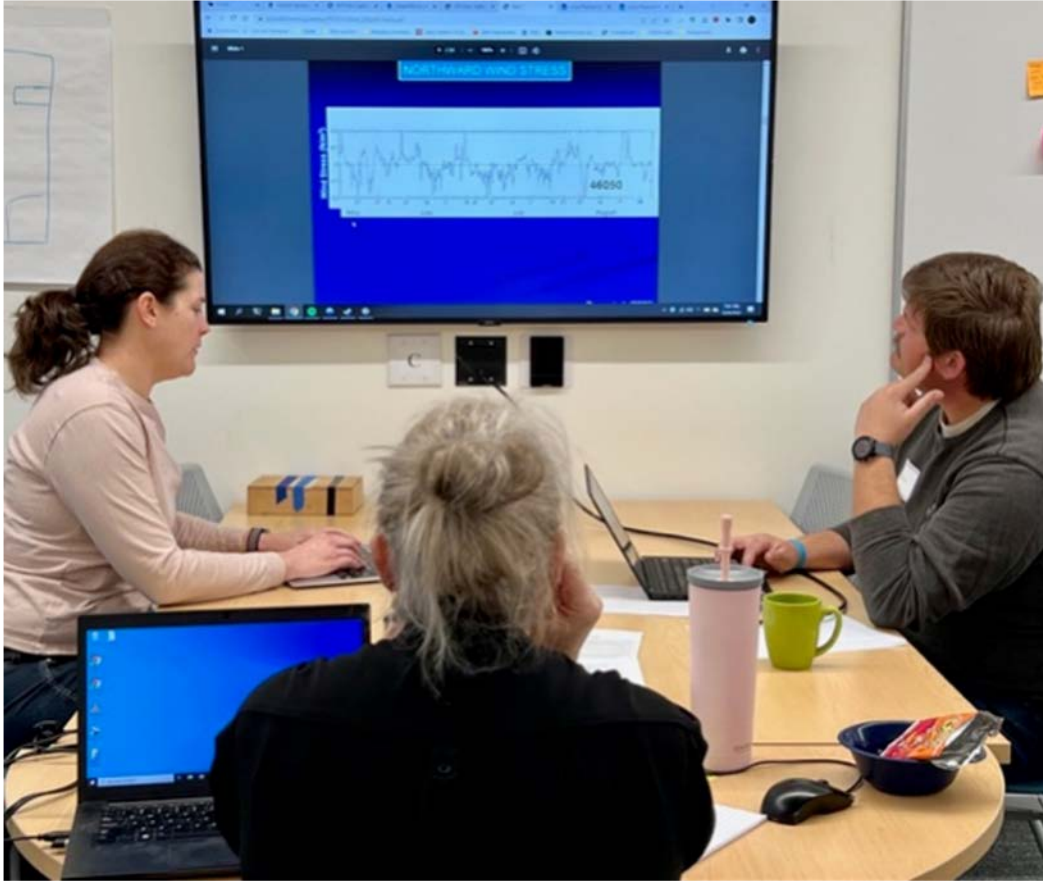
@PelayoSalinas

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.



ORSEA Structure



Multi-day PD

Scientist and Teacher
Poster Presentations

Training Science
Communication

NGSS, Anchoring
Phenomena, 5-E Model

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

Monthly Community of Practice Meetings via Zoom



OREGON MARINE SCIENTIST AND EDUCATOR ALLIANCE

Featured Lessons



COLD SUMMER WATER



TIDEPOL TUSSE



COASTAL HYPOXIA



CORAL BLEACHING



FORAMS AS STORYTELLERS



HYBRID BEACHGRASS DISCOVERY



INVASION OF THE CRABS



KELP FOREST COMPLEXITY



KRILL PREFER CHILL



MUDDY WATERS



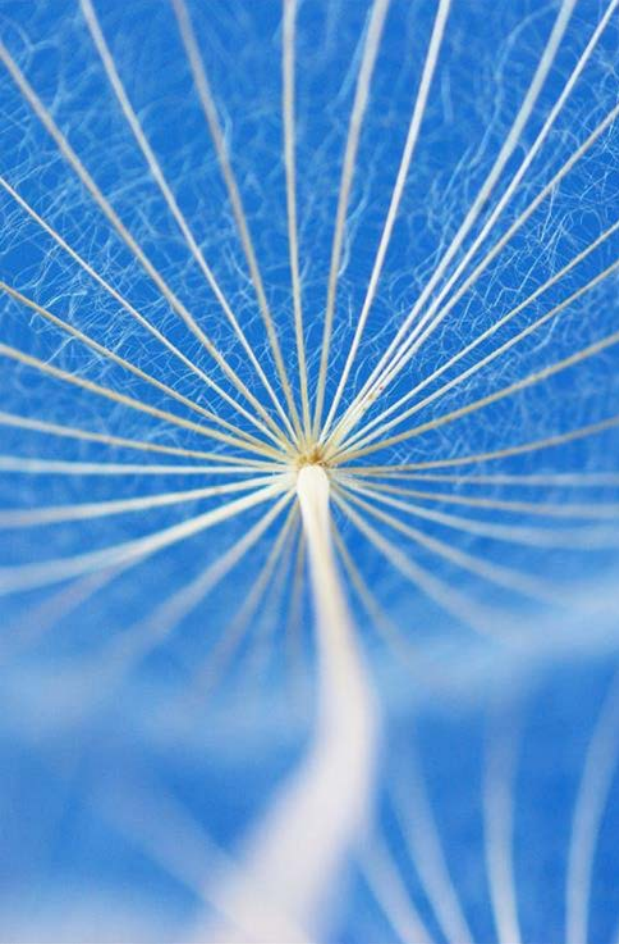
PATCHY PLANKTON



POPULATION FLUCTUATIONS IN SALMON

STEM at Sea Research Cruises





TEAM WIND FISH

2023 ORSEA Capstone Presentation

OUR TEAM



Leanne Cohn

Marine Resource Management, Oregon State
University



Ryan Loftus

Science Teacher, South Salem High School



Mark Jacobson

Math Teacher, Gresham High School

ANCHORING PHENOMENA / DRIVING QUESTION

Where do we farm the wind?

How does farming the wind impact communities?



EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

Science

- Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

Math

- Math Modeling
- Math in the real world
- Population Density
- Collecting and analyzing Data

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

- **Introduction to Offshore Wind Energy (OWE)**
- What is it?
- How does it work?

Explore

- Students will decide where to place OWE using one data point
- Compare and contrast between Groups

Explain

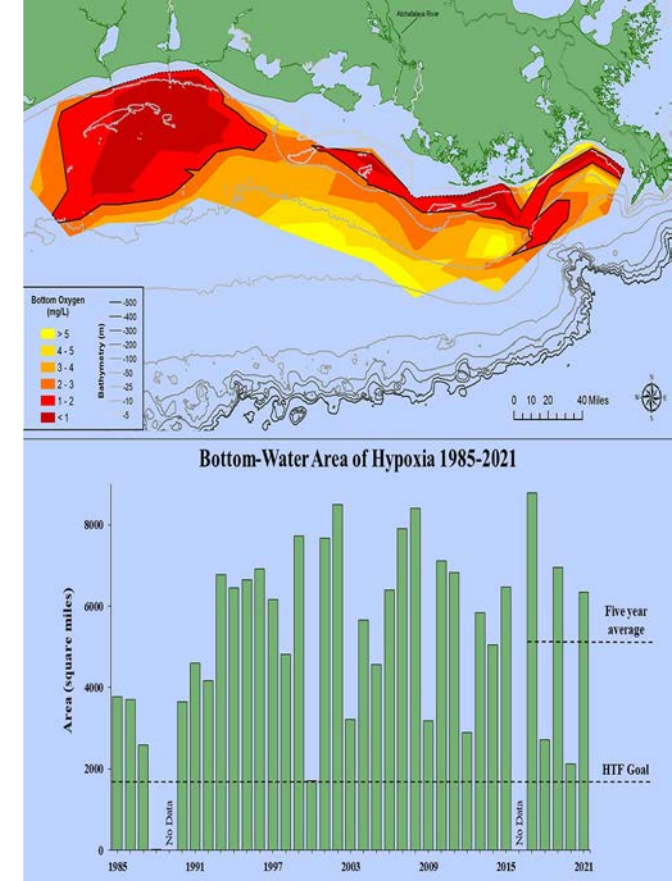
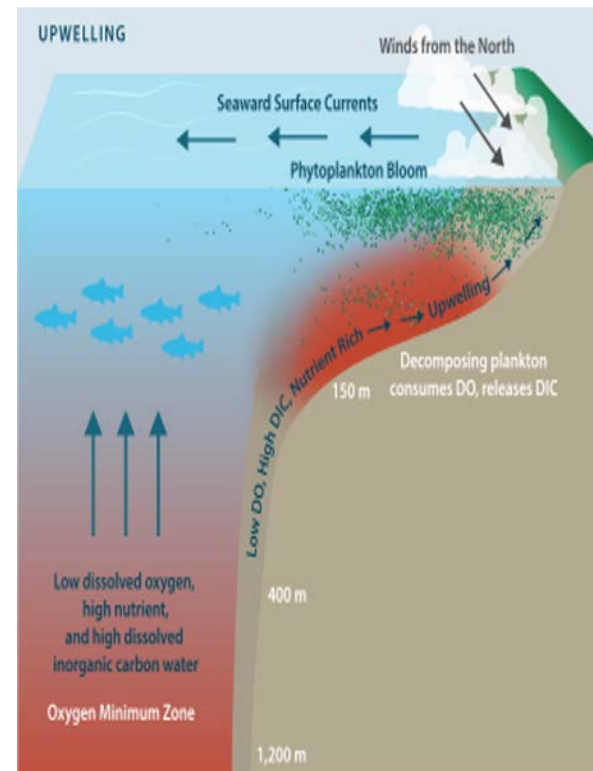
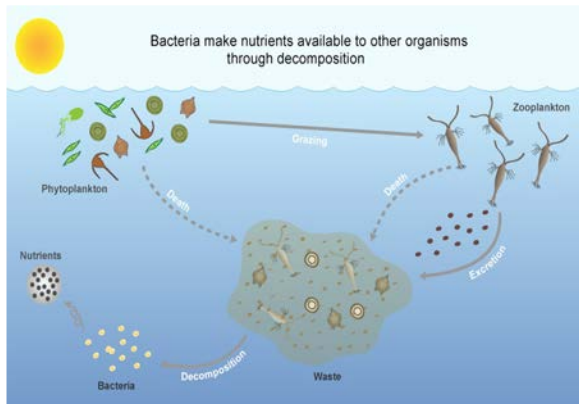
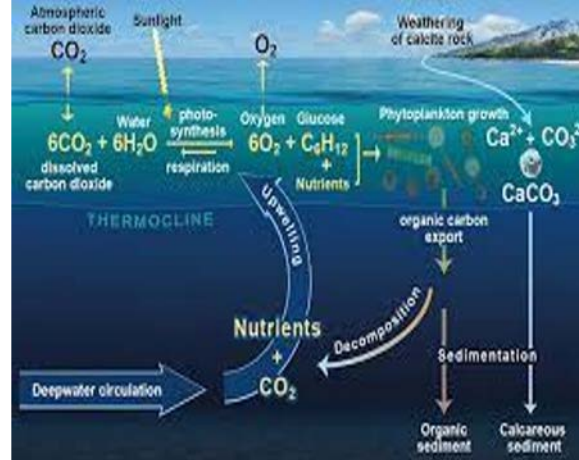
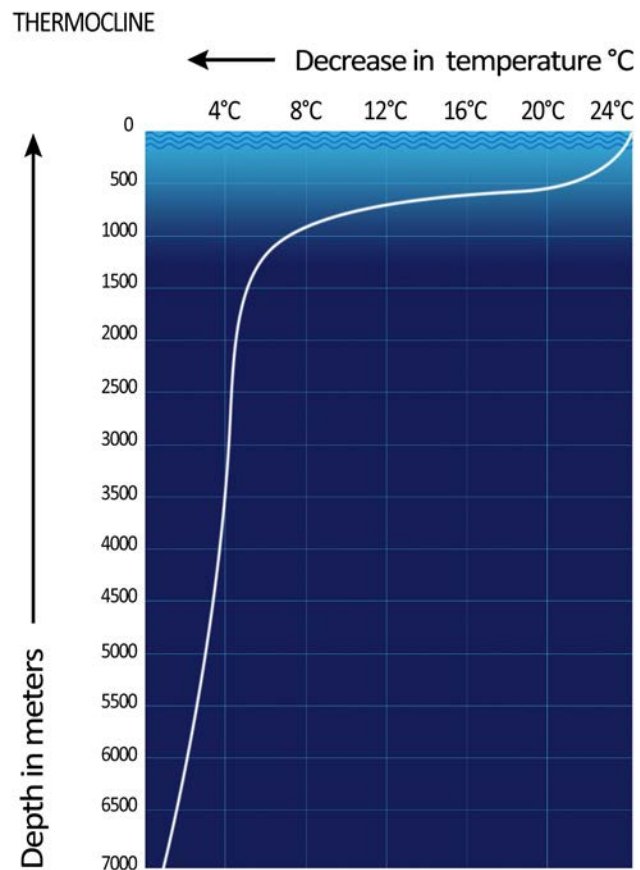
- How do we visualize our data?
 - Two different styles of presenting the data
- Which seems better?

Elaborate

- Students will pick where to place OWE based on different Roles
- Groups of multiple roles decide based on consensus where to place OWE

Evaluate

- Calculating our data
 - Population density
 - Comparing calculations to data visualization



TEAM UPWELLING

2023 ORSEA Capstone Presentation

OUR TEAM



LINUS STOLTZ

Scientist - Ocean Science Solutions LLC
Ocean Data Specialist



JULIE WALKER

Educator - Molalla High School
Science



DR. LORI VANDINE

Educator - Molalla High School
Math

ANCHORING PHENOMENA: The water on the coast of Oregon is often colder in the summer than the winter

DRIVING QUESTION: How does coastal upwelling impact ocean temperature and productivity?



EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED



Learning Goals:

- Upwelling is the vertical transport of water and is caused by winds.
- Some effects of upwelling are decreased surface temperatures, increased nutrients and decreased oxygen levels

Objectives:

- Explain how water temperature and density are related
- Analyze and compare data sets
- Explain the causes and effects of upwelling

Science

HS-ESS2-2 : Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that cause changes to other Earth systems.

Science & Engineering Practices:

Developing and Using Models
Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Disciplinary Core Ideas:

ESS2.A: Earth Materials and Systems
Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-1),

Crosscutting Concepts:

Stability and Change
Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

Math

HS.DR.A.3 Formulate inferential statistical investigative questions regarding causality and prediction from correlation.

HS.DR.A.4 Use mathematical and statistical reasoning to formulate questions about data to evaluate conclusions and assess risks.

Math Practice #2: Reason abstractly and quantitatively.

Math Practice #3: Construct viable arguments and critique the reasoning of others.

Math Practice #4: Model with mathematics

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

Initial Questions: When would it be a good time period to wade in the water on the Oregon Coast? What months do you think the surface water is going to be the warmest/coldest?

- Students will use the water temperature video and pictures to make a conjecture
- Class discussion
- Students will use the water temperature data set to make adjustments to their conjecture.

Explore

Lesson #1 Explore - Hot and Cold Water Density Lab

Lesson #2 Explore - Upwelling Guided Inquiry Learning

Explain

Explain Lesson #1 - What is upwelling?
Students will complete an online investigation .

Explain Lesson #2 - Close reading exercise
Students will place where dissolved oxygen levels and chlorophyll levels would be highest on the graph.

Explain Lesson #3 - Career Connection Video

Elaborate

Current Event (student presentations)
Upwelling Jam Board
Padlet (student sketches with explanations)
Graphic Organizer
Flip Book
Make a Stop Motion Video

Evaluate

- **Diagnostic:** Engage
- **Formative:** Explore, Explain, Elaborate
- **Summative:** Unit completion evaluation 9 long answer questions gaining complexity and deep understanding as students progress through the test.



TEAM MUSSEL MUNCHERS

2023 ORSEA Capstone Presentation

OUR TEAM



Tracie Wickham
Science Teacher, Sherwood Middle School



Elizabeth Strausbaugh
Math Teacher, Sherwood Middle School



Sarah Sellke
PhD student, OSU

ANCHORING PHENOMENA / DRIVING QUESTION

Anchoring Phenomenon: Sea stars eat mussels in the rocky intertidal ecosystem in Oregon.

Driving Question:

How do sea stars affect the rocky intertidal ecosystem?





EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

Science

Science and Engineering Practices

- Analyze and interpret data to provide evidence for phenomena.

Disciplinary core ideas

- LS2.A: Interdependent Relationships in Ecosystems
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Crosscutting Concepts

- Stability and Change
- Cause and Effect

Math

7.SP.1 - Random Sampling

7.SP.2 - Use data to draw inferences

7.SP.3 - Visually assess data

7.SP.4 - Use measures of center and variability

7.RP.3 - Use proportional relationships

6.SP.4 - Display numerical data in plots

6.RP.3 - Use ratio and rate reasoning

8.SP.J - Investigate bivariate data

8.SP.1 - Construct plots for bivariate data

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

- Video of sea stars eating mussels
- Pictures of intertidal zonation
- Reflection questions

Explore

- Intro to rocky intertidal system (videos from other scientists, worksheets on intertidal zones)
- Intro to sampling methods - slides and practice activities

Explain

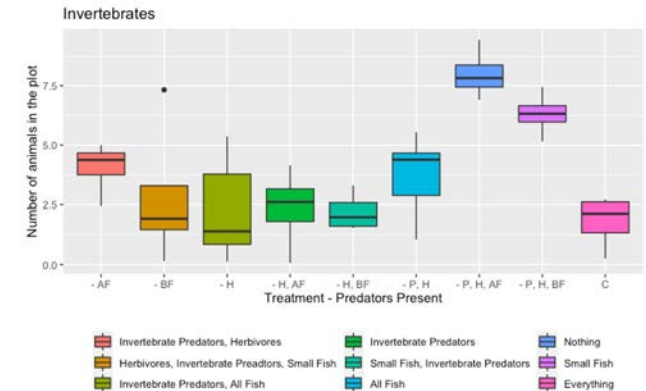
- Mussel counting activity from PISCO pictures
- Constructing bar and box plots

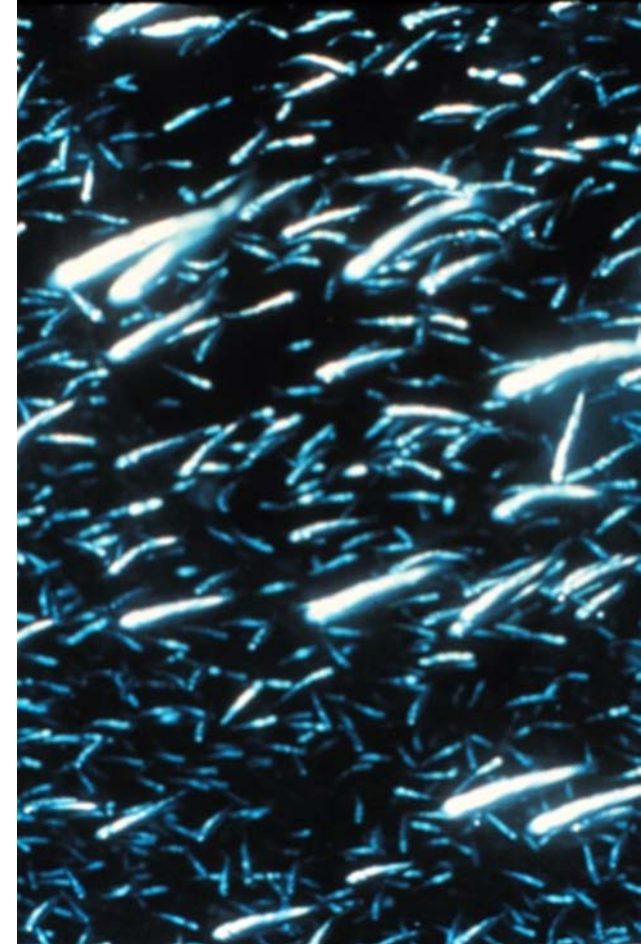
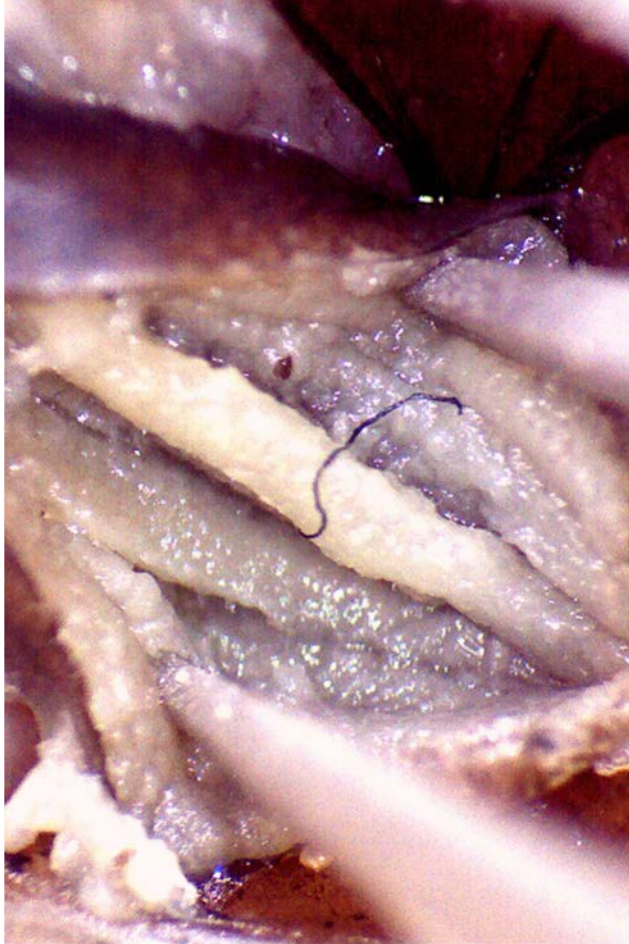
Evaluate

- Video of Bob Paine's sea star experiments
- Written argument - "How do sea stars affect populations of mussels?"

Elaborate

- Interpreting other graphs made by other scientists with similar experiments





TEAM FICKLE FIBERS

2023 ORSEA Capstone Presentation

OUR TEAM



Cassie Morrissey
6th Grade Math / Science Teacher



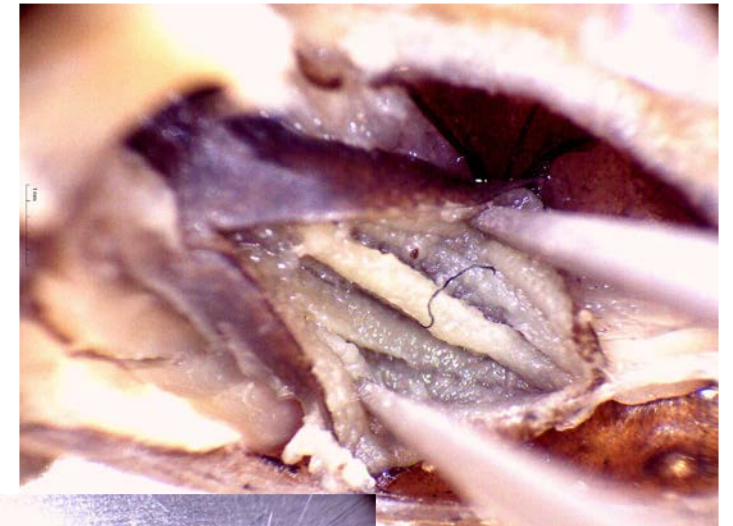
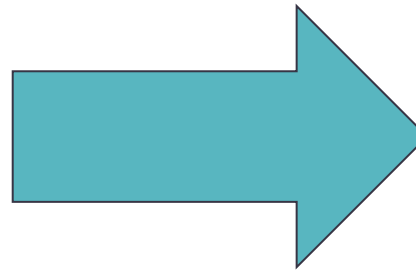
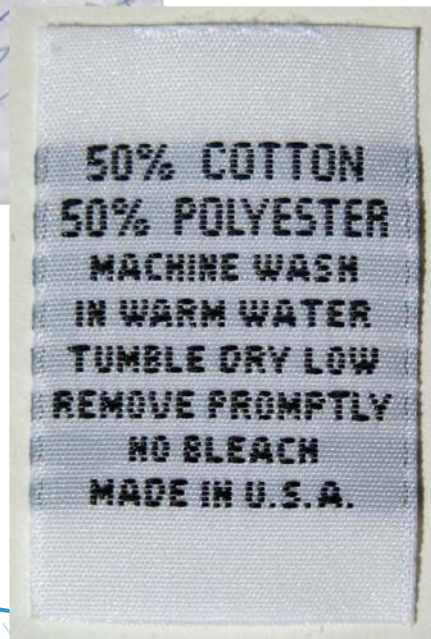
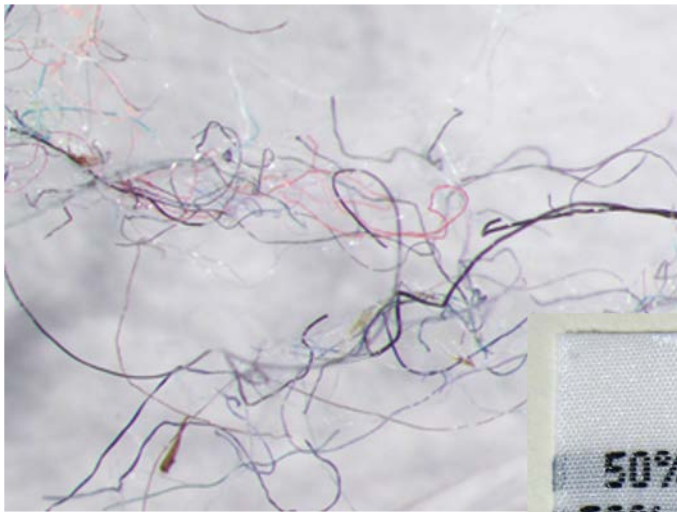
Lauren Worth
6th grade Science Teacher



Olivia Boisen
Scientist

ANCHORING PHENOMENA / DRIVING QUESTION

Do my choices in clothing affect fish in the deep sea?



A microscopic image showing a dense collection of colorful microfibers (blue, red, orange, black) against a light background.

EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

- Natural and synthetic microfibers are being ingested by organisms in the marine environment.
- Creation of microfibers are a result of human activities, like doing laundry.
- Transport of microfibers throughout the environment can be simulated and modeled.
- Actions can be taken where individuals can have a positive impact on real world issues.

Science

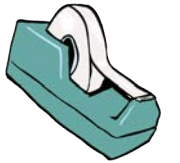
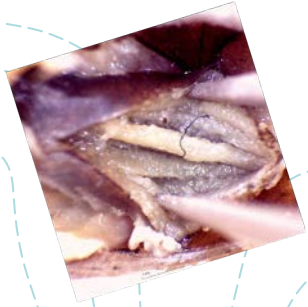
- MS-ESS3-3** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- NGSS Science & Engineering Practices: MS-ESS3-4
- NGSS Disciplinary Core Ideas: MS-ESS3-3, MS-ESS3-4
- NGSS Crosscutting Concepts: MS-ESS3-2

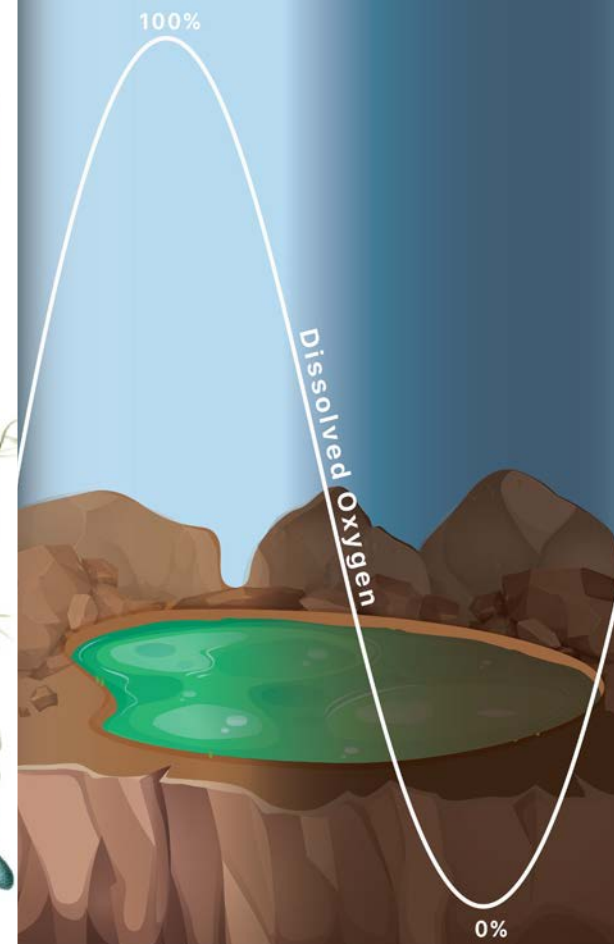
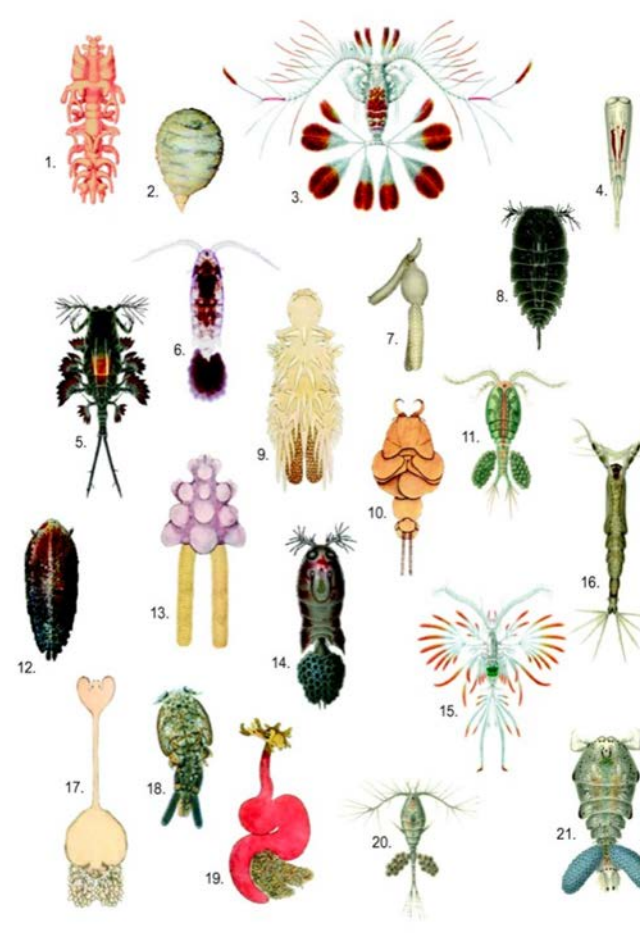
Math

- 6.DR.A.1** Formulate and recognize statistical investigative questions as those that anticipate changes in descriptive data related to the question and account for it in the answers.
- 6.DR.C.3** Analyze data representations and describe measures of center and variability of quantitative data using appropriate displays.
- 6.RP.A.3** Use ratio and rate reasoning to solve real-world and mathematical problems

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

5-E	Essential Questions	Activities
ENGAGE	<i>How do fibers from clothing end up in waterways and how does that affect marine life?</i>	<ul style="list-style-type: none"> • Anchoring phenomenon slideshow • “The Story of Microfibers” video • Clothing & Tape Activity • Meet the Scientist slideshow
EXPLORE	<i>How do fibers types differ?</i>	<ul style="list-style-type: none"> • Fiber type matching activity • Fiber fractions ratio activity • Statistical question exploration
EXPLAIN	<i>How do washing machines contribute to fiber shedding?</i>	<ul style="list-style-type: none"> • Washing machine simulation activity
ELABORATE	<i>How did this fiber end up in a deep sea fish?</i>	<ul style="list-style-type: none"> • Research article guided notes activity • “The Story of a Fiber” comic book activity
EVALUATE	<i>How can we mitigate the problem of microfiber shedding?</i>	<ul style="list-style-type: none"> • Microfiber pollution YouTube video recap • Microfiber mitigation infographic project





Team Cuckoo for Copepods

2023 ORSEA Capstone Presentation

OUR TEAM



Vanessa Wilkerson
Educator



Bryan Coyle
Educator



Jenny Koester
Scientist - Oregon OAH Council



Marine Andriot
PhD Student- OSU

ANCHORING PHENOMENA

Copepods survive in **extreme** environmental condition

DRIVING QUESTION

How can we use copepods as a model to learn about how marine organisms can tolerate **extreme** hypoxia?

STANDARDS ADDRESSED

Science

- **HS-LS2-5.** Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
- **HS-LS2-6.** Evaluate the 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.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*
- **HS-LS4-4.** Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Math

- **HS.DR.A.2** Formulate summative, comparative, and associative statistical investigative questions for surveys, observational studies, and experiments using primary or secondary data.
- **HS.DR.A.3** Formulate inferential statistical investigative questions regarding causality and prediction from correlation.
- **HS.DR.B.6** Distinguish and choose between surveys, observational studies, and experiments to design an appropriate data collection that answers an investigative question of interest.
- **HS.DR.C.8** Identify appropriate ways to summarize and then represent the distribution of univariate and bivariate data multiple ways with graphs and/or tables. Use technology to present data that supports interpretation of tabular and graphical representations.

LEARNING GOALS

Students will learn the following:

1. Dissolved oxygen is essential for supporting respiration-based life in water.
2. Climate change is causing oceanographic changes in upwelling that are leading to periods of more frequent and more extreme hypoxia.
3. Copepods are genetically related to commercially important crustaceans, and are good lab specimens.
4. Computers can be used to analyze datasets from researchers using software such as Microsoft Excel or Google

LEARNING OBJECTIVES

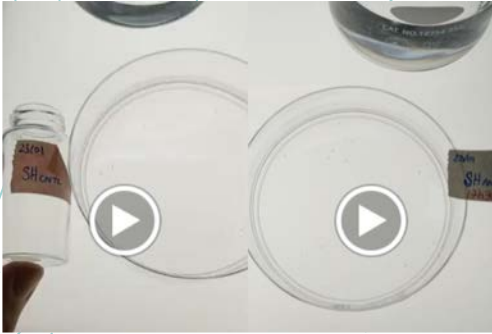
Students will be able to:

1. Describe the importance of dissolved oxygen in water.
2. Identify locations that have different dissolved oxygen levels
3. Identify species that have different dissolved oxygen needs.
4. Describe hypoxia.
5. Explain how ocean upwelling can lead to hypoxia.
6. Describe why copepods are good model species to study hypoxia on the pacific coast.
7. Describe some of the research that is currently occurring with copepods and hypoxia.

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

Copepod video introduction



Explain

Breath lab

Optional: Water dissolved oxygen sampling lab

Evaluate

Intro to hypoxia on the Oregon Coast

(Lecture & OSU Video)

Explore

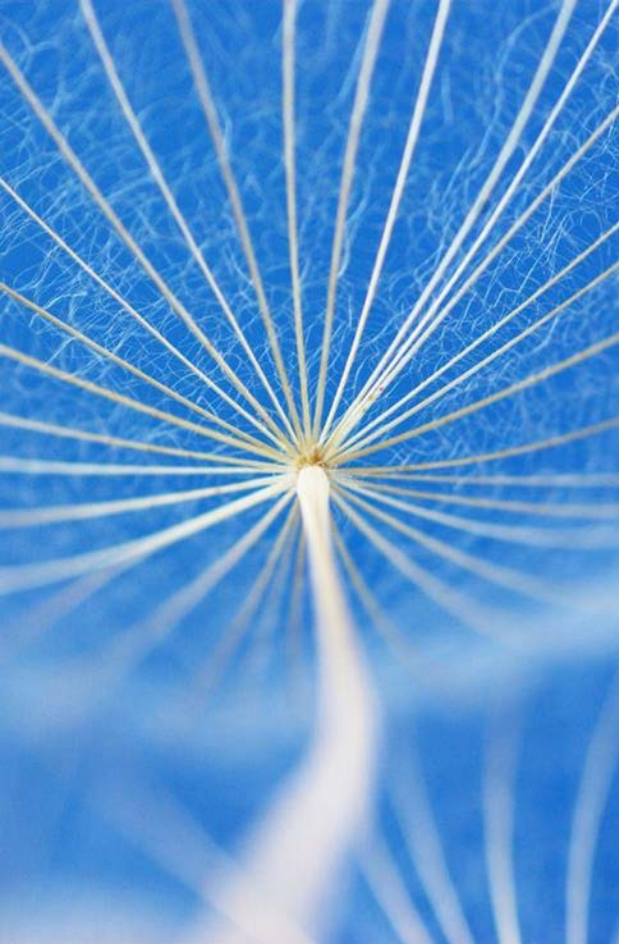
Copepod research at OSU

Copepods as model organisms

Copepod research graphing activity

Elaborate

Marine science jeopardy using daily exit questions



TEAM King Tides

2023 ORSEA Capstone Presentation

OUR TEAM



Ed Zaron, Oceanographer
Associate Professor (Senior Research)
College of Earth, Ocean, and Atmospheric Science
Oregon State University

Areas of research: Satellite altimetry, tides, ocean forecasting, sea level rise



Rachel Lyon

Science Teacher - Marshfield High

Coos Bay, Oregon

ANCHORING PHENOMENA / DRIVING QUESTION

- Changing Water Levels
 - How does sea level change over different time periods – from minutes to seasons to centuries?
 - What causes changes in sea level?
 - Can sea level change be an indicator for climate change?

Low Tide vs. High Tide



Sunny Day Flooding in Annapolis, Maryland





EDUCATION GOALS, OBJECTIVES, AND STANDARDS ADDRESSED

Science

HS-ESS3-5.

Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems.

Science and Engineering Practices

Analyzing and Interpreting Data

- Analyze data using computational models in order to make valid and reliable scientific claims.

Disciplinary Core Ideas

ESS3.D: Global Climate Change

- Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.

Crosscutting Concepts

Stability and Change

- Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

Math

HS.AFN.D.10 Explain why a situation can be modeled with a linear function, an exponential function, or neither. In a given model, explain the meaning of coefficients and features of functions used, such as slope for a linear model.

5-E LESSON MODEL AND ASSOCIATED ACTIVITIES

Engage

Show images of coastal flooding and asking students what they think is going on.

Explain

Learn how tides are measured. Meet scientist Ed who talks about time scales and variability. Students read graphs and analyze information.

Evaluate

Student presentations and summative assessments

Explore

Students use tide charts, videos, articles, and images to learn about tides.

Elaborate

Students will use data sets and research to make a claim and to provide evidence and reasoning when creating a short presentation.