OASSIS PROJECT

Ocean Acidification Study Through Systems and Inquiry Science

PORT TOWNSEND MARINE SCIENCE CENTER

COW BOYS CHIMACUM

PACIFIC NORTHWEST B-WET

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

Port Townsend Marine Science Center

- Understanding of Ocean Acidification
- Interest in STEM careers
- Collective action
- Integrate Citizen Science with Education

Keep it locally focused

Provide meaningful watershed experiences

MODULES AVAILABLE IN OUR CURRICULUM WAREHOUSE

Quicklook

Quicklook

Quicklook

Quicklook

Quicklook

Quicklook

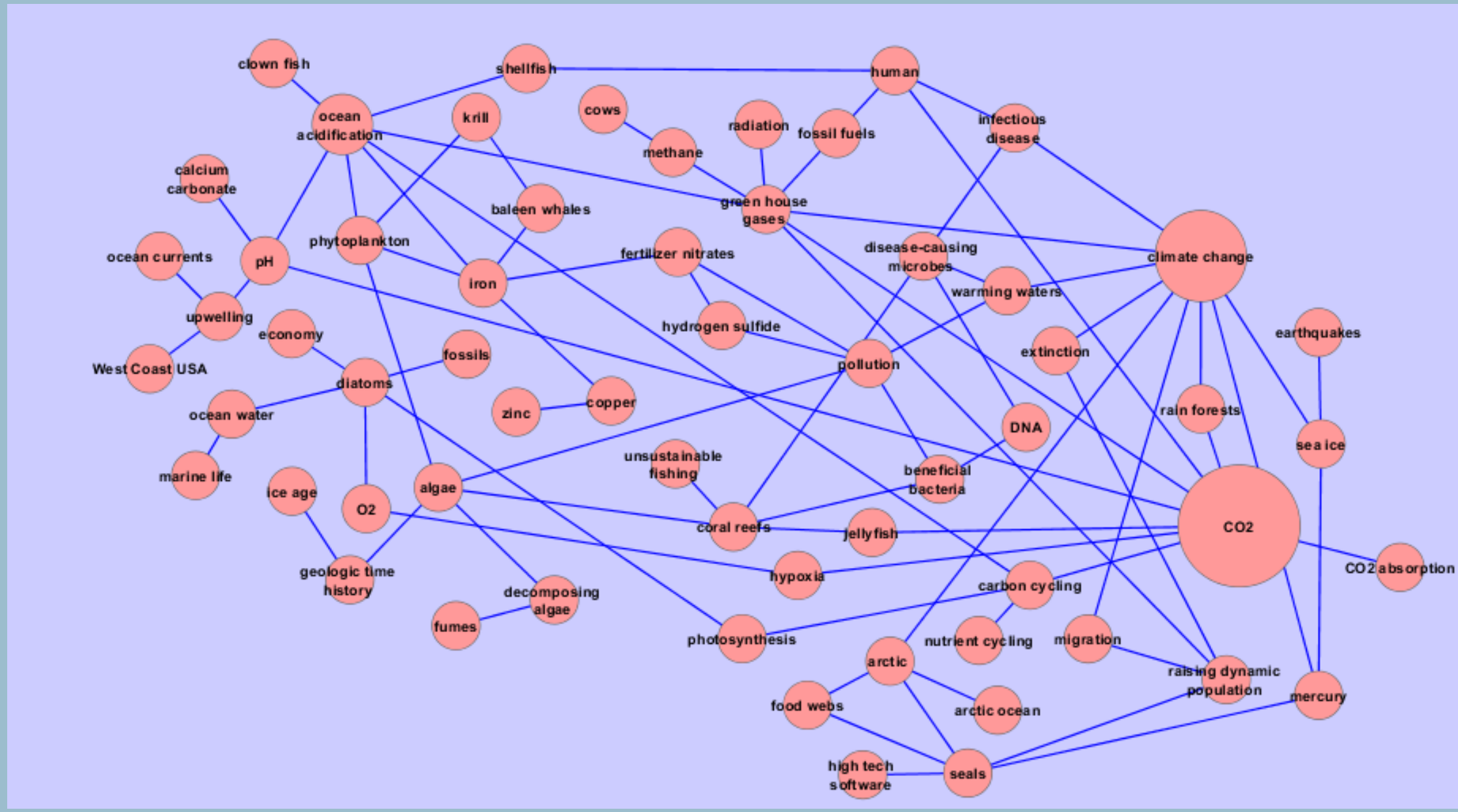
Quicklook

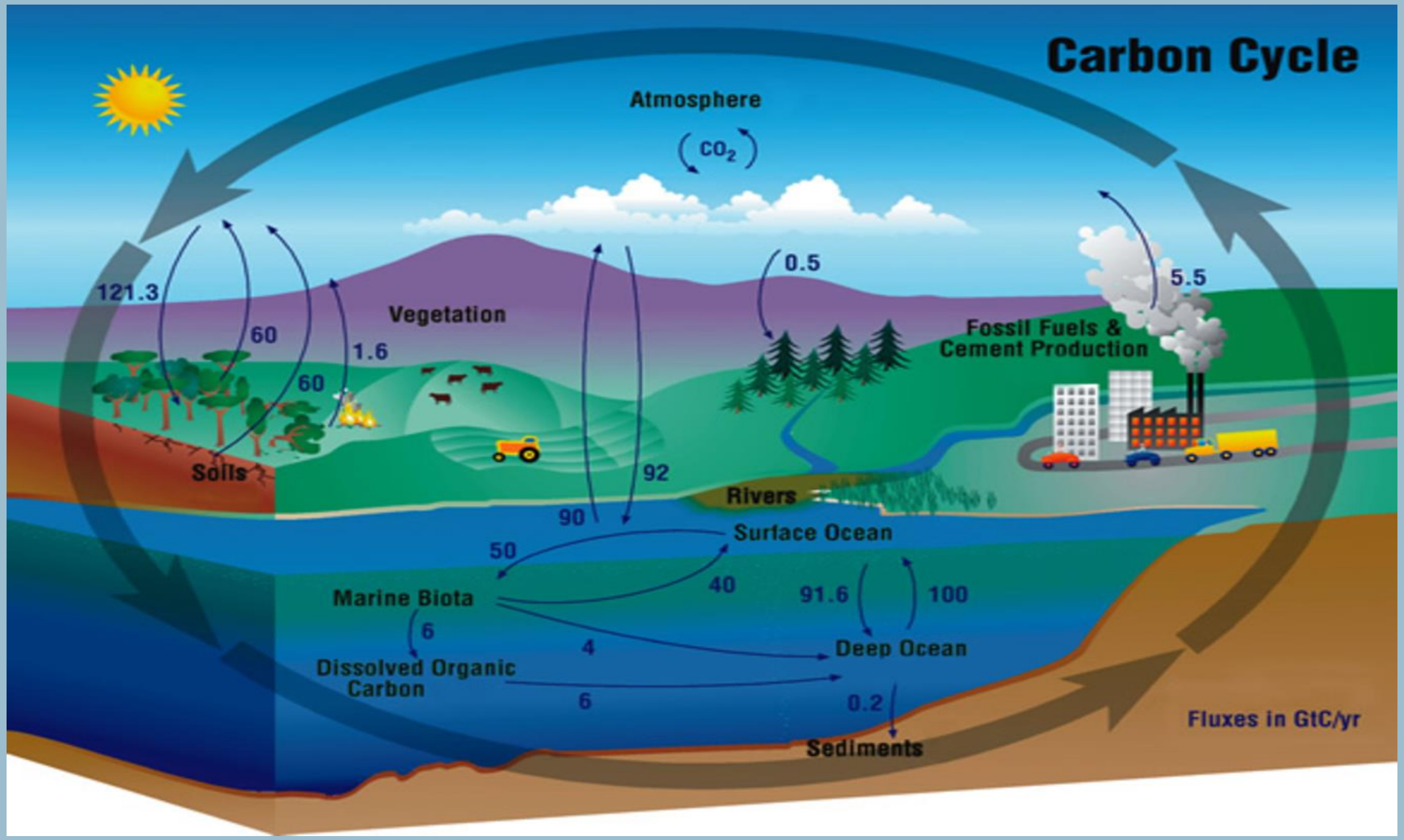
MODULES

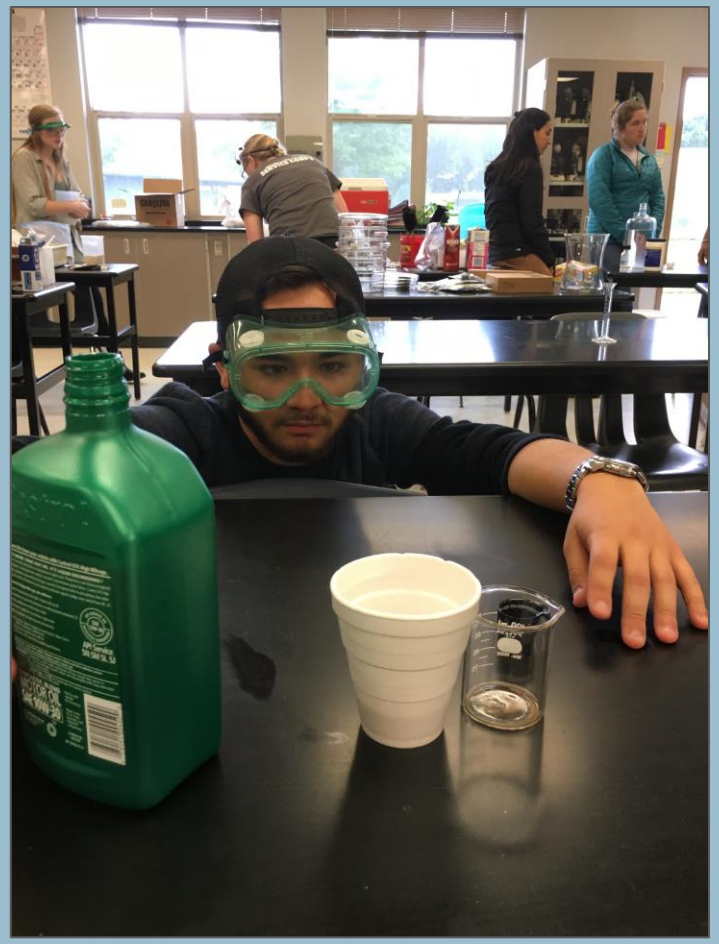
- Ecological Networks (9)
- Environmental Influence on Gene Networks Module (6)
- Food Security (8)
- Introduction to Systems (4)
- Observing Beyond our Senses (8)
- Ocean Acidification: A Systems Approach to a Global Problem (10)
- Sustainability (3)

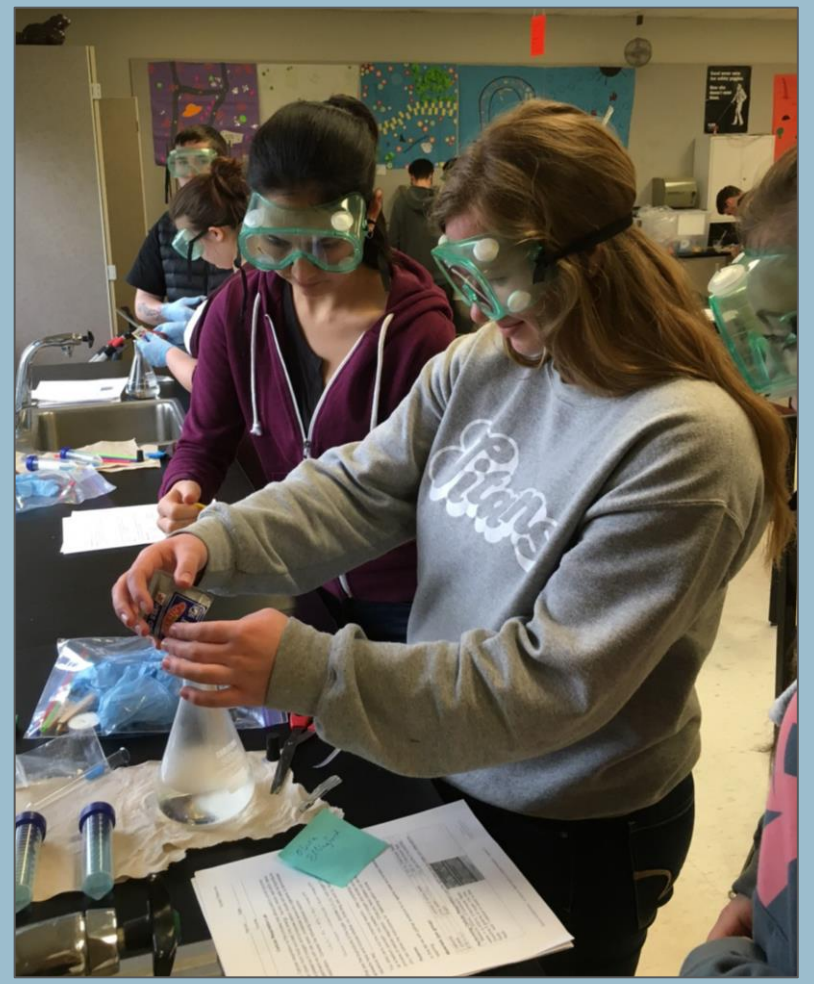
QUICKLINKS

- Purple Membrane Simulation Model
- Cell Phone Simulation
- Blank Food Web


clown fish
shellfish
human
ocean acidification
krill
cows
radiation
fossil fuels
infectious disease
methane
calcium carbonate
baleen whales
green house gases
phytoplankton
ocean currents
pH
fertilizer nitrates
disease-causing microbes
climate change
iron
warming waters
upwelling
hydrogen sulfide
earthquakes
economy
extinction
West Coast USA
fossils
pollution
diatoms
zinc
copper
rain forests
ocean water
DNA
sea ice
unsustainable fishing
beneficial bacteria
marine life
ice age
algae
CO2
O2
coral reefs
jellyfish
CO2 absorption
hypoxia
geologic time history
carbon cycling
decomposing algae
fumes
photosynthesis
nutrient cycling
migration
arctic
raising dynamic population
food webs
arctic ocean
mercury
high tech software
seals


Carbon Cycle
Atmosphere
CO_2
121.3
60
60
1.6
Vegetation
Soils
0.5
5.5
Fossil Fuels &
Cement Production
92
90
Rivers
Surface Ocean
50
40
Marine Biota
6
Dissolved Organic
Carbon
4
6
91.6
100
Deep Ocean
0.2
Sediments
Fluxes in GtC/yr





Characteristics and Sources of CO_2

CLAM POPULATION Assessment Protocol

Equipment:

- Datasheet and pencil
- Map and sharpie
- Gloves
- Shovel and trowel
- Sorting board
- Rings
- Flags
- Clam ID sheet
- Clam measure

Crew Tasks: Pace, record, dig, ID, count and measure clams, replace clams and fill hole

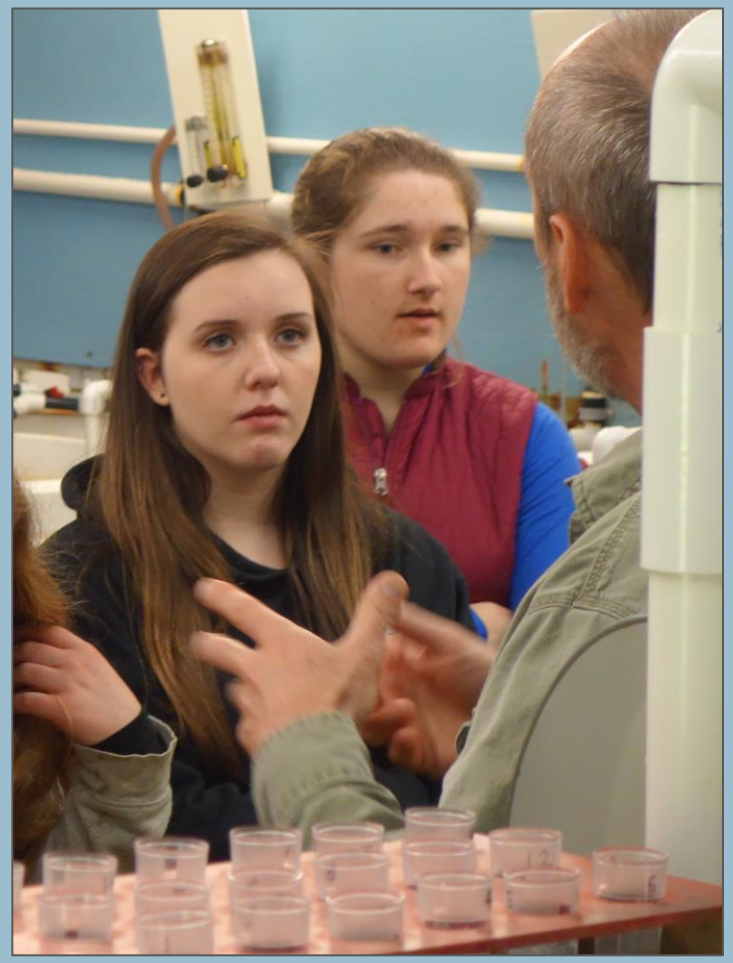
In a small group (4 - 5)

1. From Baseline walk perpendicular transect towards water and **count** the number of paces from baseline to water and **record** on data sheet.
2. **Indicate** approximate location of site on map with pen.
3. Mark with flag a location 3 paces up from water (back towards baseline)
4. Place ring on water side of flag
5. Trace a circle within the ring
6. Remove the ring
7. **Record** a description of the substrate for this sample site on the data sheet.

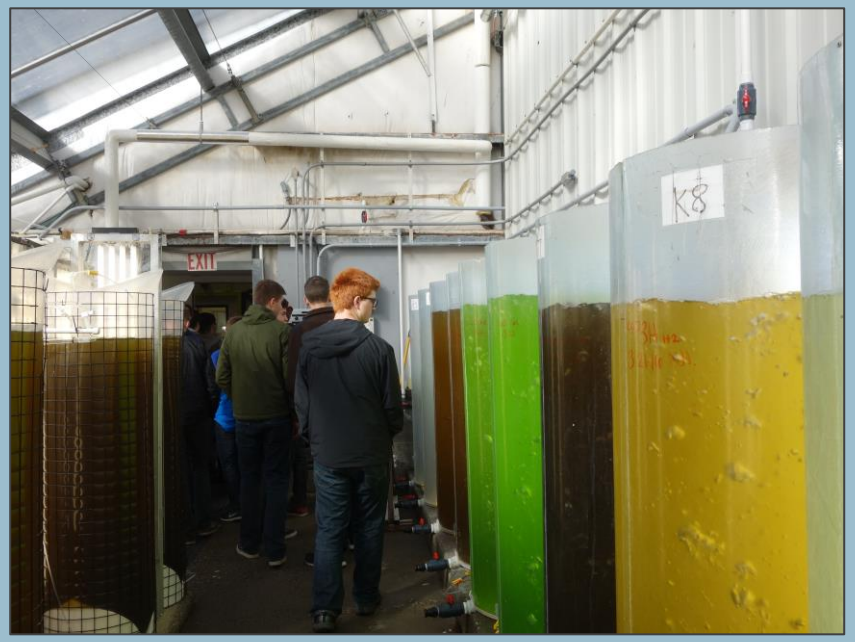
   (mud, sand (can see individual grains), pebble (> ¼ inch (4mm)), cobble (> 2.5inches (64mm)) - can be a mixture)
8. Dig your sample to the size of the ring with straight sides and to the depth of a shovel head (approximately 12 inches deep). Excavate only within the circular area.
9. Place contents on sorting board
10. **Sort** by species and **count** the number of individual clams per species and **record** on datasheet
11. Using clam measure device (blue) **measure** each clam to see if they are of legal size (1.5 inches or larger) and **record** the number per species.

12. Add up totals
13. CAREFULLY REPLACE clams back into sample hole with syphons up. Fill hole.
14. Repeat at new site 10 paces towards baseline from this site.
15. Remove flag from previous site
16. Each group should dig no more than 3 sample holes.

Citizen Science

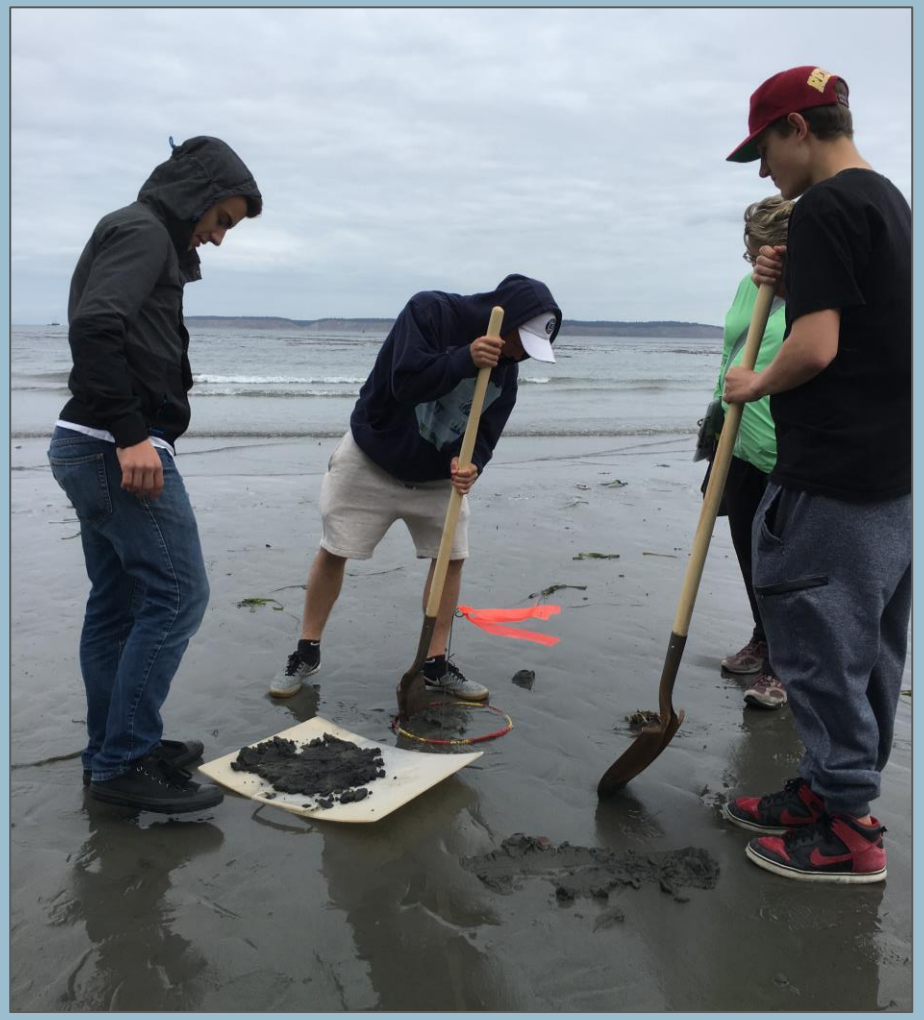


STEM Careers

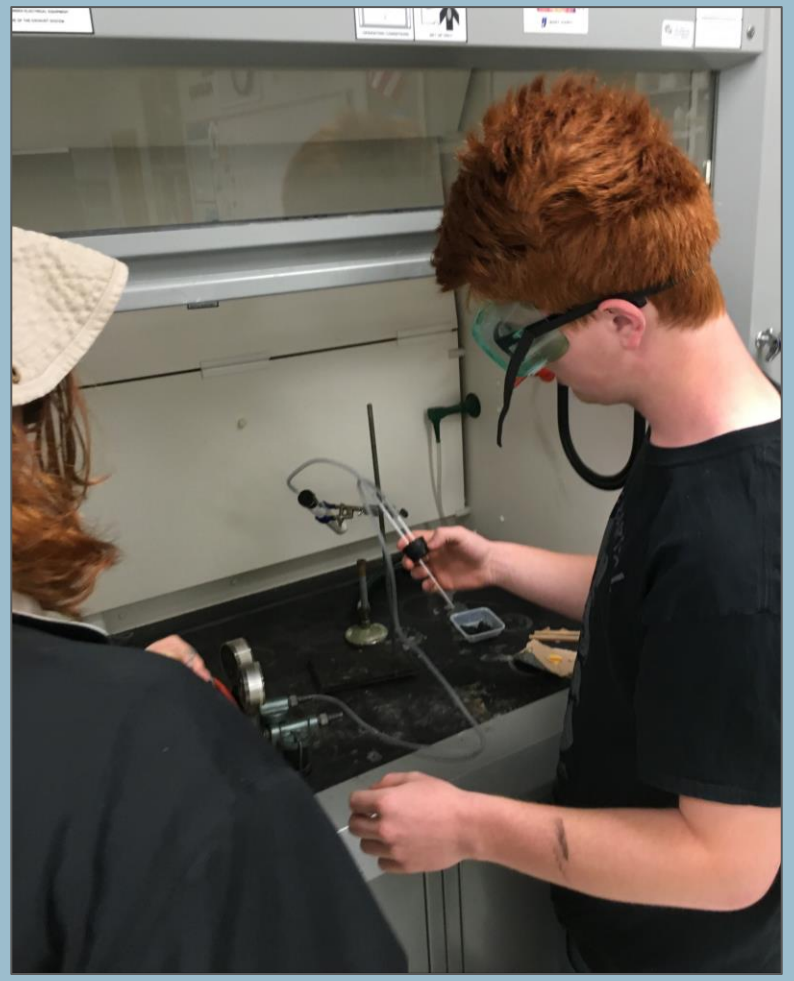


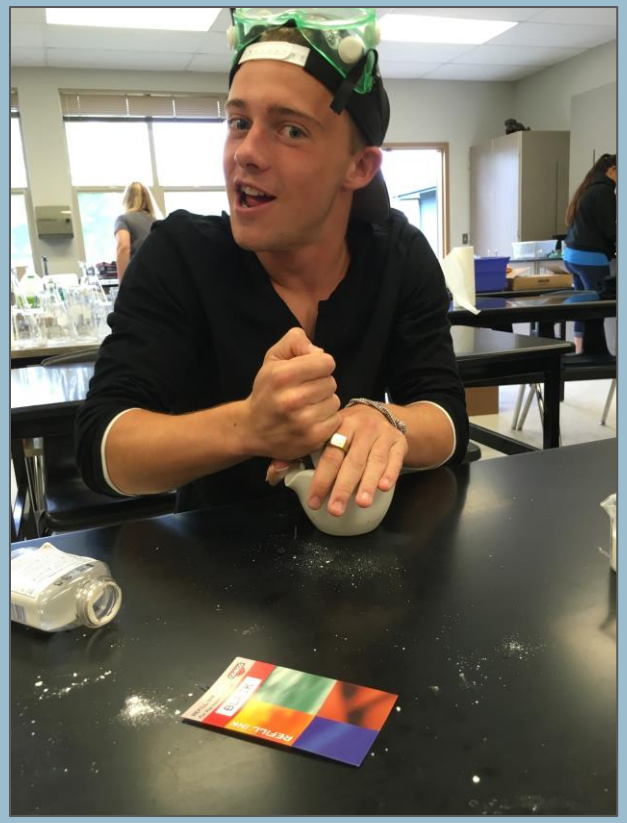
Taylor Shellfish Quilcene Hatchery

NOAA Mukilteo Fish Lab



Port Townsend Marine Science Center





Student Designed Investigations

Volcanic Eruptions: CO_2 and pH

Matthew Koenig and Adam Ogden | Chimacum High School, Chimacum, WA

Introduction

Carbon dioxide typically lowers the pH of water, making it more acidic. Knowing this, we ask: how does CO2 produced from underwater volcanoes like those in the ocean affect the acidity of water? We hypothesize that if CO2 is produced directly in the water from a submerged volcano it will have drastically lowered pH levels because the CO2 is absorbed directly and immediately. Normally, CO2 is absorbed into the ocean through wave action.

Methods

- Collect materials
- Place volcano in water in tub with CO2 hose beneath (Figure 2).
- Put probes in water, turn on hose
- Record pH change
- Repeat with volcano above water
- Record and compare to underwater volcano

Results

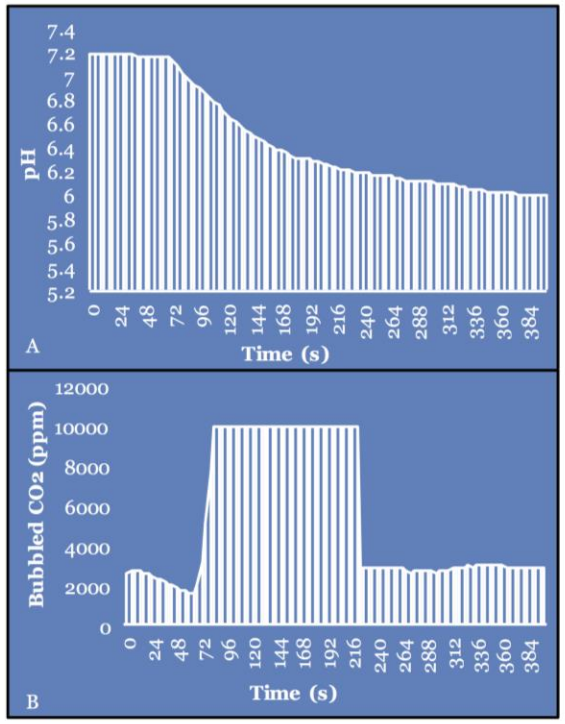


Figure 1. The top graph (A) shows how pH changed as time progressed. The bottom graph (B) is the change in CO2 as time passed.

Figure 2. Experimental setup.

Discussion

- We fail to reject our hypothesis because based on our results the volcano clearly made a large difference in our pH levels.
- The tub was not properly sealed, leading to tainted air and water, and CO2 escaping the system.
- Volcanoes underwater can, according to our results, add to the rising CO2 levels in the water increasing global water acidity, affecting the ability for some marine animals to survive.

The effects of off gassing on water pH

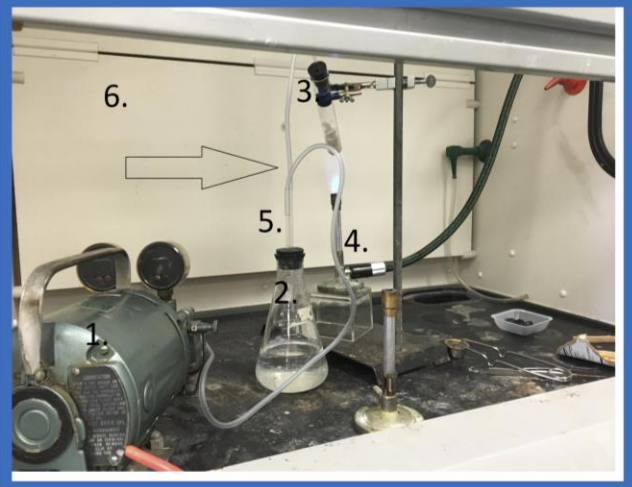
Orion Hayes and Ethan Jentzsch | Chimacum High School, Chimacum, WA

Introduction

"When CO_2 is added to seawater, it reacts with water to form carbonic acid (H_2CO_3); hence acid is being added to seawater, thereby acidifying it" (NOAA, 2016).

Hypothesis: if a solid fuel source has more carbon per gram it will then lower the pH more.

To test this bubble off gassing through water then test the pH.



1.Pump 2.Erlernmeyer flask
3.Test 4.Bunsen burner
5.Glass tubing 6. Plastic tubing

Procedure

Products Used
Wood, cardboard, paper, coal, charcoal.
Step 1.
Take the pH of water in the beaker.
Step 2.
Place 2 grams of one of the products in to the test tube.
Step 3.
Turn pump and Bunsen burner on.
Step 4.
Allow product to burn until all the way gone or done burning.
Step 5.
measure pH of water in beaker.

Results

Material	Wood	Cardboard	Paper	Coal	Charcoal
Initial pH	7.05	7.05	7.05	7.05	7.05
First Check pH	-	-	7.30	-	7.46
Final pH	4.94	6.14	6.18	7.14	7.29
Difference	2.11	.091	0.87	-0.09	-0.24

Discussion

From our research we found that: ½ of wood is carbon, 43% of Paper is carbon, no less than 70% of coal is carbon, 80% of charcoal is carbon and 45% of cardboard is carbon.

We reject our hypothesis, because the products with the highest carbon content increased the pH instead of decreasing it like we had hypothesized.

We had particulate from the product we were burning pulled into the water along with the gas, the particulate could have had an effect on the outcome of our data.

We would like to continue our research and try again with a better set up that catches particulate before it reaches the water and do more trials.

References andAknowledgements

(http://pmel.noaa.gov/co2/story/A+primer+on+pH)

Funding for this project was provided by the National Oceanographic and Atmospheric Administration (NOAA) Bay Watershed Education and Training program.

Taylor Shellfish Field Trip

Jordyn Johnson, Tessa Rasmussen | Chimacum High School, Chimacum, WA

Purpose:

The purpose of going to Taylor Shellfish was because we were learning the effect of ocean acidity on the different shellfish.

What we did:

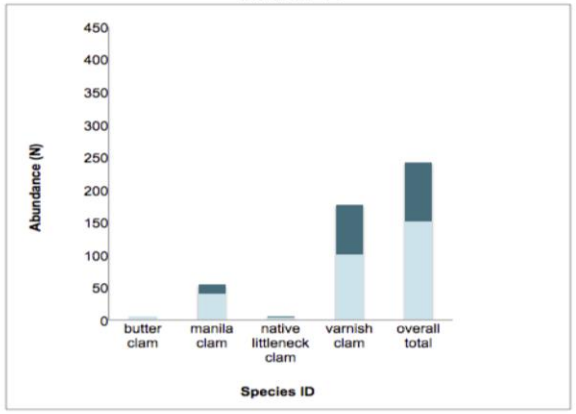
- We dug clams in different spots on the beach to see how many different clam species were there and to see how many were of legal size to harvest.
- We took a tour of the facilities to see the process of growing clams, oysters, and geoduck.
- Then we got to check out the monitoring shed where they check and contorl the temperature and the pH.

Data Collection:

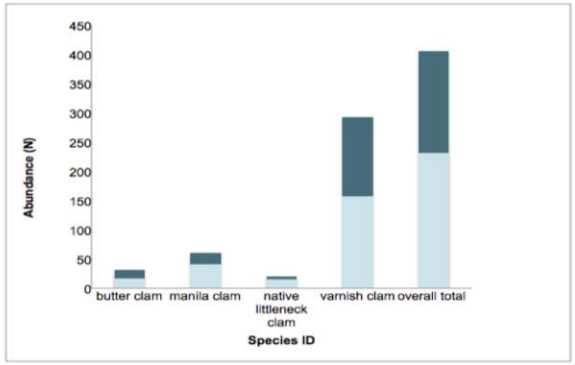
We dug three holes each different lengths from the water line, then we counted each of the species we dug up and checked to see how many were legal or not. The legal clams are the light blue and the illegal are the dark blue.

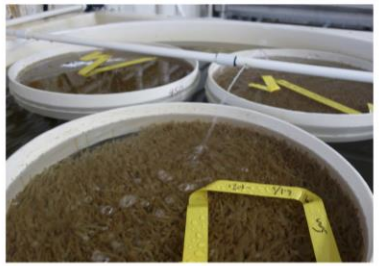
Clam Digging Data

Team 1:



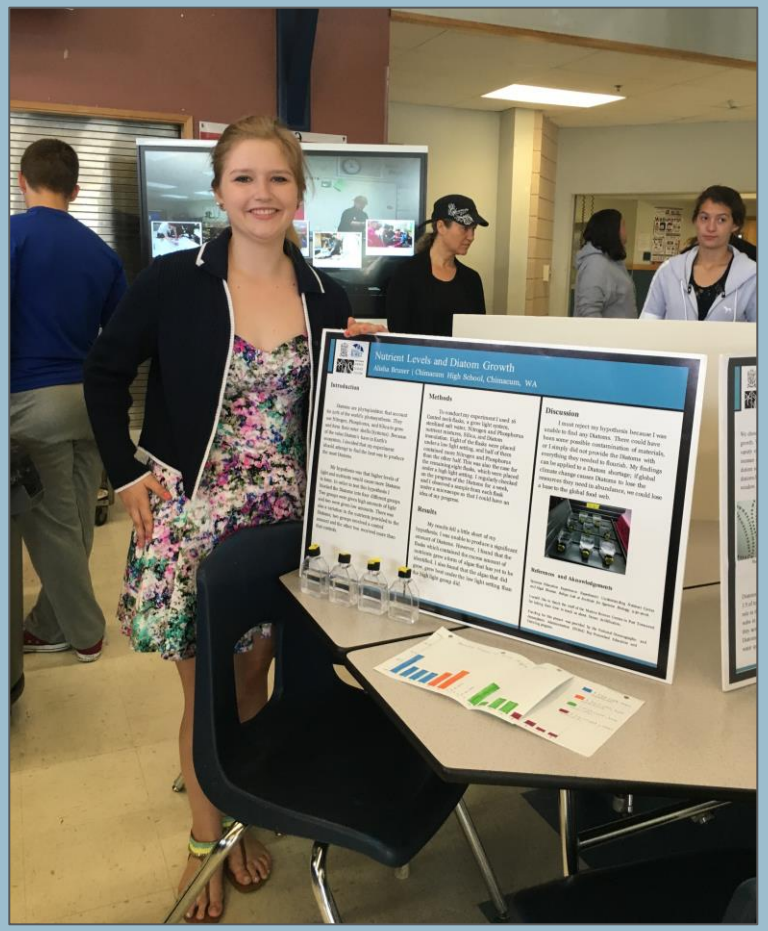
Team 2:

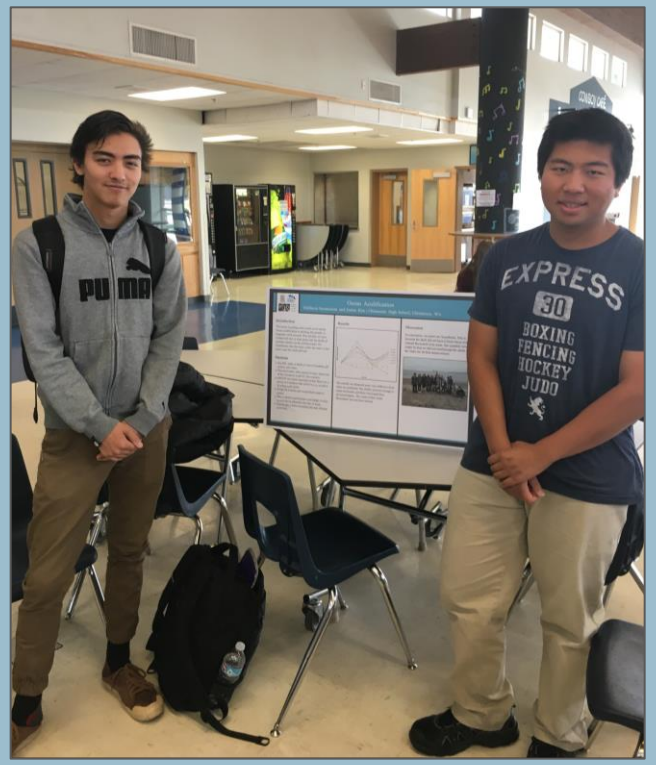




Conclusion:

We learned that Taylor Shellfish grow their clams in the building so that they can plant them and try to limit the amount of Acidification that happens to the shells. Also, that it's a lot of hard work to see how much the legal limit is when it comes to clam harvesting.





Student Summit

The OASSIS Project Team

Port Townsend Marine Science Center:
Betsy Carlson, Zophia Knorek & Lee Whitford
Chimacum High School:
Courtney Prather, AP Environmental Science teacher

Evaluation by Kathryn Owen Consulting

For copy of Summative Evaluation contact Lee Whitford at leewhitford1@gmail.com