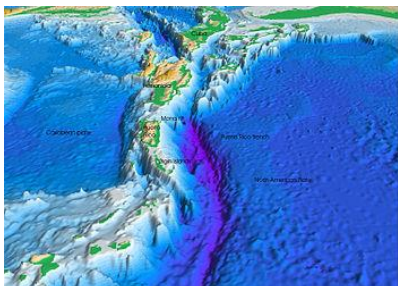


MIDDLE and HIGH SCHOOL

Next Generation Science Standards
MS-ESS2-5 (possible with additional
weather focus)

Common Core ELA
Literacy.W.6.2
Literacy.W.&.2

www.MaineAgintheClassroom.org



Climate of Change Part IV: The Future of Aquaculture

Oceanography 101

Developed by the Island Institute, Rockland, Maine
Revised and formatted by Maine Agriculture in the Classroom

Overview:

Oceanography is a broad field focused on the interconnections between geology, geography, geophysics, physics, chemistry, geochemistry, mathematics, meteorology, botany, and zoology. Because the field is so large, it has been broken down into a number of sub-disciplines. Through this lesson, students will gain a better understanding of the physical structure of the **Gulf of Maine (GoM)** including the unique semi-enclosed shape of the Gulf, freshwater input, currents, tidal action, and water temperature.

The final product of this lesson will be a diagram modeling the many elements that make the GoM unique. These diagram will be used to help with classroom discussions around the changes seen in the GoM and how these changes may affect the daily lives of those who rely on a healthy ocean for their livelihoods.

Essential Questions:

- What are the components of oceanography?
- What are the major currents in the Gulf of Maine?
- How do the currents of the Gulf of Maine affect our environment?

Learning Objectives:

Students will:

- explain the physical structure of the GoM and the direction and causes of GoM currents.
- observe and monitor water temperature and other parameters from buoys in the GoM.

Materials:

- At least five different colors of felt (full sheet of one color for background)
- GoM felt template (included here)
- GoM felt pieces for each student group (teachers may cut out before the start of the lesson)
- Foam boards for felt
- Adhesive/glue
- Laptop
- Small post-notes for labels



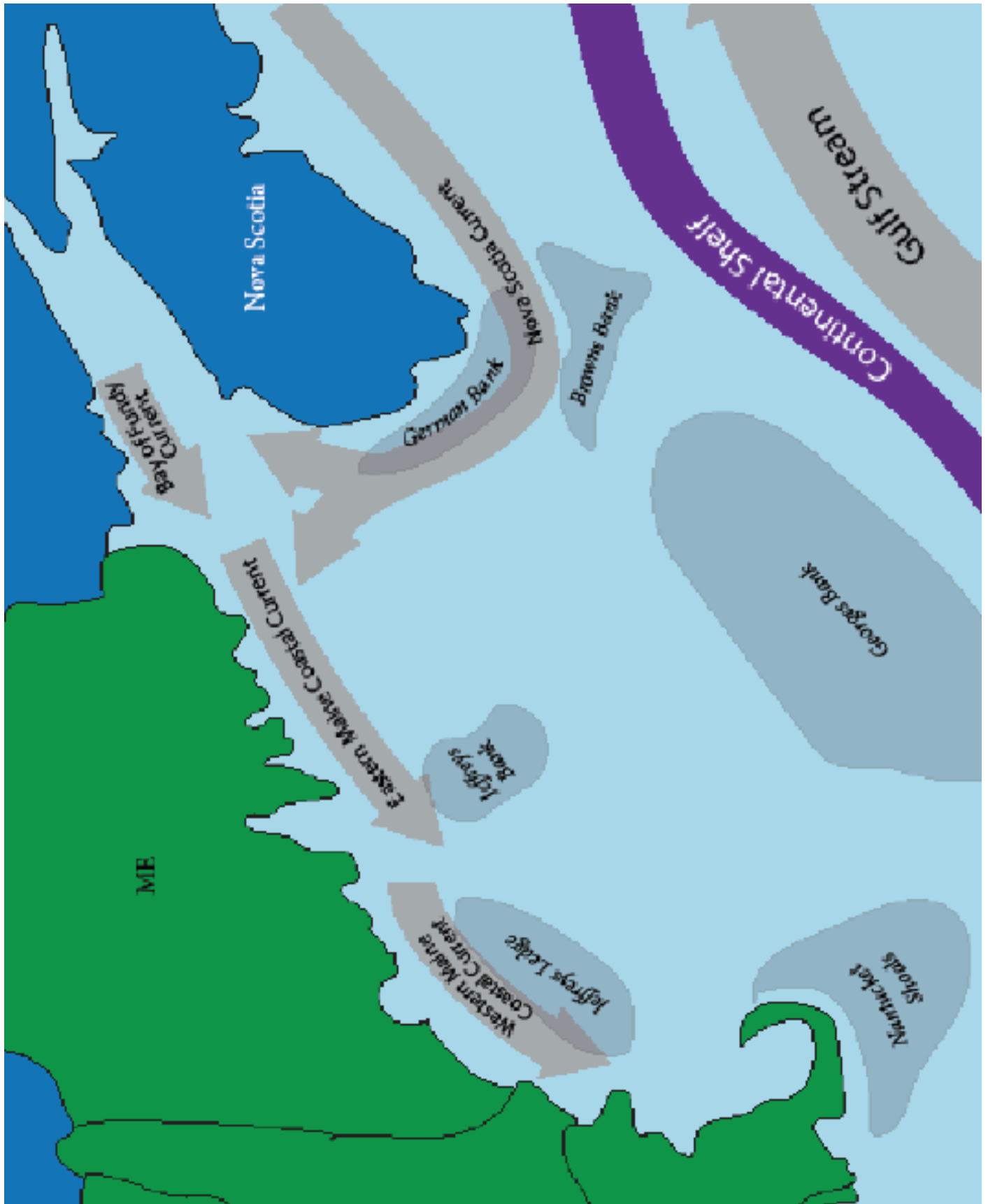
Background Information:

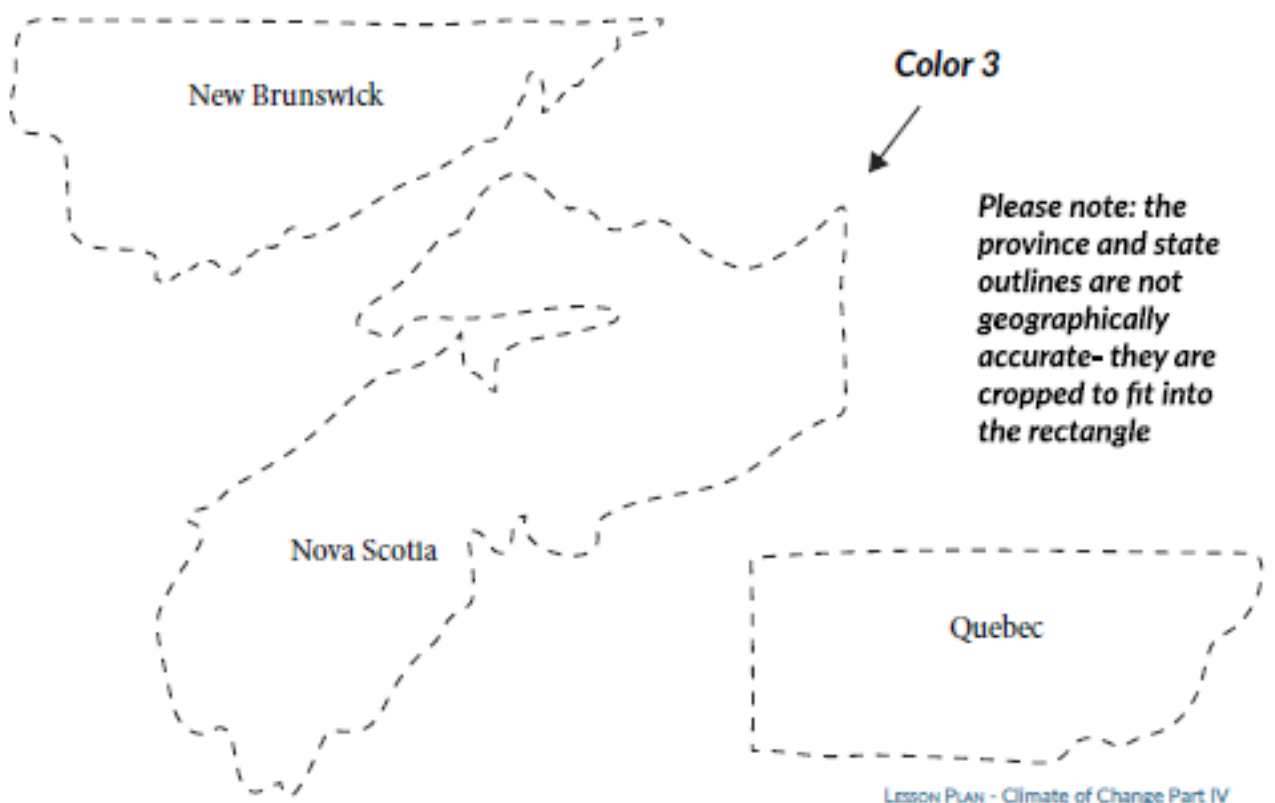
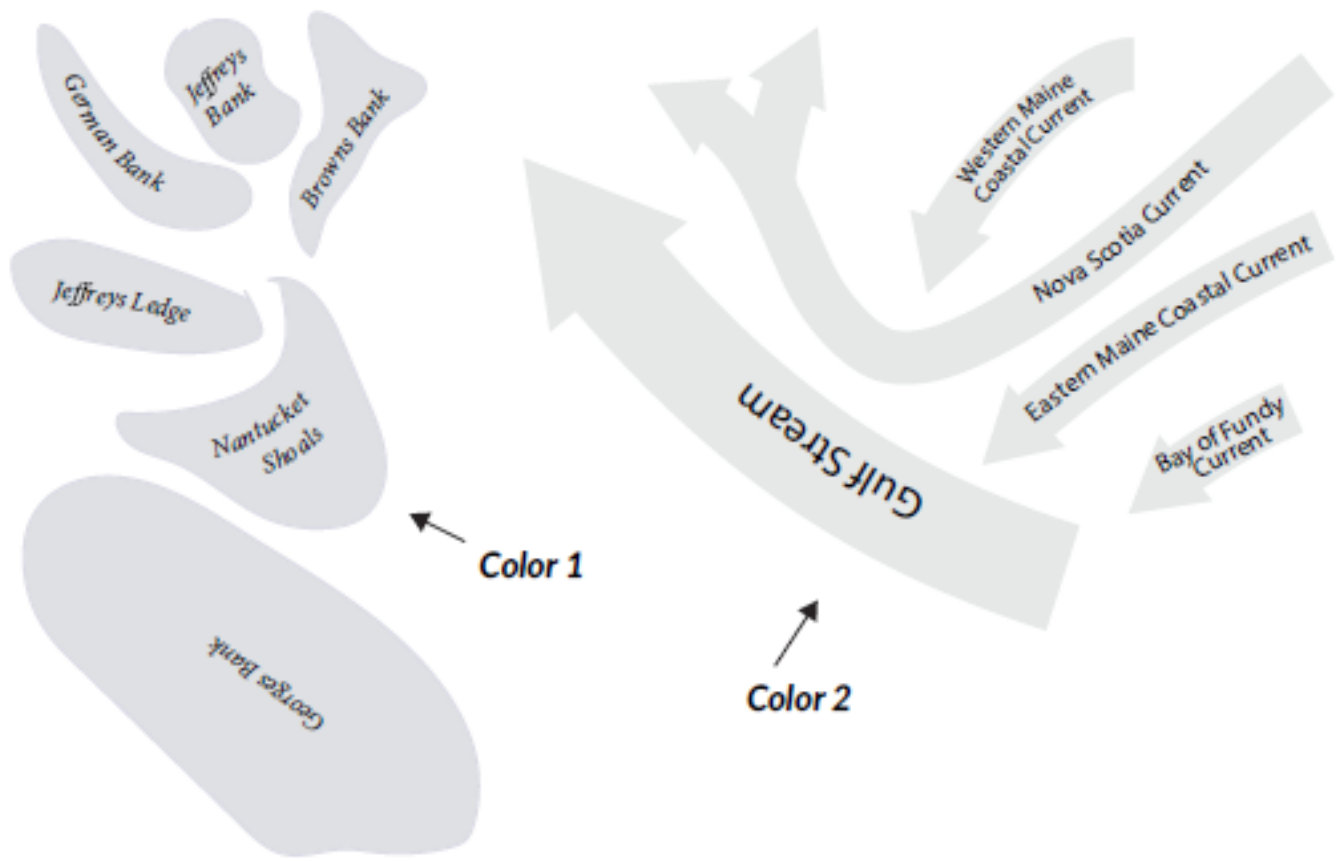
The shores of Atlantic Canada, and the coasts of Maine, New Hampshire, and Massachusetts down to the tip of Cape Cod make up the boundaries of the GoM. There is a complex flow of freshwater from the region's large rivers as well as freshwater from the Gulf of St. Lawrence and snow and ice melt from the arctic delivered by the Labrador Current. The GoM has some of the world's strongest tides and offshore wind resources. This unique geographical system is unlike any other in the world.

Procedure:

- Instruct students to work together to put the GoM together
- Hand out the GoM felt pieces to all students
- Students may work together or individually to create their GoM felt diagram
- After students have successfully completed their felt diagram, have students label each piece of their diagram using small Post-it Notes.
- Once students are familiar with the different elements of the GoM, have students remove the labels and practice building the GoM using the unlabeled pieces.
- As a challenge, have students team-up and time each other to see how fast they can successfully build their GoM felt board.
- As a writing exercise, students will answer the following questions:
 - Why it is important to understand the physical structure of the GoM? Remind students to think about the connections between the "natural" and "political" sides of the GoM. (Possible answer: if you are a fisherman or aquaculturist, it is important to understand the tides, currents, water quality, bottom type, etc. so you are profitable in your catch/harvest. You must also be aware of the regulations where you fish or where your aquaculture site is located. Fishing in state waters is different from fishing in federal waters.)
 - What are the political boundaries in the GoM and what does that mean for fisheries management? (Possible answer: political boundaries include New England states, and the Maine/Canadian border. There are different fishery management systems for state waters, federal waters and international waters).
 - What features and processes in the Gulf of Maine affect water flow? (Possible answer: currents, tides, bottom type, depth)
 - How might freshwater input from rivers affect the water in the Gulf of Maine? (Possible answer: freshwater may affect temperature, salinity, pH, oxygen, CO₂)

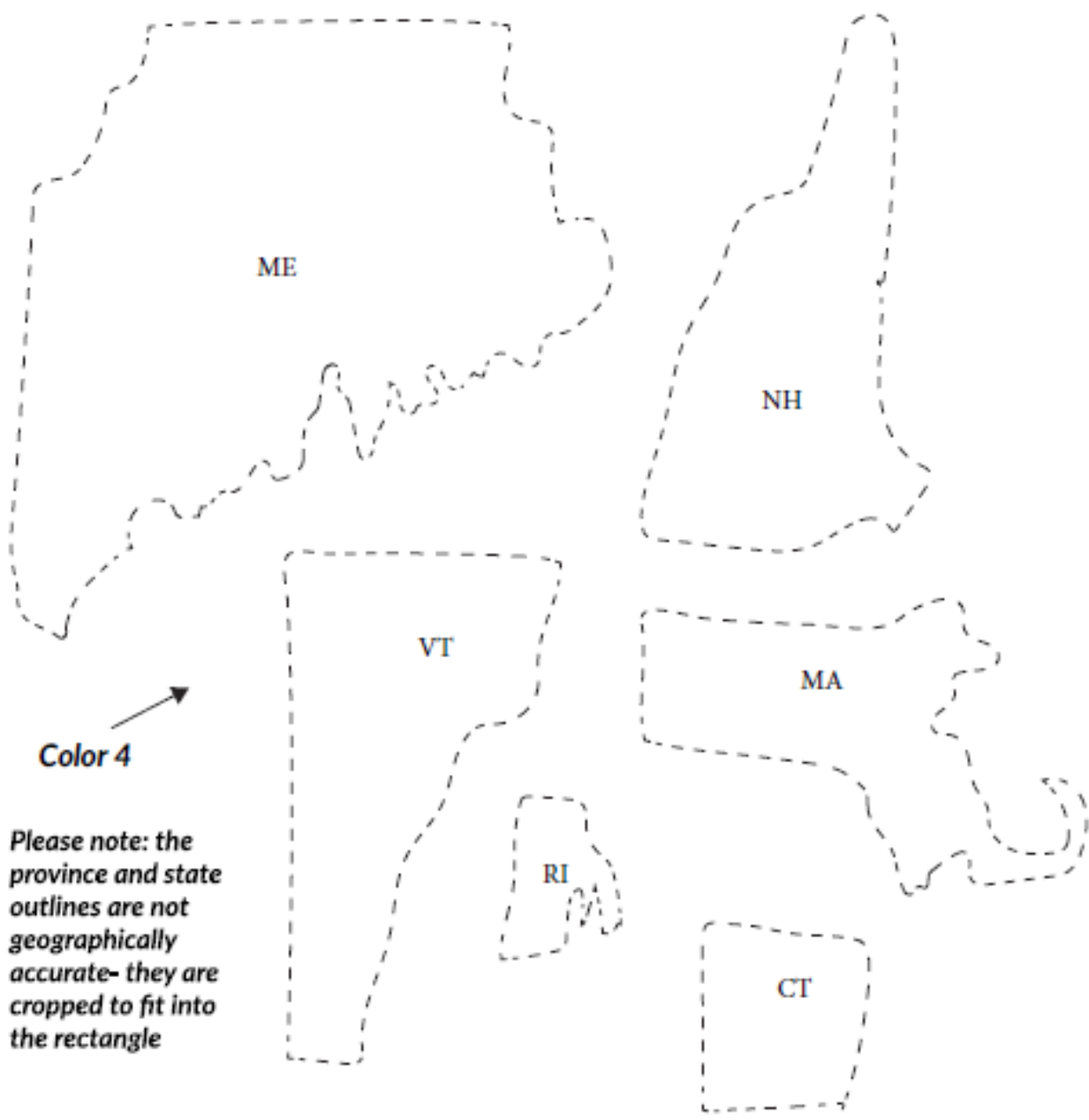






LESSON PLAN - Climate of Change Part IV





Please note: the province and state outlines are not geographically accurate- they are cropped to fit into the rectangle

Color 4



LESSON PLAN - Climate of Change Part IV



Extension:

- Hang up the newly created GoM felt boards around the room and use them for future conversations about the changes scientists, fishermen and citizens are seeing in the GoM.
- Have each student group “adopt a buoy” and mark it on their felt boards using information found at: www.neracoos.org/ . You will be looking for the **Hourly Buoy Data**, click on **Buoy Map**. Over the course of a week or several weeks, have students record the water temperature or other parameters listed there.
- Have students make predictions on the changes they may see in the data. For example, will temperature increase/decrease over a period of time? Do students think there will be a continuation of this trend?
- At the end of the collection timeframe, have students present their findings to the class.



Name: _____ Date: _____

Adopt a buoy

As an introduction to ocean observing systems, you will explore the NERACOOS database to understand the different ocean observing systems and the parameters used. Once you are familiar with the database, you will “adopt” a buoy of your choice in the GoM and record corresponding data using this guide.

What is NERACOOS?

NERACOOS is a robust regional ocean observing system that collects and delivers real-time weather and ocean data, including: waves, wind direction, water and air temperature, currents and visibility in the Northeast. These data are collected from numerous buoys and stations throughout the GoM. Its mission is “to produce, integrate and communicate high quality information that helps ensure safety, economic and environmental resilience, and sustainable use of the coastal ocean.

Your Mission

Divide into teams and explore the NERACOOS website: <http://www.neracoos.org/>

Click on the logos to find out more about waves, water level, wind, temperature, and currents data. Write down one interesting fact for each of the following categories:



LESSON PLAN - Climate of Change Part IV



Name: _____ Date: _____

Navigate to the following website: http://www.neracoos.org/realtime_map

Choose either a red (Gulf of Maine) or yellow (NOAA) buoy and click on it. Record below the most recent data for each parameter at the buoy you chose. Do this three different times throughout the day or at the beginning of each day over the course of a week.

Buoy Location		
Latitude		
Longitude:		
Observation 1	Observation 2	Observation 3
Date:	Date:	Date:
Time:	Time:	Time:
Wind Speed:	Wind Speed:	Wind Speed:
Wind Direction:	Wind Direction:	Wind Direction:
Wind Gust:	Wind Gust:	Wind Gust:
Wave Height:	Wave Height:	Wave Height:
Wave Period:	Wave Period:	Wave Period:
Air Temperature:	Air Temperature:	Air Temperature:
Air Pressure:	Air Pressure:	Air Pressure:
Visibility:	Visibility:	Visibility:
Water Temperature:	Water Temperature:	Water Temperature:
Salinity:	Salinity:	Salinity:
Other Parameters:	Other Parameters:	Other Parameters:



Name: _____ Date: _____

Writing Prompt:

Take some time to look over your data and use the following guiding questions to help you write a short essay to describe what you found.

- What did you notice after the end of the data collection period?
- Were data similar or did things change over time?
- Why is it important to monitor buoy data?
- How might these data be used by fishermen or aquaculturists?

