

Data Analysis Activities: Coral Bleaching

These activities are based on ones found at:

flowergarden.noaa.gov/document_library/edddocs/reefmonitoringlesson.pdf

Purpose: This series of activities focuses on observing change over time. In the first part, students observe photographs of a coral reef. The second activity asks students to look for patterns in data of sea surface temperatures. In the third part, students use the skills practiced to analyze a location of their choosing. These activities flow together but can be used independently.

Notes to the teacher: The National Oceanic and Atmospheric Administration maintains a robust database of weather information. Recently, NOAA has compiled interactive tools to help the public understand how weather and physical oceanography data can be used to understand local and global phenomena, such as coral bleaching. The style of the graphs that NOAA has made available may be unfamiliar, but by breaking them down into each element, students can soon see how interacting variables tell a story about the coral reef environment.

Background: When temperatures spike 1 to 2 degrees Celsius above normal for a prolonged period of time, a bleaching event can occur. These bleaching events appear to be becoming more common, threatening the health of the reef and all the organisms that depend on it. By having data on water temperature trends over time, scientists and the public can begin to find patterns and learn more about bleaching events. Such data is more than a series of numbers. When put together in a compelling manner, this data has the power not only to inform the public about a situation, but also to spark public response. There are a lot of data available through www.coralreefwatch.noaa.gov.

PART 1: OBSERVING CHANGE OVER TIME

Approximately 30 minutes

Preparation: Find a set of images that show a coral reef changing over time. The Flower Garden Banks National Marine Sanctuary has a set of monitoring images. From the sanctuary's [Image Library page](#), click on the section titled "Monitoring" and choose the location you'd like students to observe. Print the images in color (or have students examine the images online to save paper and ink).

Materials:

- Computers with Internet access OR
- Prepared images of coral reefs (printed in color)

Directions:

1. The article discusses how scientists noticed that there was a problem emerging for coral reefs. Explain that scientists will sometimes monitor a site over time and record observations in order to determine if and how a location is changing.
2. Photography is a powerful tool for recording how an environment changes. Direct students to the reef monitoring images you selected (electronic or printed). Decide if you want students to work alone or in small groups. Small groups have the benefit of increasing dialog.
3. Have students observe the images and describe changes that occurred from one year to the next. For example, a piece of coral is no longer visible or there appears to be something blocking a portion of the reef.
 - a. Have students make a grid to record their observations.
 - b. Have teams share their observations with the other groups and compare their observations.
4. Locate the Flower Garden Banks on a map (students might be exploring the eastern or western area) and have students determine the approximate geographical location of their coral reef. Ask students to research events that occurred in the region they are observing during the time of the reef photographs. What could have caused the changes that students observed? Would the changes have been natural or anthropogenic?
5. Discuss the power of using images to show the impact of natural and human-caused events. Students might brainstorm how these images could be used to inform policy makers or the general public about the impact of various events in order to raise awareness.

Optional Extension:

- Students can make a short public service announcement or flier showing what has happened to the reef and what they think caused it.

PART 2: USING DATA

Approximately 30 minutes

Materials:

- [Blackline Master 4](#) to project or pass out for students to examine

Directions:

1. Show this [NOAA animation](#) of coral bleaching events. Explain that these animations come from a series of data that are banded and colorized to help identify trends over time. This animation shows bleaching alerts over the past six months. Tell students they are going to look at a part of the Gulf of Mexico, just off the coast of Houston, Texas, known as the Flower Garden Banks National Marine Sanctuary using the given graphs.
2. Display the first graph of the Flower Garden Banks area ([Blackline Master 4](#)), covering 2013 to 2014.

3. Explain how to read the graph:

Bleaching represented on SST (focus on the purple and blue lines and text):

SST = Average Sea Surface Temperature (in purple). If the SST is greater than the temperature experienced in the hottest month (Max Monthly Mean SST, indicated by the dotted blue line), then the corals are susceptible to bleaching (indicated by the solid blue line).

Bleaching represented by DHW (focus on the orange text and figures at the bottom of the graph):

DHW = Degree Heating Weeks is the cumulative measurement of intensity and duration of thermal stress on the coral (DHW represents how many degrees greater the current average SST is from the maximum average SST for the hottest month). Significant bleaching occurs when DHW values reach 4 (indicated by the bottom dotted orange line). When the DHW is equal to 8, widespread bleaching is likely (indicated by the top dotted orange line). The level of stress is also indicated by the color-coding (light blue is no stress and dark red is Alert Level 2 Stress).

4. Ask students what the area along the bottom of the graph represents. [*Months of the year.*] Ask students to identify when there is a bleaching watch [*July and September 2013; July, August and September 2014*] and when there is a bleaching warning [*August 2013; July, August and September 2014*]. What about bleaching alerts? [*None.*]
5. Show students the next graph, from 2014 to 2015. Have them compare the data to the first graph. Do they notice any differences? If so, what?
6. What about the graphs covering 2015 to 2016? Have students look over the three graphs for similarities. Do there seem to be any patterns or trends?

PART 3: ANALYZE A REEF

Approximately 30 minutes

Materials:

- [Blackline Master 5](#) for each student
- Computers with Internet access

Directions:

1. Direct students to [NOAA's regional virtual stations](#) interactive website. Have each team explore the main page. By clicking on a pin, students can get information on current coral bleaching alerts. Have them select a location where coral reefs can be found. They can click on the "Alert Gauges & Outlook" for short- and long-term data on bleaching alerts at this location. The "Time Series Graphs & Data" link will take them to a series of data graphs from the chosen location and those surrounding it. Give students time to explore the data that is available using [Blackline Master 5](#).
2. Ask students to use the available data to tell a story about the location they selected. What do they know about the level of threat to that reef? Can students predict when the next bleaching alert is

likely to occur based on the data they have available? Can they anticipate how long the alert might last? [Blackline Master 5](#) can help guide their research.

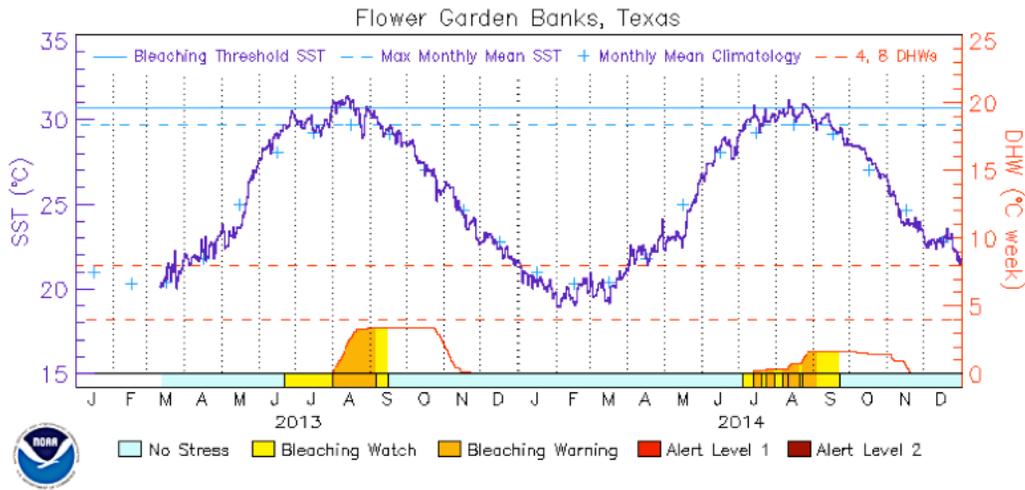
Optional Extensions:

- Students can compare data from a region to find the location that is at greatest threat.
- Students can prepare information to tell the public about the threat to the reef they are studying. Who should they share this information with? Who is the most appropriate audience? What do students want the public to do? Students might decide to write an open letter to a news outlet or an international body. They might want to create an informational video to post online.
- Many scientists use climate models to better understand phenomena like climate change. Scientists adjust the model to test ideas and see how the model is affected. Could students design an experiment using the data available through NOAA's site? What would the experiment look like? What ideas could students explore? Is there any data they wish the site provided to help create a more complete picture of the bleaching situation?

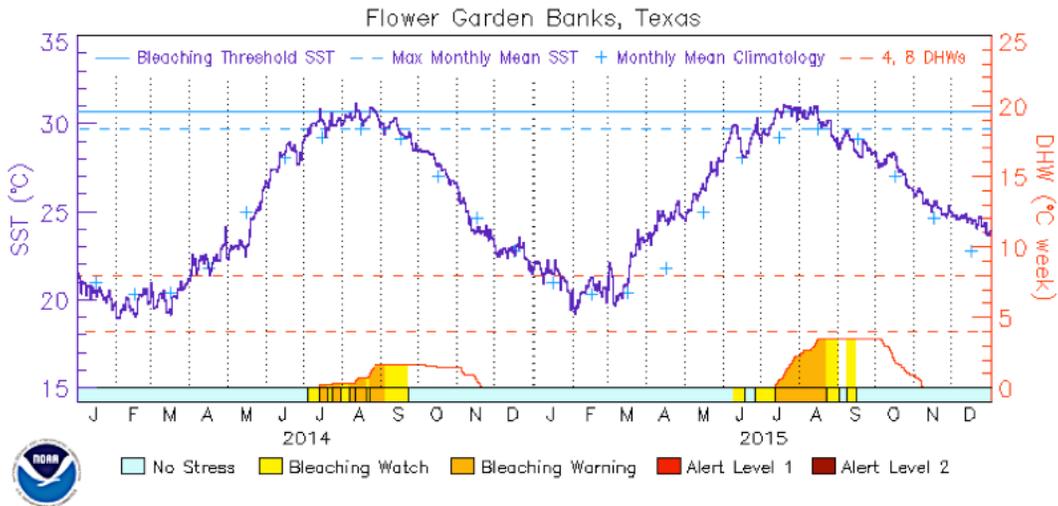
Data Analysis Activities: Part 2

Graphs from Flower Garden Banks National Marine Sanctuary

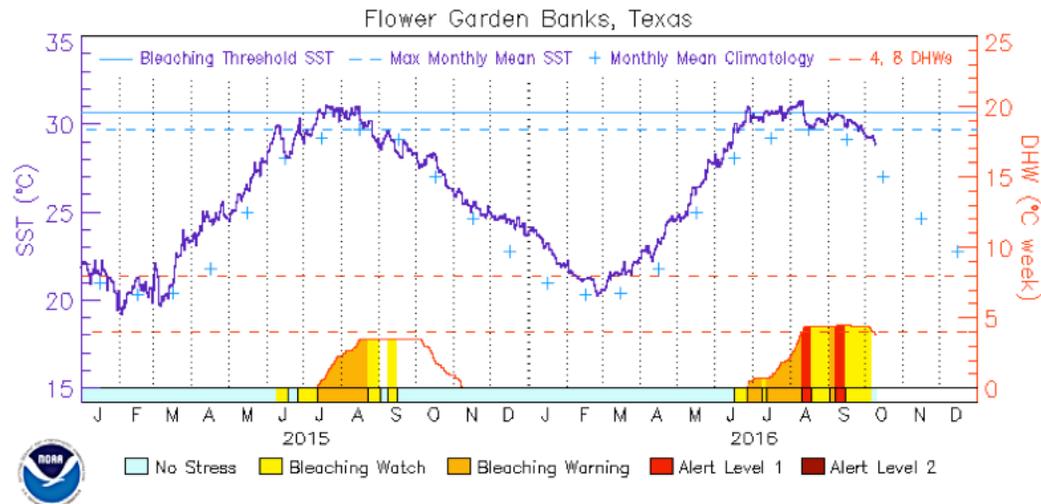
2013-2014



2014-2015



2015-2016



Data Analysis Activities: Part 3

Directions:

1. Go to the NOAA Virtual Stations website: coralreefwatch.noaa.gov/vs/map.php. Take a look around. You can select map or satellite view. Notice the color scale along the bottom of the map and the date on the bottom left. Click on some of the pins around the world and see what information comes up. What information is provided about each location?

2. Along the top of the initial page, there are boxes with information. Click on the ones below and see if you can determine what information is given:

SST:

DHW:

BAA (Bleach Alerting Area), Give a general description of what you see:

Outlook: What happens to each of the above when you switch this to a different year?

3. Select a location and click on it. Notice that there are additional links. What information is provided from each link?

Location:

Alert Gauges & Outlook:

Time Series Graphs & Data:

