

ED21B-0624

<http://serc.carleton.edu/earthlabs/index.html>

On the web, Earthlabs is composed of two sites, one for educators or policy makers and the other for students. This strategy provides teachers with the support they need without overwhelming the students with all this additional information. The students get pages that lead them through the activities which they need to complete. To avoid potential confusion for instructors, we've given the different pages distinct characteristics and labeling. There are also links from the Educator's Page to the Student's Page but not in the other direction.

Investigate how, where, and when hurricanes occur. Explore the dangers to humans and property caused by hurricanes and how we can be prepared to deal with those risks.


- Learning Objectives
- Teaching Notes and Tips
- Teaching Materials – Activity Sheets, Grading Sheets, Supporting References
- Context for Use
- Background Information
- Applicable State and National Standards

Lab Observations

- 1. Plenty of Fish in the Sea?**


Students are introduced to the dire predictions about the future of the global fishing industry. Students read an NSF press release about the projected collapse of currently fished seafood. Students also use ImageJ to analyze oceanic biodiversity maps spanning 40 years.

Tools Needed: ImageJ


- 2. Are You Going to Eat That?**


Students learn about destructive and wasteful fishing practices contributing to the decimation of the world's fisheries. Students explore various resources for identifying sustainable seafood and visit local markets and restaurants to investigate the availability of seafood on regional and national watch-lists in their community.

Tools Needed: Adobe Flash Player, Adobe Reader


- 3. Oh What a Tangled Web: Ecosystem-Based Management**


Students learn about ecosystem-based management and how it can be used to manage fisheries sustainably. They explore the challenges of managing fisheries in a complex, interconnected system.

Tools Needed: QuickTime Player, Adobe Reader



- 4. To Fish or Not to Fish?**

Students are introduced to Marine Protected Fisheries. Students also learn about the Gulf of Mexico's marine conservation areas and the challenges of managing fisheries in a complex, interconnected system.

Tools Needed: TV/DVD Player, Adobe Reader


- 5. Gone Fishing**

Students learn about the consequences of overfishing by examining the sharp declines in groundfish landings in New England over the last several decades. They also investigate whether or not the effects of overfishing



As for the students' work, all answers should be done on the activity sheet that was handed out at the beginning of the lab. Here is a [grading sheet](#). (Acrobat (PDF) 524k, Jan 08) With example answers to the questions in the lab.

State and National Science Teaching Standards

- ▶ Show me California standards
- ▶ Show me Massachusetts standards
- ▶ Show me New York standards

▼ Hide

Applicable North Carolina [Earth and Space Science Standards](#)

Competency Goal 5: The learner will build an understanding of the dynamics and composition of the atmosphere and its local and global processes influencing climate and air quality.

5.03 Analyze weather systems:

- Movement.

5.04 Analyze atmospheric pressure:

- Planetary wind systems.
- Pressure cells.

5.05 Analyze air masses and the life cycle of weather systems:

- Air masses.
- Hazardous weather.

5.06 Evaluate meteorological observing, analysis, and prediction:

- Worldwide observing systems.
- Meteorological data depiction.

▶ Show me Texas standards

▶ Show me National standards

Additional Resources

Background Information (pre-teaching)

Downloaded by Katelyn Collier of NC State University

Related Links

Unit Conversations from The

- Click the thumbnail image at right to see a larger view of a climograph for San Antonio, Texas. The graph shows conditions for January through mid-June.
- Examine the graph to interpret the conditions in San Antonio. Red for temperatures and light green for accumulated precipitation conditions compiled from many years of data. The brighter the green, the more accumulated rainfall through July of 2008.

Checking In Questions help students self-assess how well they understand topics. Hints and/or answers are given on the page so they can check their thinking.

Checking In Questions

- What does the graph indicate about San Antonio's temperature?
➤ [Show me](#)
- What does the cumulative rainfall graph indicate?
➤ [Show me](#)

- Explore current dynamic climographs for cities in the southern states at NOAA's Southern Regional Climate Center [Climate Summaries](#) page.
- To generate accumulated precipitation graphs for other regions of the country, start at [NOAA's Earth System Research Laboratory](#). Click the "Plot accumulated daily precipitation" link near the top of the page then click a location on the map.

➤ [Show me](#)

Stop and Think

- List 5 cities or locations for which you examined dynamic climographs or accumulated precipitation graphs. Tell whether each location is wetter than normal, about normal, or drier than normal. Explain your reasoning.

Nitrates and Phosphates and Algae, Oh My!

Part A: Making an Algal Bloom

Because algae and other planktonic species are the primary producers upon which the rest of the marine food chain depends, it is important to understand why algal blooms occur and what effects they have on the surrounding water and marine life. In this part of the investigation, you will make your own algal bloom and test what factors influence the occurrence and duration of the bloom.

- Prepare a "Control" container and a "+ Nutrients" container for your algae samples.
 - Show me materials needed for this experiment
- Label one container with your group number and the word "Control". Label the other container "+ Nutrients".
 - Add an equal amount of water to each container.
 - Add 3 drops of algal culture to each container.
 - Add 1 teaspoon of liquid fertilizer to the 250 mL of distilled or bottled water and mix well. The use of distilled or bottled water will ensure that you do not contaminate your experiment with trace metals, nutrients, or chlorine found in tap water.
 - Using a pipette or eyedropper, decide on a small unit (such as one half or one third of the pipette), that will be your standard base unit of fertilizer. As a class, decide how many units of fertilizer mixture each group will add to their "+ Nutrients" container. Add the proper number of units of liquid fertilizer mixture to your "+ Nutrients" container. Tweak the number of fertilizer units you add to label.
- Take a drop of water from each sample and look at it under a microscope, 10x magnify and record the number of phytoplankton visible in both sample. Have each member of the average number of phytoplankton per drop of both the "Control" and "+ Nutrient"
- Place both containers near a window, out of direct sunlight, but where they will receive light and are kept at the same temperature (don't place some containers on a heater window).
- Every day or two over the course of 1-2 weeks, make observations (e.g., color, opacity, smell) on the algal cultures in each of the containers. You should also observe one drop of water from each sample and count the number of phytoplankton per drop as you did in Step 3. Carefully record your findings.
- Analyze your findings.
 - For each treatment ("Control" and "+ Nutrients"), create a graph to illustrate algal growth (determined by number of phytoplankton cells per water drop) on the y-axis versus number of days on the x-axis.
 - Compare your findings to those of other groups using different amounts of fertilizer. Discuss any differences or inconsistencies.
 - As a class, create a graph of final cell density versus fertilizer concentration for each student treatment.

Microscopic view of tetraselmis algae.
Image source: [Food and Agricultural Organization of the United Nations \(FAO\)](#)

Hands-On Labs

All the units have labs where students do something to learn about the topic.

On the Student Pages, students are presented with the materials they are going to interact with:

- Readings
- Videos
- Visualizations
- Formative and Summative Questions

Earthlabs

Corals

Drought

Fisheries

Hurricanes

Lab 11

Microclimatology

Monsters

Lab 12: Hurricane Anatomy

2A: Saffir-Simpson Scale

Types of Satellite Data

2C: Under the Hood

2D: Comparing North and South

Hurricane Anatomy

Part A: The Saffir-Simpson Scale

One piece of information you'll hear about repeatedly while studying hurricanes is the Saffir-Simpson Scale of cyclone intensity. The scale is based on measurements of sustained wind speed; it categorizes hurricanes from 1 (lowest intensity) to 5 (most intense). The technical definition of a hurricane is winds of 74 miles per hour or greater, sustained for 1 minute or more. We see the major differences in scale read the chart on the right. You can also read more about what the scale really means in ranking storms at the following links:

- [NOAA: Saffir-Simpson Hurricane Scale](#)
- [Wikipedia: Saffir-Simpson Hurricane Scale](#)

Saffir-Simpson Hurricane Scale			
Category	Wind Speed		Storm Surge
	mph	knots	
1	74-95	12-15	
2	96-110	14-16	
3	111-130	16-18	
4	131-155	19-23	
5	156-200	24-30	

EarthLabs

Coralals

Drought

Fisheries

Hurricanes

Lab 1: Meteorological Monsters

Lab 2: Hurricane Anatomy

2A: Saffir-Simpson Scale

2B: Types of Satellite Data

2C: Under the Hood


2D: Comparing North and South

Hurricane Anatomy

Part B: Types of Satellite Data

Step 1: Satellites and Forecasting

Click the image to watch this NASA video with researchers study and forecast hurricanes, then answer the questions that follow.



▶ Slide over

Click 'Link in Questions'

Related Links

[Satellite watch the eye of the hurricane as it study the eye of the storm](#)

[Wikipedia - Hurricanes](#)

[Hurricanes: Science for Kids](#)

[Hurricanes: Science for Kids](#)

[Wikipedia National Data Buoy Center](#)

[Albion](#)

[Hurricane Anatomy](#)

[Albion](#)

[Hurricane Field Studies](#)

EarthLabs

Coralals

Drought

Fisheries

Hurricanes

Lab 11

Meteorological Monsters

Lab 20: Hurricane Anatomy

2A: Saffir-Simpson Scale

2B: Types of Satellite Data

2C: Under the Hood

2D: Comparing North and South

Hurricane Anatomy

Part C: Under the Hood

Advances in computer models and observational methods have made it possible to learn more about how hurricanes develop. These still images and animations give a data view of our current understandings of these storms.

Step 1: Internal Structure



- Earthquakes
- Corals
- Drought
- Fisheries
- Hurricanes**
- Lab 1: Meteorological Monsters
- Lab 2: Hurricane Anatomy
- Lab 2A: Saffir-Simpson Scale
- Lab 2B: Types of Satellite Data
- Lab 2C: Under the Hood
- Lab 2D: Comparing North and South
- Lab 3: Putting Hurricanes on the Calendar
- Lab 4: Putting Hurricanes on the Map
- Lab 5: All About Air Pressure
- Lab 6: Why Keep

Hurricane Anatomy

Part D: Comparing North and South

Up to this point, you've been dealing with hurricanes that occurred in the Atlantic north of the equator. Now, you'll examine some visualizations of cyclones that form south of the equator. You'll be asked to draw conclusions about how these storms differ from those that North Americans are familiar with.

Step 1: Severe Tropical Cyclone George

Severe Tropical Cyclone George came ashore near Port Hedland on the northwest Australian coast on March 8, 2007. The storm had average winds of about 195 km/h, or 125 km/h.

In the South Pacific basin, they use the Australian Cyclone Scale to indicate storm intensities. Developed by the Australian Bureau of Meteorology, this scale places emphasis on the strength of individual wind gusts rather than the 10-minute average winds that the **Saffir-Simpson** scale uses. On the Australian scale, George was a borderline Category 4/Category 5 storm.

Click the image to see the animation. Check the color code to interpret what's in the storm.

Australian Cyclone Scale			
Category	Sustained Winds (km/h)	Wind Gust (km/h)	
5	≥200	≥280	
4	160-199	225-274	

