

El Niño's Powerful Reach

Educational Activities

Food Web: Hold the Anchovies

Summary:

Participants learn how El Niño events are predicted.

Grade level:

Intermediate (grades 5-8)
Secondary (grades 9-12)

Time needed:

one, 90-minute class or
two, 45-minute classes

Learning Objectives:

Ability to do scientific inquiry

- Understanding scientific inquiry
- Regulation behavior
- Populations and ecosystems
- Behavior of organisms
- Structure of the earth system
- Energy in the earth system
- Science in personal and social perspectives
- Natural resources
- Science and technology in local, national, and global challenges

Background:

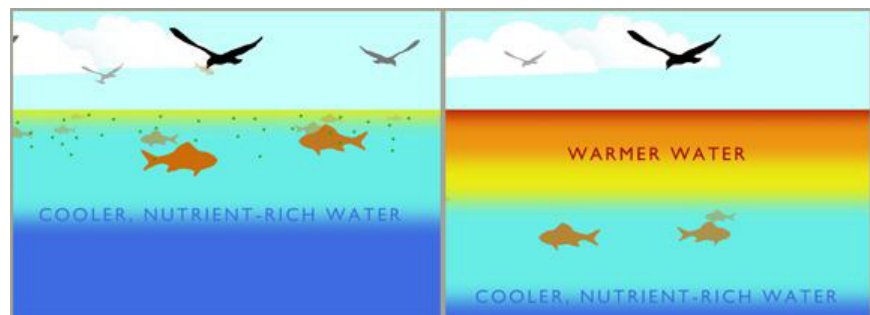
The most immediately obvious effect of an El Niño is a change in weather patterns. Newspapers and news broadcasts become full of stories about extreme and unusual weather events. However, El Niños can also cause ecosystem and food chain effects that may be less obvious but are no less important or dramatic. One small change in a food chain can cause rippling and dramatic effects across interconnected food chains within a larger food web.

Ocean temperatures, heights and currents change during an El Niño. These changes affect many species of microscopic life, fish and even marine mammals that live in or depend on ocean waters. Some species benefit from changes in ocean patterns, while other populations can be devastated. These biological impacts have real-world ramifications out of the waters as well. Many species of birds depend on oceanic lifeforms as a primary food source. This is one example of the rippling impacts of food chain impacts - one change have broader marine food web impacts as population levels affect other predatory species, which in turn affects even more species, and so on.

People living and working around the globe also depend depend on these oceanic fish and mammals for food and income. Because the impacts of El Niño can have such broad global ramifications, scientists around the globe are researching better ways to predict El Niño events. If scientists can better predict future events, it could help countries around the globe to prepare for their effects.

PROCEDURE:

Review the No Fish, No Dinner section of the El Niño exhibit interactive available on-line at <http://www.forces.si.edu/>.



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1. Define the terms food chain and food web.
2. Explain the El Niño food web impacts that affect the people in Peru who live near or depend on the Pacific Ocean.
3. Explain how some bird and iguana species have been affected by El Niño in the past.

Advanced Enrichments: Data Comparisons:

Dr. Francisco Chavez at the Monterey Bay Aquarium Research Institute studied historic fisheries landings data and found that two fishes species seem to be greatly influenced by ENSO. (See http://www.mbari.org/news/news_releases/2003/nr01-chavez.html). The South American sardine (*Sardinops sagax*) and the Peruvian anchoveta (*Engraulis ringens*) are open ocean swimming, plankton-feeding fish found in large schools off the coast of South America.

1. List the ways that El Niño events can affect fish populations and the marine food web.
2. Go to the following website - <http://www.vims.edu/bridge/mbarianchovy.xls>
3. Open Microsoft Excel, highlight data then click on File/ Save as type: Microsoft Excel Worksheet. The data includes:
 - Year - from 1900 to 2002
 - Global-average Surface Air Temperature Anomalies (GSATA) - difference between the annual air temperature and the mean air temperature over the past century (° Celsius)
 - Atmospheric Circulation Index (ACI) - relative amount of wind blowing east-west versus north-south
 - Mauna Loa CO₂ - atmospheric CO₂ measured at Mauna Loa, Hawaii (parts per million)
 - Sardines - annual landings from Peru (metric tons)
 - Anchovy - annual landings from Peru (metric tons)
4. Follow the instructions below to make a graph comparing the sardine and anchovy landings.
 - Highlight cells E13 through F116.
 - Click on the Chart Wizard icon.
 - Under the Standard Types tab, select Line and choose the first chart sub-type.
 - Click Next.
 - In Step 2 of the Chart Wizard, click on the Series tab.
 - In the Category (X) axis labels box, click on the icon at the right end of the box and then highlight cells A14 through A116.
 - Click on the icon at the right end of the box to get back to the Chart Wizard.
 - Click Next.
 - In Step 3 of the Chart Wizard, enter titles for the chart (example: "Peruvian Sardine and Anchovy Landings"), X axis (example: "Year") and Y axis (example: "Sardine Landings (metric tons)").
 - Under the Legend tab, select Bottom placement.
 - Click Next.
 - In Step 4 of the Chart Wizard, select "As new sheet" and give it a name such as Fisheries graph.
 - Click Finish.
 - On the graph, right click on the Anchovy line and select Format Data Series.
 - Under the Axis tab, select Secondary axis.

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- Click OK.
- Right click in the white background area of the page and select Chart Options.
- Under the Titles tab in the Second value (Y) axis box enter "Anchovy Landings (metric tons)."
- Click OK.

5. Print the graphs and compare them to the [Bridge's graphs](#). Use your graphs to answer the following discussion questions.

Analysis and concluding questions:

1. What trend do you see in the amount of anchovy and sardines caught?
2. Do these trends seem to correlate with the warm and cold regimes of the PDO? Which species is more abundant during the warm regime? Which species is more abundant during the cold regime?
3. On a clean sheet of looseleaf paper, write a summary of your research.
4. Did El Nino events only happen in the past, or do El Nino events still occur? Do you think El Nino is an important area for scientific study today? Why or why not?
5. How can an El Nino effect life in the earth's oceans?
6. List three ways the ocean effects of an El Nino have an impact on human cultures around the world today.

Impact #1:

Impact #2:

Impact #3:

7. What did this project teach you about how scientists use data to better understand our world?