

The Oceans Are Downhill from Everywhere: Changes Caused by Humans in the North Pacific Gyre Ecosystem



A. Using Google Earth, go to the Search Panel under the "Fly to" tab.

B. Type your place of learning or school's address and hit search. 

C. Click "Add Placemark"  on the tool bar.

D. Name your placemark with the name of your school.

1) What is the latitude and longitude of your school? (Record below)




Latitude _____

Longitude _____



E. Use the Navigation Control to "zoom out" until you can see the ocean.

F. Use the Ruler  tool to measure the distance from your school to the ocean.



2) What is the distance from your school to the ocean?



G. Use the direction ring around the Navigation Controls to rotate your view of the world until the ocean coast nearest to your school is at the top of the screen.

H. Use the Navigation Control tilt down function to move your viewing angle to a horizontal view of the earth.

I. Using zoom functions and the navigation controls, follow the path that you think a raindrop would take through the watershed from your school to the ocean.

Let's Look at Nutrients



Nutrients in the form of nitrates move downhill like plastics from the land into the ocean and can promote "blooms" of tremendous amounts of phytoplankton in the water.

Common sources of nitrate contamination include fertilizers, animal wastes, septic tanks, municipal sewage treatment systems, and decaying plant debris. When the sun is shining, phytoplankton produce oxygen through the process of photosynthesis. They also use the process of respiration which requires oxygen. At night phytoplankton cannot photosynthesize, but their respiration still requires oxygen. This may deplete the water of oxygen for other marine life if there is an extensive bloom.

Phytoplankton are an important food for zooplankton. However in excessive amounts, the phytoplankton can produce red tides, reduce needed oxygen for marine life, and produce toxins.



3) In the Global Earth satellite view, find and describe one potential source that could be contributing nitrogen compounds to the surface water from your school as it flows to the ocean.



See “ Dead Zone’ spreads across Gulf of Mexico” which is available at http://oceancolor.gsfc.nasa.gov/cgi/image_archive.cgi?c=CHLOROPHYLL
Drag the scroll bar slightly more than 1/3 of the way down to find the image. Read the text below the image.



4) What causes the phytoplankton bloom and low levels of oxygen off the coast of Texas according to most studies?

Let’s Look at Plastic Marine Debris



5) What types of plastic debris would you predict that you might find in storm water that flows to the ocean from your school or home?



Plastic marine debris has negatively affected the ocean. Plastic nets that are lost from fishing vessels are called Ghost Nets and they can entangle marine animals. Plastic ingested by marine life can cause death by blocking the digestive system. Toxins in the plastic or absorbed onto the plastic from the water can affect life. Many research expeditions were started in 1999 by the Algalita Marine Research Foundation. In 2007 the Oceanographic Research Vessel *Alquita* sailed from the Port of Long Beach on a research voyage to Hawaii studying plastic pollution in the Pacific Ocean and a daily blog was recorded. You can download the blog.



J. Open an internet browser and visit the link:
<http://www.algalita.org/MappingPlasticPollution.htm>

Go to the table near the bottom of the page and click to download:
FallVoyage2007.kml, Voyage2009.kml, North Pacific Currents.kmz,
AMRF_GIS_DATA_Sites.kmz, and Gyre Animation.pps

K. Open all of the .kmz and the .kml files in Google Earth. In the Places section, check only the < **ORVAlquitaGyreVoyage2007.kml** > file box to make it active. Move to the Pacific Ocean near the coast of California and zoom in just enough to see some sailboats with the days numbered. Take a moment to follow the voyage by clicking on the sailboat icons. Each icon contains the blog for the day and images taken by the crew.



6) Plastic marine debris impacts life in the ocean. Review the observations made by the crew on the research vessel and describe how plastic debris might impact the survival of one species that was observed during the voyage.



7) Non native species that invade an ecosystem may cause problems. The spread of the Zebra Mussel is one example. Zebra Mussels cause problems by clogging pipes that transport water. How might plastic debris contribute to the spread of non-native species across the world's oceans? (Look at the photograph on Day 8)



L. In the Places section, check the < NorthPacificMapForGyre.kmz > file box to make it active.



Notice that the major currents in the North Pacific Ocean rotate in a clockwise direction and form the North Pacific Gyre. The North Pacific Eastern "Garbage Patch" is found inside of this gyre northeast of the Hawaiian Islands. A large amount of plastic debris accumulates in this location from the shores of the countries bordering the North Pacific Ocean.



8) Plastic debris and chemical pollutants from your watershed might flow far enough from land to get into a major current of the North Pacific Gyre.

a. What is the name of the first encountered major current?

b. What direction does this major current move?



Changes in an ecosystem can result from changes in climate, changes in population size, human activity, and introduction of nonnative species.



9) Based on what you have experienced with this lesson, how has human activity changed the ocean ecosystem in the North Pacific Ocean?



The Algalita Marine Research Foundation (AMRF) has been measuring the marine plastic density in the North Pacific Gyre since 1999. Activate these four files in Google Earth:

North Pacific Current Map.kmz , AMRF GIS Data Sites.kmz, Voyage 2007.kml., and Voyage 2009.kml.



M. Highlight the Pacific Current Map and use the slider at the bottom of the Places section to highlight how the data collection sites of the Algalita Marine Research Foundation fall into the North Pacific Gyre.



10) If you were in charge of choosing two areas that have not been explored for marine plastic debris within the North Pacific Gyre that are east of the international time zone, what are the latitudes and longitudes of the approximate centers of these areas? Latitude and longitude appear at the bottom of the screen as you move the cursor.

Area #1 Latitude _____ Longitude _____

Area #2 Latitude _____ Longitude _____

11) Watch the animation of trash traveling to the “Garbage Patch” in the PowerPoint animation named GyreAnimation.pps. What ideas do you have to take action against the problem of marine plastic debris?