32 Shades of Water

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Summary

What does the color of the water tell you about conditions in marine and freshwater environments? What are the variables that affect that color? In this lesson students will participate in a variety of activities that allows them to brainstorm what impacts the color of our global water. They will perform research, analyse graphs and use real time data sets to make predictions, discuss limitations of methodology and the similarities and differences between different parts of the global ocean system.

*[TAGS: color, water quality, phytoplankton.]*

Key Concepts

* Reading and Analysing graphs
* Making observations
* Creating and revising hypothesis
* Researching and collaborating

Objectives

Students will be able to do:

* Ask questions and construct explanations
* Define problems and design solutions
* Plan and carry out investigations
* Analyze and interpret data
* Engage in argument from evidence
* Obtain, evaluate, and communicate information

Materials

* Engage- teacher and student worksheet
* Explore-teacher and student worksheet
* Explain-student activity worksheet
* Elaborate-student activity worksheet
* Evaluate- teacher guide and student worksheet

Procedure

*This lesson follows the BSCS 5-E Instructional Model*

Engage: What’s the Color of the Ocean?

Explore: What Influences Ocean Color?

Explain: Research the parameters that may impact ocean color

Elaborate: Is the Sea Really Blue?

Evaluate: Analysing and interpreting data to reformulate hypotheses, make predictions

Assessment

* **Formative assessments**- Students will identify and describe factors that influence ocean color by analyzing satellite images and discussing factors that contribute to differences in ocean color.
* **Summative assessment**- In this activity students will make a prediction about the color of the Southern Ocean, the North Atlantic, Hawaii and the California Current. They will then look at graphs and use the claim, evidence, reasoning and tradeoffs model to compare their results to their predictions. Students will then discuss their reasoning for their responses. Please see activity sheet for complete assessment

Additional Resource

What color is YOUR water? Monitoring the Coastal Ocean Through Color by NASA

<http://oceandatacenter.ucsc.edu/home/outreach/poster_blue.pdf>

Biological and Satellite Oceanography Lab Outreach Site

<http://oceandatacenter.ucsc.edu/home/outreach.html>

Monterey Bay Weekly Phytoplankton Sampling color reference

<http://oceandatacenter.ucsc.edu/PhytoBlog/color.html>

What is Ocean Color and how to create a simple spectrophotometer activity

<https://pace.oceansciences.org/docs/what_color_is_the_ocean.pdf>

Scientific Journal Article by Lee et al on primary productivity of phytoplankton and ocean color

<http://onlinelibrary.wiley.com/doi/10.1002/2015JC011018/full>

Ocean Colour Remote Sensing in Polar Seas

<http://ioccg.org/group/polar/>

The Difficulty and limitations of using ocean colour in polar regions

<http://www.ioccg.org/groups/polar-details.html>

NOAA STAR Ocean color science

<https://www.star.nesdis.noaa.gov/sod/mecb/color/>

The Color of the Great Lakes

<http://www.iaglr.org/jglr/release/39/2013.02.002_peng.php>

Sediment and Algae color of the great lakes

<https://earthobservatory.nasa.gov/IOTD/view.php?id=76115>

How LANDSAT is used to determine color

<https://landsat.usgs.gov/how-landsat-8-coastal-aerosol-band-used>

National Geographic Satellite imagery and change over time

<https://www.nationalgeographic.org/activity/satellite-imagery-and-change-over-time/>

Overview of the Landsat satellite

<https://landsat.gsfc.nasa.gov/landsat-8/landsat-8-overview/>

Explanation of Chlorophyll A and how it is measured

<http://biogeochemical-argo.org/measured-variables-chlorophyll-a.php>

NASA overview of Ocean Color

<https://science.nasa.gov/earth-science/oceanography/living-ocean/ocean-color>

International Ocean Colour Group images of Ocean color from around the globe with article links

<http://ioccg.org/featured-image-archive/>

Is the Sea Really Blue?

<http://www.bbc.com/earth/story/201505226-is-the-sea-really-blue>