



Ocean Acidification Resources

General Ocean Acidification Information

- NOAA Ocean Acidification Program oceanacidification.noaa.gov
 - NOAA Ocean Acidification Education Needs Assessment
ftp://ftp.oar.noaa.gov/oa/NOAA_OA_Needs_Assessment_Report%20Final_5_16.pdf
- NOAA Pacific Marine Environmental Laboratory
<http://www.pmel.noaa.gov/co2/story/Ocean%2BAcidification>
- Smithsonian Institution Ocean Portal <http://ocean.si.edu/ocean-acidification>
 - Ocean Acidification [Infographic](#)
- 20 Facts about Ocean Acidification
<http://www.whoi.edu/files/server.do?id=165564&pt=2&p=150429>
- Fact sheet: Ocean Acidification in the Pacific North West
<http://www.ecy.wa.gov/water/marine/oa/201405-OAfactsheet.pdf>
- Six things we know about ocean acidification in Pacific Northwest coastal waters:
<http://coenv.washington.edu/research/major-initiatives/ocean-acidification/ocean-acidification-in-the-pacific-northwest/>
- 'Sea Change' Seattle Times Series:
<http://apps.seattletimes.com/reports/sea-change/2013/sep/11/pacific-ocean-perilous-turn-overview/>

On Social media

- NOAA Ocean Acidification Program shares upcoming events and webinars, scientific publications, ocean acidification in the news on both [Facebook](#) and [Twitter](#): @OA_NOAA
- Ocean Acidification International Coordination Centre: share ocean acidification scientific publications daily on [Twitter](#): @oaicc_project
- Biological Impact of Ocean Acidification Project: shares ocean acidification publications on [Twitter](#): @BIOACID_project
- Common hashtags: #oceanacidification, #ourchangingocean, #scicomm

Activity & Lesson Plan Collections

- Channel Islands National Marine Sanctuary Ocean Acidification Portal
<http://cisantuary.org/ocean-acidification/>
 - A collection of hands-on activities and useful links
- Washington Sea Grant's Ocean Acidification Outreach and Education Resources
<https://wsg.washington.edu/our-northwest/ocean-acidification/oa-outreach-and-education-resources/>
 - A collection of resources including videos, presentations, demonstrations, handouts, and other classroom resources.
- NOAA Office of Education: Education Resources for Ocean Acidification
http://www.education.noaa.gov/Ocean_and_Coasts/Ocean_Acidification.html
- Ocean Acidification Curriculum Collection oacurriculumcollection.org
 - OA resources evaluated for classroom use, grade level.
- The NOAA Coral Program's Ocean Acidification Portal <http://coralreef.noaa.gov/education/oa/>
 - Includes videos, presentation, interactive media, and curricula and activities
- Climate Literacy & Energy Awareness Network (CLEAN); cleanet.org
 - One stop "shopping" for top climate & energy interactive resources on the web. Vetted and reviewed by experts. Aligned with Climate Literacy & Energy Literacy principles.
- Climate Interpreter; <http://climateinterpreter.org/>
 - A collection of resources for climate change educators
- Sharing Ocean Acidification Resources with Communicators and Educators (SOARCE) webinar series and archive
<http://oceanacidification.noaa.gov/AreasofFocus/EducationandOutreach/SOARCEWebinarSeries/TabId/2295/PgrID/13162/PageID/2/Default.aspx>
 - This webinar series provides ocean acidification communication tools to formal & informal educators, and stakeholders across the country.

Lesson plans and hands-on activities:

- [Pteropod Education Packet](#)
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- Virtual Urchin; virtualurchin.stanford.edu
 - Interactive biology and environmental science resources using urchin examples; including developmental biology and lots of microscopy
- The International Student Carbon Footprint Challenge; footprint.stanford.edu
 - Students worldwide calculate their footprints, classes receive map pin with their computed averages and go online to discuss with peers.
- Virtual Marine Scientist; virtualmarinescientist.com
 - Students propose, design and run their own OA experiment virtually, using multiple stressors. Graph and analyze the data and discuss.
- Institute for Systems Biology Ocean Acidification Modules for the Classroom:
<http://baliga.systemsbiology.net/drupal/education/?q=content/ocean-acidification-systems-approach-global-problem>
- NOAA Coral Reef Program's "Data in the classroom" datainthe classroom.noaa.gov
 - Students can access & use real oceanographic data to explore OA, El Niño, sea level and water quality
- NOAA National Marine Sanctuaries deep sea coral community lesson plans;
<http://sanctuaries.noaa.gov/education/teachers/deep-coral-communities/>
 - This curriculum takes students into the deep sea to identify the soft corals, hard corals, invertebrates and fish found in these communities and to investigate the unique biology of and threats to deep-sea corals.
- EarthEcho Expedition: Shell Shocked; <http://earthecho.org/expeditions/shell-shocked>
 - The EarthEcho Expeditions team travels to the Pacific Northwest to explore how the continued absorption of carbon dioxide by our oceans is changing the fundamental chemistry that marine ecosystems depend on to operate.
- pH indicator acidification experiment:
<http://www.middleschoolchemistry.com/lessonplans/chapter6/lesson10>
- Garden of the Salish Sea Ocean Acidification Curriculum;
<http://www.restorationfund.org/salishseacurriculum/lessons/acidification>
 - These laboratory investigations are conducted in the classroom and give an introduction to pH and the effect of carbon dioxide on water.

Video Resources:

- North Carolina Aquarium's Ocean Acidification video, including carbonate chemistry and solutions

<https://www.youtube.com/watch?v=01oIF-t05Es>

- Tullio Rossi's "Lost at Sea"

<https://www.youtube.com/watch?v=TNISbtM41dQ>

- Tullio Rossi's "Nemo on Acid"

https://www.youtube.com/watch?time_continue=2&v=wtKDke1EUYE

- Ocean Acidification by the Alliance for Climate Education

<https://www.youtube.com/watch?v=Wo-bHt1bOsw>

- Integrated Ocean Observing Systems: on how the Pacific Northwest responded

http://www.ioos.noaa.gov/ocean_acidification/welcome.html

- C-MORE animation: <http://cmore.soest.hawaii.edu/education/animation.htm>

- Follow a research cruise: <http://cmore.soest.hawaii.edu/sea-it-live/> or <http://science360.gov/series/sea-live-presents-big-rapa-cruise/426d1ddd-97b5-442b-bcc8-862995e3bfe7>

- Microbial oceanography and the Hawaii Ocean Time-series programme:

<https://vimeo.com/113502705>

- Santa Barbara Museum of Natural History Ocean Acidification Video

<https://www.youtube.com/watch?v=XNdfJT4Pq8o>

Data Visualizations and Real Time Data for Education

- OA Outreach Website containing curriculum that incorporates real time data
<http://lydiakapsenberg.weebly.com/outreach.html>
- Northwest Association of Networked Ocean Observing Systems is a good source of data for the Pacific Northwest Region:

http://www.nanoos.org/education/learning_tools/oa/ocean_acidification.php

- o Data can also be accessed here: <http://nvs.nanoos.org/Explorer> and selecting filter: ph/CO2 gives a very nice visual representation of where geographically data is coming

from.

- The Hawaii Ocean Time-series: <http://hahana.soest.hawaii.edu/hot/>
- Station Aloha: <http://aco-ssds.soest.hawaii.edu/ALOHA/>
- Mauna Loa Observatory: <http://www.esrl.noaa.gov/gmd/ccgg/trends/>
- NASA Ocean Satellite Visualizations - <http://svs.gsfc.nasa.gov/cgi-bin/search.cgi?sortby=relevance&value=ocean>
- There are a number of ocean acidification data set visualizations for Science On A Sphere here: <http://sos.noaa.gov/Datasets/search.php?q=ocean%20acidification>
 - Also a variety of general Ocean Visualizations - <http://sos.noaa.gov/Datasets/list.php?category=Ocean>

Kits, Resources, Supplies:

- C-MORE Ocean Acidification Kit: http://cmore.soest.hawaii.edu/education/teachers/science_kits/ocean_acid_kit.htm

People Taking Action/Solutions

- SEAS Solar Monitoring Deck - <http://portfolio.deckmonitoring.com/SeattleAquarium>
- Blue Carbon Initiative <http://thebluecarboninitiative.org/> “Blue Carbon Buzz” e-newsletter from Restore America’s Estuaries: <http://goo.gl/HTL99G>

The Research behind Communicating about Ocean Change

- How to Talk about Climate Change and the Ocean: Prepared for the National Network for Ocean and Climate Change Interpretation with Support from the National Science Foundation (2015). http://frameworksinstitute.org/assets/files/PDF_oceansclimate/climatechangeandtheocean_m_m_final_2015.pdf
- Getting to the Heart of the Matter: Using Metaphorical and Causal Explanation to Increase Public Understanding of Climate and Ocean Change http://www.frameworksinstitute.org/assets/files/PDF_oceansclimate/occ_metaphor_report.pdf
- “Just the Earth Doing Its Own Thing: Mapping the Gaps Between Expert and Public Understandings of Oceans and Climate Change” http://www.frameworksinstitute.org/assets/files/cc_oceans_mtg.pdf
- The Psychology of Climate Change Communication (CRED Guide) <http://guide.cred.columbia.edu/>

This video, by the Alliance for Climate Education provides an overview of the chemistry and also addresses some of the socioeconomic aspects of OA -

<https://www.youtube.com/watch?v=Wo-bHt1bOsw>

Web page that includes brief snapshots of different aspects of OA: <http://ocean-acidification.net>

Ocean Acidification comic: <http://birdandmoon.com/acidification.html>

- Narratives
 - Oyster Story in the US Pacific Northwest
- [The Seattle Times](#)
- [NOAA](#)
- Scallop Loss in British Columbia; [Vancouver Sun](#)