SHORE STEWARDS NEWS

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Ocean Acidification

As air and water cycle around the globe, everyone's actions have an impact on the health of the Puget Sound. Being Shore Stewards, we are all interested in taking steps to improve and maintain water quality through our lifestyle choices. Did you know that the impacts seen in the marine environment are a result of not only what is happening on the ground, but also what is happening in the air? Since the industrial revolution the amount of carbon released into the atmosphere from burning fossil fuels has greatly increased. About 1/3 of this carbon is absorbed by the ocean. For many years this was seen as a valuable benefit because it reduced CO_2 levels in the atmosphere, but unfortunately we are starting to see negative consequences in the water quality. As atmospheric CO_2 levels increase, so do the levels in the ocean. When the ocean absorbs carbon from the air it changes the chemistry of the ocean, lowering the pH, through a process called ocean acidification. Ocean acidification is impacting the water quality in the Puget Sound. Studies show that the local shellfish being affected by ocean acidification.

What is Ocean Acidification?

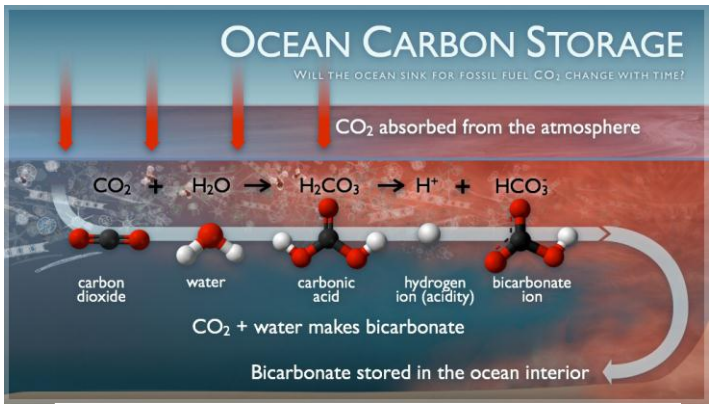
The Natural pH of marine water varies by location, but average ocean water is about 8.1. Levels as low as 7.4 have been found in the Hood Canal during a study by National Oceanic and Atmospheric Administration's Pacific Marine Environmental Laboratory in Seattle. While that may not sound low, it is more than 200 percent more acidic than open ocean surface waters. The pH scale is logarithmic which means there is a 10 fold difference between each successive full number

Concentration of Hydrogen ions compared to distilled water				Examples of solutions and their respective pH
	1/10,000,000	14	Liquid drain cleaner, Caustic soda	
	1/1,000,000	13	bleaches, oven cleaner	
	1/100,000	12	Soapy water	
	1/10,000	11	Household Ammonia (11.9)	
	1/1,000	10	Milk of magnesium (10.5)	
	1/100	9	Toothpaste (9.9)	
	1/10	8	Baking soda (8.4), Seawater, Eggs	
	0	7	"Pure" water (7)	
	10	6	Urine (6) Milk (6.6)	
	100	5	Acid rain (5.6) Black coffee (5)	
	1,000	4	Tomato juice (4.1)	
	10,000	3	Grapefruit & Orange juice, Soft drink	
	100,000	2	Lemon juice (2.3) Vinegar (2.9)	
	1,000,000	1	Hydrochloric acid secreted from the stomach lining (1)	
	10,000,000	0	Battery Acid	

Source: http://www.chemeddl.org/

on the scale. The pH scale measures how acidic or basic a substance is. It ranges from 0 to 14. A pH of 7 is neutral while a pH less than 7 is acidic, and a pH greater than 7 is basic. The "H" in pH refers to the concentration of Hydrogen ions, and the "p", well it has several definitions—(check it out on Wikipedia).

Carbon in the atmosphere leads to increased ocean acidity. When CO_2 dissolves in ocean water, it forms carbonic acid, which releases hydrogen ions leading to increased acidity. The newly released hydrogen ions then bond with carbonate ions to form bicarbonate molecules which reduce the number of carbonate ions available for marine animals like oysters and clams to utilize for building their shells. Check out the chemistry diagram.



Source: http://pmel.noaa.gov/co2/files/pmel-research.004.jpg

So what does this chemistry mean for the Puget Sound? Over the last five years, larval mortalities have been observed in Hood Canal and Willapa Bay shellfish hatcheries. Current research is being conducted to acidity and shellfish development. There are two research stations located Big Cove, and Totten Inlet in southern Puget Sound and Dabob Bay in Hood Canal are in important shellfish growing areas. This research is funded through a Puget Sound Partnership grant with Puget Sound Restoration Fund, NOAA, University of Washington, Pacific Shellfish Institute and Baywater, Inc. to establish index stations at two important shellfish growing areas in Puget Sound.

Another study done by researchers at the University of Washington's Friday Harbor Laboratories found that mussels are responding to acidification by a weakening of the fine fibers called byssal threads which allow the mussel to hang on to rocks. When waves crash and the mussels get knocked off they become easy food for predators like crabs, fish and sea stars.

Benefits of a Healthy Shellfish Population

Shellfish provide many ecosystem services beyond a culinary treat and the local economy. The presence of shellfish in marine water provides the following environmental benefits:

· Reduce the amounts of nitrogen in the water through denitrification.

· Reduce erosion from storms and boat wakes by absorbing wave energy and acting as a natural buffer.

· Clean the water by filtering suspended particles, which leads to improved water clarity. The clarity is not only more enjoyable to look at but it also increased eelgrass growth, which is critical habitat for many juvenile fish and crustaceans.

How You Can Reduce Your Carbon Footprint

The total amount of greenhouse gases, or carbon dioxide (CO_2), produced to support human activity is refered to as a Carbon Footprint. What is your Carbon Footprint? This is a difficult number to calculate. The average American's carbon foot print is 40% direct energy use, such as driving an automobile. However about 60% is from indirect purchase of goods and services. You can get an idea of the size of your carbon footpring by visiting these websites: http://www.carbonfootprint.com/individuals.html **or** http://whatsmycarbonfootprint.com/index.htm

There are many ways you can reduce the amount of carbon you release into the atmosphere.

Reduce. Reuse. Recycle. Most items we buy produce an average 4-8 pounds of CO_2 for every pound of manufactured product. Products require resource extraction, manufacturing, transportation and market space- all of that adds up to the total carbon footprint.

Stop your junk mail with the help of 41Pounds, a nonprofit service that contacts dozens of direct mailers to remove your name from their lists. www.41pounds.org

Plant Native. Trees are one of the best ways to pull carbon from the atmosphere as well as provide many additional environmental benefits. Native plants reduce erosion, provide shade to keep water cool, and create wildlife habitat.

Reduce the Carbon Footprint of Your Car

Drive better - Studies have shown up to 30% of the difference in miles per gallon (MPG) is due to driving habits alone. You could save more than a ton of CO_2 per year by:

- Accelerating slowly and smoothly
- Driving the speed limit
- Maintaining a steady speed
- Anticipating your stops and starts

Maintenance - Keep your car tuned up and running efficiently.

More Maintenance - Replace your air, oil and fuel filters according to schedule.

Tires - Keep your tires properly inflated (this can save 400-700 pounds of CO_2 per year).
Alternatives - considering public transportation, carpooling, walking, or biking.

For more ideas visit http://carbonfund.org/

Publications and Resources

Isabella, Jude. "The Tyee – Latest Species Threatened by Climate Change: Mussels." *The Tyee*. 14 Mar. 2012. Web. 02 Apr. 2013. <http://thetyee.ca/News/2013/03/14/Mussels-Threatened-by-Climate-Change/>.

"The Nature Conservancy. Protecting Nature. Preserving Life.™." *Learn About Shellfish Reefs at Risk*. Web. 02 Apr. 2013. <http://www.nature.org/ourinitiatives/habitats/oceanscoasts/howwework/shellfish-habitat.xml>.
"Ocean Acidification Network." *Ocean Acidification Network*. Web. 02 Apr. 2013. <http://www.ocean-acidification.net/FAQacidity.html>.
"Ocean Acidification." *Ocean Acidification*. Web. 02 Apr. 2013. <http://www.pmel.noaa.gov/co2/story/Ocean%20Acidification>.
"Ocean Acidification." *Puget Sound Restoration Fund*. Web. 02 Apr. 2013. <http://www.restorationfund.org/projects/ocean>.
"PH." *Wikipedia*. Wikimedia Foundation, 31 Mar. 2013. Web. 02 Apr. 2013. <http://en.wikipedia.org/wiki/PH>.

Also See: February 2009 issue of Shore Stewards News:
http://www.shorestewards.wsu.edu/island/newsletter/2009/February2009Newsletter.pdf

Information on the Recent Landslide on Whidbey Island

The Department of Natural Resources has posted some great detailed information with a series of links to help us understand the causes and background on the recent landslide at the Ledgewood neighborhood: http://washingtondnr.wordpress.com/2013/03/27/whidbey-island-coupeville-landslide/

Hugh Shipman, Coastal Geologist for our state's Department of Ecology, has some observations on the landslide, posted on his Gravel Beach blog: http://gravelbeach.blogspot.com/2013/03/ledgewood-beach.html (This is a good blog to follow for information on Puget Sound coastal geology.)

If you would like to download or view previous Shore Steward newsletters, please visit http://county.wsu.edu/island/nrs/shorestewards/Pages/Newsletter.aspx Your Shore Stewards Coordinator is Scott Chase, (360) 387-3443, ext 258, or email at shorestewards@wsu.edu