National Oceanic & Atmospheric Administration
U.S. DEPARTMENT OF COMMERCE
CLIMATE SCIENCE & SERVICES

The Vital Role of Earth Observations in Understanding Changing Ocean Chemistry

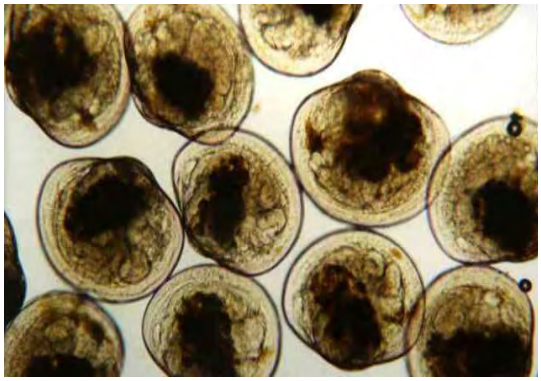
NOAA Ocean Acidification Buoy, Photo courtesy of Dr. John Payne, Pacific Ocean Shelf Tracking Project.

The immense value of integrated Earth observations, and how even small monitoring and observation efforts can make a huge difference, are evident in the Pacific Northwest where oyster hatcheries on the verge of collapse just a few years ago are again major contributors to the $111million West Coast shellfish industry.[1] A $500,000 investment in monitoring coastal seawater, strengthened by the fuller offshore picture provided by the U.S. Integrated Ocean Observing System (IOOS®) and the NOAA Ocean Acidification Program, is helping to restore commercial hatcheries and expected to reap an estimated $35 million for coastal communities in Oregon and Washington.[2]

Led by the Commerce Department's National Oceanic and Atmospheric Administration (NOAA), IOOS is an interagency and regional effort aimed at characterizing, predicting and monitoring coastal, ocean and Great Lakes environments. "Putting an IOOS buoy in the water is like putting headlights on a car. It lets us *see* changing water conditions in real-time," said Mark Wiegardt, co-owner of Whiskey Creek Shellfish Hatchery in Oregon. Bill Dewey, of Taylor Shellfish Farms in Washington, calls IOOS a vital management tool for understanding ocean chemistry. "When you see oyster shells dissolving in water, there's a compelling need to know," he said.

Beginning in 2005, production at some Pacific Northwest oyster hatcheries began declining at an alarming rate, posing severe economic impact and challenging a way of life held by shellfish growers for over 130 years. Oyster production represents 76 percent of the West Coast shellfish industry, which supports more than 3,000 jobs.[3] By 2008, oyster losses at Whiskey Creek, a supplier to about 75 percent of West Coast oyster farmers, reached 80 percent. At the same time, corrosive acidified seawater was reaching the Pacific Coast.

As natural reservoirs for excess atmospheric carbon dioxide CO_2, the world's oceans absorb about 26 percent of the human-generated greenhouse gas each day, removing about 22 million tons from our atmosphere daily.[4] The downside is that CO_2 is literally causing a sea change. Rapidly-increasing CO_2 mixed with seawater forms carbonic acid, which depletes our oceans of a nutrient vital to building shells. Known as ocean acidification, this process slows growth or even dissolves shells to the point



Oyster Larvae,
Photo courtesy of Taylor Shellfish Farms

where oyster larvae cannot survive. Currently, ocean chemistry is changing at least 30 times faster than at any time during the 800,000 years prior to the industrial era.[5]

In the Pacific Northwest, Earth observations both detected the acidification that was threatening shellfish and offered an approach to address it. With monitoring revealing the water conditions that oysters can and cannot tolerate, 2010 was Taylor Shellfish's best year since 1989. Whiskey Creek also enjoyed rising productivity. In 2008, productivity was just 20 percent. In 2010, it was up to 70 percent.

Complementing coastal monitoring, real-time data from off-shore IOOS buoys act as an early warning system for shellfish hatcheries, signaling the approach of cold, acidified seawater 1-2 days before it arrives in the sensitive coastal waters where larvae are produced. The data enable hatchery managers to schedule production when water quality is good and avoid wasting valuable energy and other resources when water quality is poor.

While this information focuses on the U.S. West Coast, ocean acidification, often referenced with climate change as the other CO_2 problem, is an emerging global issue, particularly since shelled organisms are an essential nutrient throughout the entire marine food chain and for many millions of people worldwide.

"Monitoring is key," Mark Wiegardt said. "It gives us hope for the future of the shellfish industry."

Oyster Farm, Washington State,
Photo courtesy of Taylor Shellfish Farms

For information about ocean acidification:
http://www.pmel.noaa.gov/co2/story/Ocean+Acidification

1 Pacific Coast Shellfish Growers Association, 2009

2 Sustainable Fisheries Partnership from data provided by the Pacific Coast Shellfish Growers Association, 2009

3 Pacific Coast Shellfish Growers Association, 2009

4 Feely, R.A., S.C. Doney, and S.R. Cooley (2009): Ocean acidification: Present conditions and future changes in a high-CO2 world. Oceanography, 22(4), 36–47

5 Doney, S.C., W.M. Balch, V.J. Fabry, and R.A. Feely (2009): Ocean acidification: A critical emerging problem for the ocean sciences. Oceanography, 22(4), 18–27