10-8-09

Oregon had hypoxia again in 2009, but as winds died down, so did low oxygen

By Mark Floyd, 541-737-0788
Sources: Jack Barth, 541-737-1607; Francis Chan, 541-737-9131

CORVALLIS, Ore. – The Pacific Ocean off Oregon again experienced low-oxygen waters near the seafloor in summer of 2009, but the winds that fuel annual upwelling abated sufficiently in August and September to avoid severe hypoxia and the threat of biological "dead zones," according to scientists.

Oregon State University researchers, who have been monitoring the near-shore waters with help from colleagues ranging from NOAA fish surveyors to Oregon crabbers, say this season's hypoxia area was "about average" in size and duration in comparison with recent years.

"We did experience hypoxic conditions for the eighth consecutive year, but unlike 2006 when strong, steady winds led to near zero-oxygen, or anoxic, conditions, we got a break," said Jack Barth, a professor of oceanography at OSU. "A series of wind reversals late in the summer helped dissipate the low oxygen, in essence allowing the system to 'flush itself.'"

The oxygen level got as low as 0.5 milliliters per liter in early August off Newport and Cape Perpetua, which is at the cusp of being classified as "severe," when the winds eased.

OSU scientists run regular transects off Newport using undersea gliders equipped with oxygen sensors, and similar instruments aboard four moorings from water 15 meters deep out to about 80 meters. They also had sensors aboard a NOAA hake survey cruise that sampled waters from northern California to the Strait of Juan de Fuca this summer.

Barth said the ability of oceanographers to monitor and measure hypoxic conditions is improving every year and should become even greater when OSU deploys a new network of undersea gliders and cabled moorings off the coast as part of the national Ocean Observatories Initiative, a $386.4 million effort funded by the National Science Foundation to gauge the effects of climate change on the world's oceans.

Oregon scientists now have 10 times the sensors in the water as they did when hypoxia was first discovered off the central Oregon coast early this decade, Barth pointed out. The expanded instrumentation is allowing them not only to measure low oxygen, but to understand the underlying mechanisms behind it and how hypoxia manifests itself along the coast.

Unlike hypoxic areas in the Gulf of Mexico, which are caused by agricultural runoff and pollution, the low-oxygen waters of the Pacific Ocean off Oregon are triggered by seasonal upwelling, or the wind-driven mixing of cold, nutrient-rich deep water with surface waters. This fertilization of the upper water column generates large phytoplankton blooms, and as the plant material dies, it sinks to the bottom and decomposes, lowering the oxygen level of the water just off the seafloor.

This seasonal upwelling is normal, scientists say, yet hypoxia hadn't been observed in near-shore waters prior to 2002. What changed, Barth said, was the pattern of Northwest winds and decreasing oxygen levels in the deep, offshore waters that are upwelled toward the coast.

"Historically, winds would blow at the coast for a week or so, then settle down for several days," he pointed out. "As the winds eased, so did upwelling, and low-oxygen water was washed away – likely off the continental shelf. But in some years, those traditional wind patterns have shifted and now may last 20 to 30 days instead of a week. The system doesn't have time to cleanse itself."

Barth says the change in wind patterns and decrease in the oxygen levels in deep offshore waters are consistent with impacts suggested by many climate change models.

Previous research by Barth and colleagues found that changes in the wind patterns are triggered by slight variations in the Jet Stream. When the Jet Stream veers slightly to the south, as in 2005, it can cause a delay in upwelling that led to a devastating lack of biological production in the spring – a condition that may have been the cause of depressed salmon runs two and three years later.

When it shifts northward, the Jet Stream can cause strong, steady winds that "super-charge" the upwelling system, as happened in 2006, said Francis Chan, a senior research professor in OSU's Department of Zoology. Chan and Barth are investigators for the Partnership for Interdisciplinary Studies of Coastal Oceans program based at OSU.

"The 2006 situation was not only the strongest, most widespread hypoxia event yet seen off the Pacific Coast," Chan said, "it also was the most long-lasting. The oxygen levels were off the charts and they continued through October of 2006, which is unheard of. For the first time we've ever observed, some parts of the near-shore ocean actually ran out of oxygen altogether."

Photos and video of dead fish and crabs taken by a remotely operated vehicle in 2006 made national news and though hypoxia has been an issue every summer since, it hasn't been nearly as severe. The researchers had hoped to use the ROV, operated by the Oregon Department of Fish and Wildlife, to observe hypoxic areas this summer, but it has been out for upgrades.

"We didn't have any visual evidence from the rocky reefs we've been monitoring year after year," Barth said, "but neither did we get any reports of significant die-offs, as happened with crabbers in 2006."

Oregon's crab industry, in fact, is partnering with OSU scientists in the monitoring of low-oxygen waters. OSU oceanographer Kipp Shearman is working with 10 Oregon crabbers, who have agreed to have oxygen sensors attached to 60 crab pots from Port Orford to Astoria, providing scientists with additional data.

"Because of the cooperation of crabbers, NOAA, ODFW and others, we now have a better understanding of how hypoxia works," Barth said, "and that understanding will improve greatly as we expand our fleet of undersea gliders and ocean moorings."

-30-

About Oregon State University: OSU is one of only two U.S. universities designated a land-, sea-, space- and sun-grant institution. OSU is also Oregon's only university designated in the Carnegie Foundation's top tier for research institutions, garnering more than 60 percent of the total federal and private research funding in the Oregon University System.