

5th Annual Heceta Head Coastal Conference

"Oregon's Ocean: The Land/Sea Connection"

SUMMARY of CONFERENCE PROCEEDINGS

Lectures

Hypoxia in Oregon Coastal Waters

Jack A. Barth, College of Oceanic and Atmospheric Sciences, Oregon State University

Near-bottom waters over the inner shelf (< 50 m water depth) off central Oregon, have been increasingly hypoxic (dissolved oxygen < 1.4 ml/l) over the last 8 years, including the appearance of anoxia (zero oxygen) in summer 2006. The appearance of near-bottom, inner-shelf hypoxia is driven by upwelling of low-oxygen and nutrient-rich sourcewater onto the continental shelf, followed by the decay of organic matter raining down from surface phytoplankton blooms.

Oregon hypoxia is not driven by algal blooms fed by excess nutrient runoff from land-based activities; rather, the Oregon algal blooms are driven by the upwelling of nutrients from deep waters offshore. On the other hand, most of the over 400 hypoxia zones in the world's oceans are associated with excess nutrient runoff. When oxygen gets too low, marine organisms become stressed and can die if they are unable to leave the hypoxic region.

Where there are large numbers of marine organism die-offs, these regions are called "dead zones." It is important to note that documented late-summer marine die-offs in Oregon coastal waters, observed using video cameras mounted on underwater vehicles, are restricted to near the sea floor – while the marine food web in the mid and upper water column is very much alive.

Through a combination of ship sampling, moorings and autonomous underwater vehicle gliders, we have been measuring dissolved oxygen with increasing temporal and spatial coverage. For longer term context, we use historical observations along the Newport Hydrographic Line sampled since the 1960s. Since April, 2006, we have occupied the Newport Hydrographic Line nearly continuously using autonomous underwater gliders.

In total, gliders have been at sea for 1,253 days (3.4 years), sampled over 400 cross-shelf sections, collected in excess of 110,000 vertical profiles and traveled over 28,000 km. Oxygen data are used to show how the severity of inner-shelf hypoxia varies year-to-year due to changes in upwelling sourcewater properties and the characteristics of wind-driven upwelling.

In 2009, near-bottom oxygen levels decreased to just around "severe" hypoxia (0.5 ml/l) by early August, but a series of wind reversals in August and September helped flush low-oxygen waters away. We did not receive reports of any significant marine life die-offs as observed from shore.

In summary, during 2009 we saw low oxygen levels (hypoxia), consistent with recent years, and this year's hypoxic area was about average in size and duration.

Nearshore Resource Teams

Gregory K. Krutzikowsky, Nearshore Project Leader, Oregon Department of Fish and Wildlife

In the first decade of this century a number of community groups from specific coastal areas have formed to

provide input on management of the nearshore ocean's common-pool resources off Oregon. The specific organizational structure of these groups and their focus on specific issues varies, but a number of groups have extractive users of nearshore ocean resources, i.e. fishermen, prominently represented.

Management of common-pool resources has been strongly influenced by the "tragedy of the commons" concept articulated by Hardin and the two solutions, government control or private ownership, he proposed in a 1968 publication in the journal *Science*. The recent award of the Nobel Prize in economics to Elinor Ostrom has focused more attention on the fact that for many, but not all common-pool resources including fisheries, users make significant investments in designing and implementing governance systems to increase the likelihood of sustaining them. Ostrom notes that no single management solution works in all cases.

Factors leading to the formation of community groups of extractive users invested in management of common-pool resources in Oregon's nearshore waters were examined with respect to recent work by Ostrom. Specifically, five user characteristic variables, three resource system variables, one resource unit variable, and one governance system variable in the social-ecological system were explored in terms of how they fit into the predictive model framework for user group formation she proposed in a 2009 article published in the journal *Science*.