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Vertical Distribution of Deep-Pelagic (0-3000 M) Fishes Over the Charlie-Gibbs Fracture Zone Region of the Northern Mid-Atlantic Ridge

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EFFECTS OF HYPOXIA ON NUTRIENT BIOGEOCHEMISTRY IN THE BALTIC SEA

Hypoxia has been intermittently present in the Baltic Sea over the last 8000 years driven by morphometric changes, changes in climate and anthropogenic activities. Hypoxia regulates the biogeochemical cycles of both phosphorus and nitrogen in the water column and sediments. These feedbacks can regulate productivity in the Baltic with benthic fauna playing a significant role in biogeochemistry. Significant amounts of P are currently released from sediments, an order of magnitude larger than annual anthropogenic inputs. Simulations with a reactive-transport model demonstrate that forced reoxygenation of hypoxic deep waters – a suggested engineering solution – has little impact on sedimentary P retention, but results in the conversion of organic phosphorus to redox-sensitive iron-bound species. A relapse into hypoxia would release this P to overlying waters, potentially exacerbating hypoxic conditions. The Baltic Sea is unique for coastal marine ecosystems experiencing N losses in hypoxic waters below the halocline and in sediments – both not yet well quantified. We will discuss some of our recent findings from the EU funded BONUS HYPER (Hypoxia mitigation for Baltic Sea Ecosystem Restoration) project.

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VERTICAL DISTRIBUTION OF DEEP-PELAGIC (0-3000 M) FISHES OVER THE CHARLIE-GIBBS FRACTURE ZONE REGION OF THE NORTHERN MID-ATLANTIC RIDGE

Only a tiny fraction of the world's largest volume of living space, the ocean's mid-water biome, has ever been sampled. As part of the International Census of Marine Life field project, MAR-ECO, a discrete-depth trawling survey was conducted in 2009 aboard the NOAA ship *Henry B. Bigelow* to examine pelagic assemblage structure and distribution over the Charlie-Gibbs Fracture Zone of the northern Mid-Atlantic Ridge. The bottom topography in this region ranges from 4500 m in the channel to 700-800 m on top of adjacent seamounts. Sampling was conducted at 11 stations from 0-3000 m using a Norwegian "Krill" trawl with five codends that opened and closed by a pre-programmed timer. Seventy-five species of fishes were collected, with a maximum species diversity and biomass being observed between 700-1900 m. Other key features observed were a strong diel migrating component and frequent captures of putative bathypelagic fishes, shrimps, and cephalopods in the epipelagic zone (0-200 m). The results of MAR-ECO sampling show patterns unlike those previously reported for open ocean ecosystems.

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SEASONAL AND SPATIAL DYNAMICS OF NON-INDIGENOUS *DAPHNIA LUMHOLTZI* IN TWO NUTRIENT-SENSITIVE RESERVOIRS AFFECTED BY MULTIPLE STRESSORS

I recently discovered exotic *Daphnia lumholtzi* in two water supply reservoirs in North Carolina. Falls Lake and Jordan Lake, deemed "nutrient-sensitive waters", frequently experience multiple stressors, including excess nutrient and chlorophyll levels. My objectives were to determine (1) if and under what conditions this non-indigenous species may be considered invasive; and (2) if *D. lumholtzi* dynamics correlate to seasonal and spatial variations in chlorophyll and other water quality parameters in Falls Lake. I sampled zooplankton in Falls Lake over 20 months and nine different sites, concurrent with routine water quality sampling conducted by state officials. Jordan Lake zooplankton were sampled over seven months. *D. lumholtzi* density and dominance varied widely across sites and season in Falls Lake, and preliminary results suggest that its abundance increases with turbidity. In most sites, *D. lumholtzi* was present, but copepods were often the dominant group. In contrast, *D. lumholtzi* was consistently dominant in Jordan Lake, often comprising 95% of the crustacean zooplankton. Further analysis is needed to determine the effects of *D. lumholtzi* in each reservoir, including its response to algal bloom events.

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COULD TODAY'S MOLLUSK HARVESTS SUGGEST TOMORROW'S VULNERABILITY TO OCEAN ACIDIFICATION?

We examine the possible implications of ocean acidification on worldwide mollusk harvests by examining present production, consumption, and export and by relating those data to present and future surface ocean chemistry forecast by a coupled-climate ocean model (Community Climate System 3.1; CCSM3). We identify the "threshold date" when future ocean chemistry will distinctly differ from that of today (2010), and when mollusk harvest levels similar to those of the present cannot be guaranteed. We assess nations' susceptibilities to ocean acidification-driven decreases in mollusk harvests by comparing their nutritional and economic dependences on mollusk harvests, overall societal adaptability, and the amount of time until the threshold date. Projected threshold dates for individual countries will occur 14-46 years after 2010. Countries with low adaptability, high nutritional or economic dependence on mollusks, rapidly approaching threshold dates, or rapidly growing populations will therefore be most vulnerable to ocean acidification-driven mollusk harvest decreases. These threshold dates suggest how soon nations should implement strategies, such as increased aquaculture of resilient species, to help maintain current per capita mollusk harvests.

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EDUCATING NON-SCIENTISTS ABOUT OCEAN ACIDIFICATION

As ocean acidification research has exploded worldwide in the past five years, the demand for educational materials explaining this subdiscipline has also rapidly increased. Media attention and public interest have created a need for educational materials targeting a range of ages and backgrounds. As part of the U.S. Ocean Carbon and Biogeochemistry Project's (OCB's) mission to support scientific research and provide education and outreach materials, the OCB Project Office has developed and distributed several types of materials intended to teach non-specialists about the state of ocean acidification knowledge. In addition, we cooperated with other organizations to develop and distribute other materials. We will review the ocean acidification outreach materials available for different target audiences developed by OCB and others, we will discuss forthcoming efforts, and we will review opportunities to close existing gaps.

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EFFECTS OF LODGEPOLE PINE MORTALITY DUE TO MOUNTAIN PINE BEETLE INFESTATION ON STREAM CHEMISTRY

Recently, bark beetles have caused widespread tree mortality across approximately 50 million hectares of coniferous forests from Alaska to Mexico. This study documents effects of tree mortality caused by the mountain pine beetle (*Dendroctonus ponderosae*) on stream chemistry. Samples were analyzed for carbon, nitrogen, and phosphorus fractions across the Colorado Rockies (54 watersheds) and on a single date in Rocky Mountain National Park (185 watersheds). In the 54-watershed study, sites with the highest tree mortality showed a slight but significant increase (approximately 7 ppb) in TDP but no significant changes in nitrogen or carbon fractions.