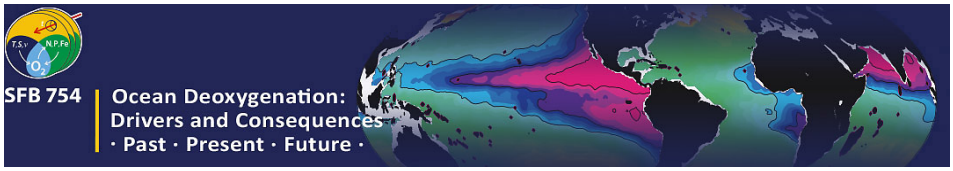

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Greening of the Land and the Coastal Ocean

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Increasing human population. Increasing need for food, fiber and fuel. Increasing use of fossil fuel. Increasing generation of reactive-Nitrogen into airscapes, landscapes, and seascapes. Increasing incidences of coastal ocean oxygen-depleted waters (or hypoxia), especially since the 1950s.
Increases in coastal areas of oxygen depletion parallel large-scale landscape changes, including deforestation, expansion of agricultural lands, more intense fertilizer use, cropping choices including corn for corn-based ethanol, loss of wetlands and riverine buffer zones, changes in cropland drainage, especially subsurface tile drains, and hydrologic controls restricting the floodplain removal of nutrients (i.e., levees or impervious surfaces). This trend for well-developed countries and developing countries is especially evident in agriculture landscapes and highly populated coastal urban centers.
Physical/biological dynamics generate varying levels of dissolved oxygen concentrations that affect living resources in multiple ways. The assemblages of organisms in estuaries and coastal waters are exposed to deoxygenated waters in ecosystems ranging from mostly permanent hypoxia, seasonally but annually persistent hypoxia, intermittent deoxygenation where physical forces disrupt longer periods of seasonal deoxygenation, and during diel cycles in areas with subaquatic vegetation. Oxygen deficiency creates unsuitable feeding habitat for demersal organisms, including the commercially important penaeid shrimps, crabs, lobsters, cod, red snapper, and other prized fish. Consider that cod eggs sink to their preferred density/depth within macroalgal beds affected by low oxygen, and where they now die and do not contribute to future recruitment, and that a 20,000 km2 swath of severely low oxygen waters in the northern Gulf of Mexico occurs at the same time brown shrimp need to migrate from estuaries to deeper waters and greater secondary production.
Hypoxia restoration requires the reduction of the high nutrient loads to coastal waters, which are primarily the result of expanded agribusiness (artificial fertilizers), intensified animal husbandry, insufficiently treated wastewater, and unnecessary consumption of fossil fuels. The societal shifts to a less consumptive life style are not always politically palatable, but some governmental units have come together and implemented multifaceted plans that partially reduced nutrient loading. Ecosystem recovery may take years to decades following long-term exposure to long-lasting hypoxia, and a serious commitment by individuals, societies and governments will be needed to improve coastal water quality.

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