The coastal dissolved oxygen squeeze: Future interactions of land and ocean processes, and consequences for ecosystem services

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Land and ocean processes have converged to make our coastal zones incredably productive of fisheries and other species. Nutrients from land and upwellings support much of this production. Over the last 50 years, however, human activies have drasticly altered land processes, primarily through increased nutrient loading and hydrological modifications, leading to development of low dissolved oxygen (DO) or hypoxic (<2 ml O^2/l) zones [1]. These seasonal 'dead zones' are not historic features of coastal oceans [2].

Current trends in oceanic DO, in particular trends within oxygen minimum zones (OMZs), also threaten to impact coastal zones as OMZs become shallower and push lower DO water onto outer continental shelfs and patterns of upwelling change [3].

The future of coastal dead zones and consequences for ecosystem services, from fisheries production to elemental cycling, will depend on a combination of factors and their interactions: 1 – land use and agricultural patterns leading to increased erosion and fertilizer use, 2 - climate change leading to localised changes in freshwater runoff and nutrient loadings, which control stratification and support eutrophication, 3 – climate change leading to increased or decreased upwelling from shifting wind and current patterns, 4- global warming leading to lowered solubility of dissolved oxygen and higher metabolism in OMZ.

The formation of dead zones will been exacerbated by any combination of interactions that increases primary production and consequent worldwide coastal eutrophication fueled.

[1] Turner *et al.* (2008) *Environ. Sci. Technol*. **42**, 2323-2327. [2] Díaz & Rosenberg (2008) *Science* **321**, 926-929. [3] Helly & Levin (2004) *Deep-Sea Res. Part I* **51**, 1159-1168.

Reconstruction of sedimentation and pollution in Havana Bay, Cuba

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The highly disturbed Havana Bay ecosystem has been the objective of a mitigation program for the last 10 years. We evaluated the historical trends of pollution in sediments using ^{210}Pb chronology, validated by correlation with hurricane-derived signals. Enrichment factors, mass accumulation rates and fluxes of 20 elements were assessed (see Pb in Fig. 1).

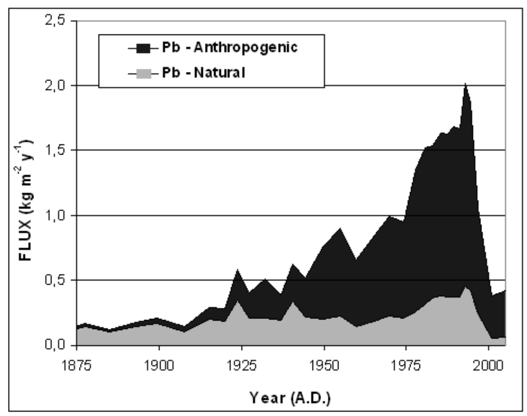

Figure 1: Temporal Pb fluxes in sediments from Havana Bay.

We observed a steady increase of pollution since 1900 to the mid 90s. However, the mitigation program most probably dramatically reduced pollutant fluxes. The excess inventory (since 1900) of most enhanced pollutants was calculated, showing the relevance of dated environmental archives in the evaluation of management practices.