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Tampa Bay estuary: Monitoring long-term recovery through regional partnerships

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ABSTRACT

Historically, significant impacts to Tampa Bay's water quality (e.g. chlorophyll-a concentrations) and ecosystem (e.g. seagrass coverage) have been documented as a result of early coastal development and urban expansion that occurred between the 1950s and 1980s. Since this time, Tampa Bay's estuarine water quality and ecosystems have significantly recovered. A long-term water quality monitoring program, first established by the Environmental Protection Commission of Hillsborough County (EPCHC) in 1972, was instrumental in the development of water quality management targets and regulatory thresholds related to the recovery of seagrass that helped guide restoration activities in the Bay from the 1980s to present. The EPCHC monitoring program has provided over 40 years of consistent and quality assured data that have been used to document Tampa Bay's ecosystem recovery, as well as, guide future research, monitoring, and management actions. Forecasted future pressures of continuing coastal population growth and climate change impacts further necessitate the need to maintain long-term water quality monitoring efforts in the Tampa Bay estuary. Maintenance of a robust estuarine monitoring program will not only help to identify future risks to the important environmental assets represented in the Tampa Bay estuary, but also help to identify potential risks to Tampa Bay's economic vitality that are garnered from maintaining a "healthy" Tampa Bay.

1. Background

Henry B. Plant is credited with initiating modern industrial and commercial development of the Tampa Bay area through the establishment of railroad and steamship transportation networks to and from the region in the 1880s (Simon, 1974). Since that time, port development and shipping interests have benefited from a federally maintained navigation channel also established in the 1880s. Today, Tampa Bay ranks among the U.S.'s most productive port regions (United States Army Corps of Engineers). Establishment and maintenance of the shipping channel (Fig. 1) was one of the first anthropogenic alterations influencing Bay water quality conditions (Meyers et al., 2014; Zhu et al., 2015).

The region continued to expand throughout the 20th century as agriculture, phosphate mining, and industry grew, but it was not until after World War II when indoor air conditioning became readily available to homeowners that widespread suburban and urban development ensued. Population within the region continues to expand, and it is estimated that the region will approach 5M people by mid-century (Tampa Bay Partnership). Significant alterations to fresh and saltwater wetlands, submerged aquatic vegetation, and other natural uplands have been documented throughout Tampa Bay's 20th century coastal development (Robison, 2015; Ries and Scheda, 2015; Yates et al., 2011). Hydrologic alterations to the landscape (e.g. mosquito ditching, creek channelization and ditching, and spoil mound and borrow pit creation), as well as, changes in land use and intensity (e.g., conversion of natural lands to rangeland to agriculture to suburban and urban development) further influenced bay water quality during this period. In addition, causeway and bridge construction across Old Tampa Bay and Lower Tampa Bay further modified hydrodynamics within the Bay proper (Meyers et al., 2014; Zhu et al., 2015).

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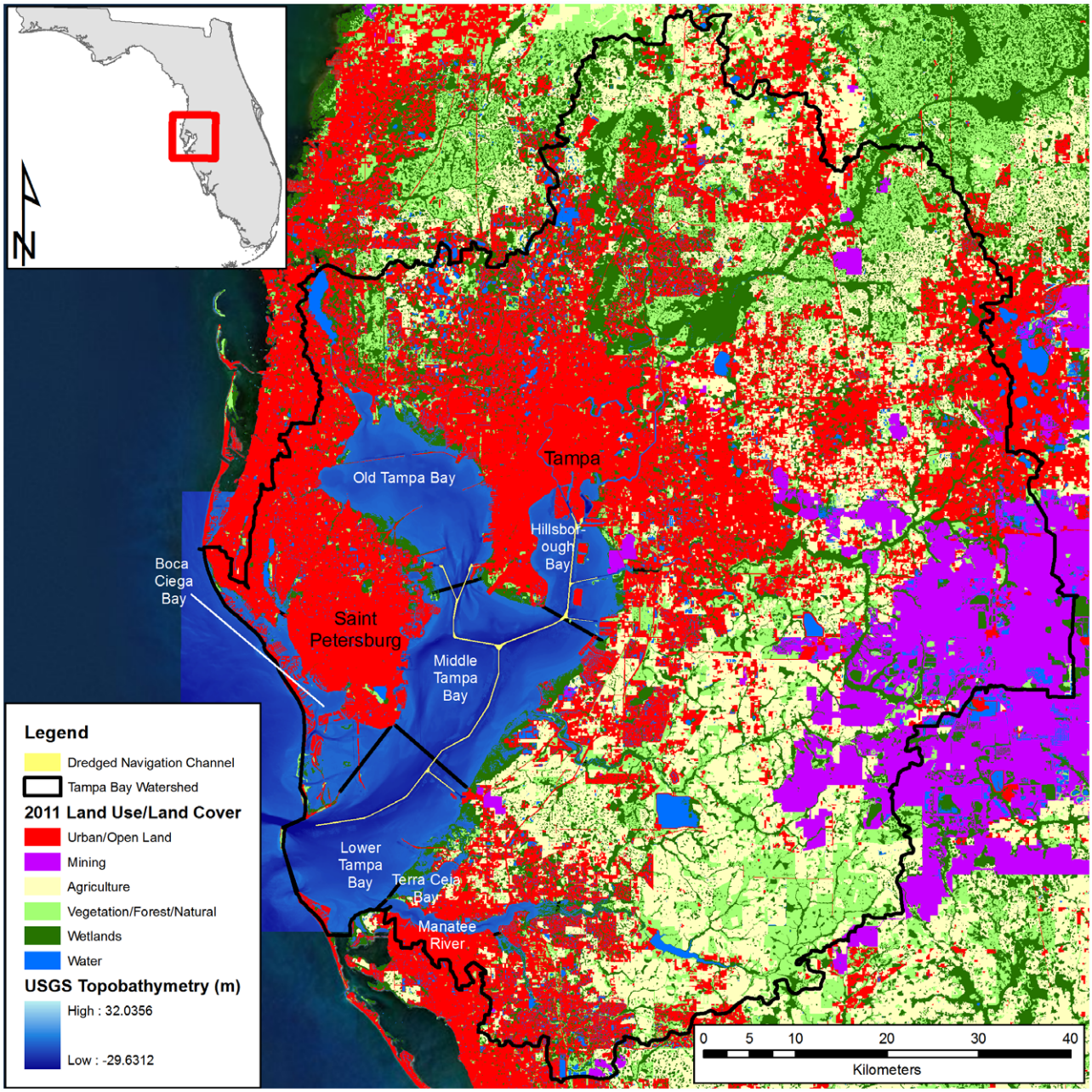

Fig. 1. Tampa Bay overview map highlighting watershed development, dredging alterations to the bathymetry, and management segments (white text labels). Data sources: SWFWMD, TBEP and USGS.

Perhaps the greatest influence on Bay water quality has been the alteration of external nitrogen load inputs to the bay itself (Yates et al., 2011). Regional development between the 1950s–1980s manifested in significant increases in nitrogen loads from municipal wastewater treatment and industrial point sources. During this time, Bay water quality deterioration contributed to significant decline in baywide seagrass coverage (Greening et al., 2015, 2011). Initially led by citizens, a call to action ensued in the 1970s–80s (Johansson and Lewis, 1992; Lewis et al., 1999; Lewis, 2012). After which advanced treatment and/or reuse of domestic wastewater effluent was required prompting an initial kick-start to the Bay's recovery. The bay is now considered a worldwide model for a recovering estuary, and as of 2014, it has met restoration targets related to seagrass coverage (Greening et al., 2015, 2011; Greening and Janicki, 2006; Morrison et al., 2006; Bricker, 2008; Cloern and Jassby, 2009; Duarte et al., 2009; Waycott, 2009; Rabalais, 2010). Significant effort to manage nutrient loading to Tampa Bay began in the 1980s and still continues today through an ad-hoc, public–private partnership termed the Tampa Bay Nitrogen Management Consortium (NMC) (Yates et al., 2011; Greening et al., 2015). Through these regional collaborations, external nitrogen loads have been significantly reduced, and indicators of ecosystem recovery (e.g., reduced chlorophyll-a concentrations, greater seagrass abundance, and enhanced fisheries stocks) are now approaching thresholds documented in the 1950s (Yates et al., 2011; Greening et al., 2015, 2011; Greening and Janicki, 2006). A benchmark period that predates the rapid population growth experienced in the region following World War II.

Modern record of studies to investigate Tampa Bay's ecology began during the 1950s period prior to the initial boom in coastal development (see Simon, 1974 for review). A US National Marine Fisheries Service laboratory conducted many initial

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