Exploring the Geospatial Distribution of Water Quality Data for the 2016 Harmful Algal Bloom and Fish Kill in the Indian River Lagoon, Mosquito Lagoon, and Banana River Lagoon

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Challenge
The Indian River Lagoon (IRL) is a bar-built estuary extending from Ponce Inlet in Volusia County, Florida to Jupiter Inlet in Martin County, Florida (Steward and VanArman, 1987 and Lapointe et al., 2015). Excess availability of nutrients has fueled an increase in the frequency and intensity of harmful algal blooms (HABs) of multiple species in the IRL (Phlips et al., 2011). The IRL is particularly vulnerable to HABs because it is shallow, narrow, and has long water residence times, especially in southern Mosquito Lagoon, northern IRL and Banana River. Blooms can affect local economies, fisheries, recreation, and public health reducing levels of dissolved oxygen (DO), shading seagrasses and other benthic plants, or releasing toxins. Successful responses to blooms rely on clearly communicating the spatial distribution of key water quality characteristics.

Approach
Data were from monthly samples. Parameters of interest included dissolved oxygen (% saturation), chlorophyll-a (µg/L), temperature (°C), salinity (ppt), and pH (standard scale). Over 40 interpolations were run (see workflow below). Standard error represented a measure of accuracy. Raster images and contours visualized spatial distributions.

Results
Standard kriging with minor elongation of search radii to keep the focus on individual waterbodies was the best option. Models for concentrations of chlorophyll-a yielded the best fit (see figures to the right, with warmer colors representing higher concentrations). Models for dissolved oxygen, temperature, salinity, and pH yielded acceptable fits. Models for turbidity and concentrations of inorganic nitrogen and phosphorus were not sufficiently reliable.

Future Development
- Incorporate other datasets to fill gaps and improve kriging
- Address additional gaps identified in the One Lagoon Monitoring Plan and Network
- Discuss the type of sampling needed to increase the usefulness of data that informs management decisions, communication, and emergency response by agencies

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The photos above show the brown tide (Aureoumbra lagunensis) and fish kills that occurred during 2016.