

Coupling FerryMon based water quality monitoring to remote sensing for large scale assessment of water quality and habitat condition in Pamlico Sound, NC

North Carolina Albemarle-Pamlico Estuarine System (APES) is North America's second largest estuary and the most important coastal fisheries nursery in Southeast/Mid Atlantic. Despite ecological and economic significance, the Pamlico Sound remains the largest coastal system about which we know the least; in large part because no routine water quality assessment program exists for the Sound. This substantial knowledge gap makes it difficult to assess potentially negative habitat impacts associated with declining water quality, as observed in other, well monitored sub-estuaries of the Sound (e.g. Neuse and Pamlico River Estuaries). Exacerbating this gap is the lack of interdisciplinary expertise required to properly study this critical system lodged between the terrestrial and marine realms.

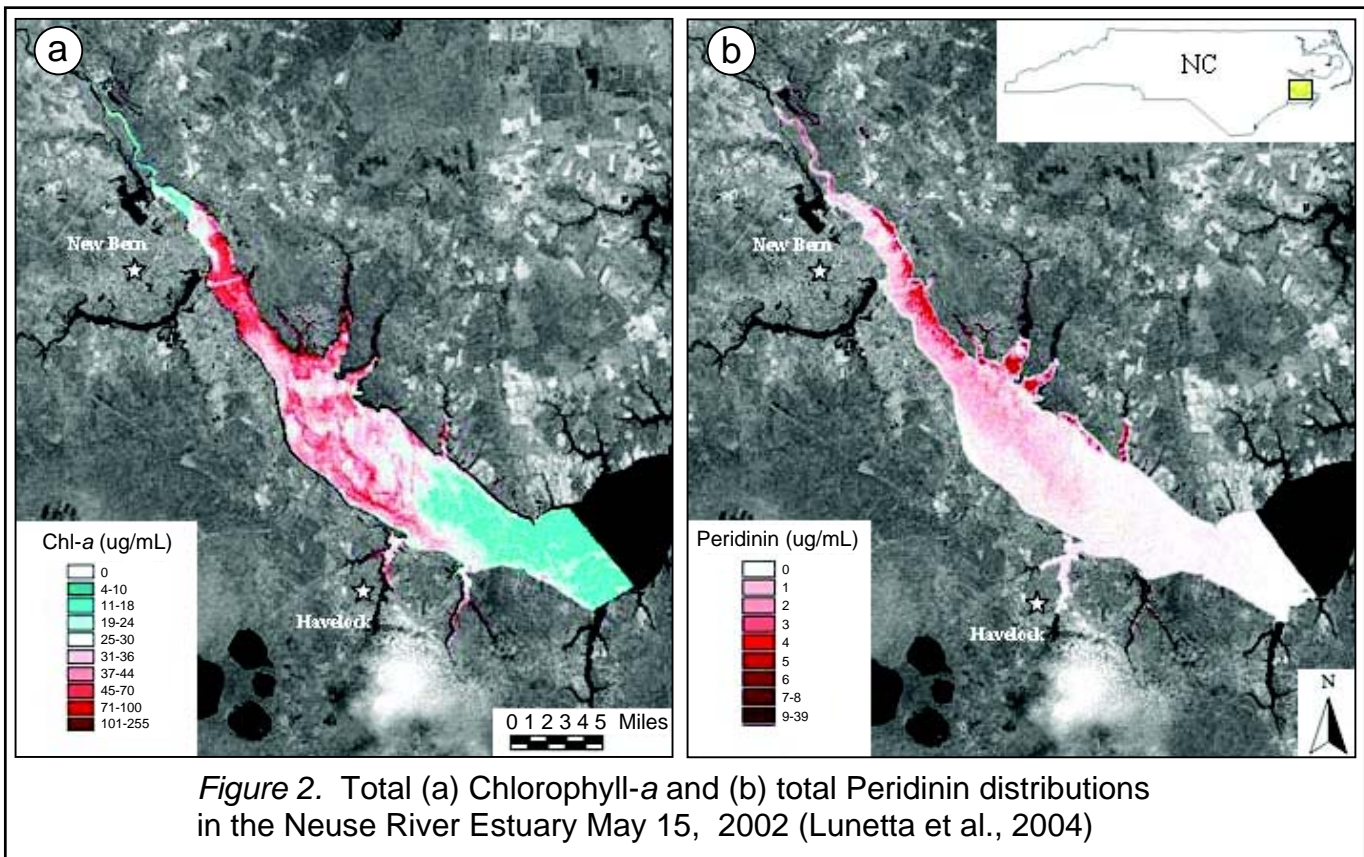
FerryMon (www.ferrymon.org) represents an investment in monitoring infrastructure designed to both gather baseline water quality information (including temperature, salinity, dissolved oxygen, turbidity, nutrients, chlorophyll *a* and other pigments as indicators of algal density and composition) and function as a spring board to attract and conduct advanced interdisciplinary research. A significant return on this investment has been the decision of EPA's Landscape Characterization Branch and NASA to target Pamlico Sound for a series of remote sensing missions. The decisions to fly missions during the summers of 2002 and 2004 have been due to in large part to the availability of the FerryMon Platform to calibrate and ground truth aircraft based optical instruments. A modified U2 reconnaissance plane mounted with an AVIRIS (Airborne Visible Infrared Imaging Spectrometer) instrument, capable of detecting differences in light absorbed and reflected by the vast amounts of suspended phytoplankton supporting the estuarine food chain, was flown at an altitude of 12 miles. By developing correlations between direct



Figure 1. FerryMon, EPA, NASA remote sensing mission, Pamlico Sound, NC

measurements on the ferries and remote measurements from the aircraft, (Figure 1) researchers are able to create maps of the amounts and types of suspended algae or phytoplankton across the entire estuary, well beyond the areas covered by the ferry routes.

Because phytoplankton determine the Sound's fertility and water quality, studying their distribution, diversity, and abundance is important for understanding ecosystem processes and the condition of this system. Of particular interest are periodic phytoplankton blooms, including dinoflagellate "red tides", which can occur in the Sound and adjacent coastal regions. Data from the 2002 flight was used to create maps of total chlorophyll *a* and the dinoflagellate indicator pigment peridinin in order to determine total phytoplankton and dinoflagellate biomass respectively (Figure 2). This work serves as the initial step in monitoring coastal waters well beyond the APES, awaiting the satellite deployment of AVIRIS sensors and instrumentation of ships of opportunity, such as those employed for the FerryMon water quality program.



Beyond this advanced remote sensing effort and the collection of baseline water quality data, the system has also been employed to explore human health concerns and natural disturbances. From a public health standpoint, the collection equipment on the ferry has allowed researchers to track coliform bacteria and virus concentrations that are detrimental to humans through direct contact or shellfish consumption. Addressing the

forecast of increasing hurricane frequency along the Atlantic Coast, information collected following Hurricane Isabel in 2003 showed a statistically significant increase in Pamlico Sound salinity due to the formation of a temporary inlet. These applications are examples of the many benefits FerryMon provides the State and Nation as they strive to improve assessment and management of our precious and resourceful coastal waters.

For additional information concerning the role FerryMon plays in determining water quality and habitat condition of the Pamlico Sound and its tributaries, visit our website (www.ferrymon.org) or contact the Principal Investigators:

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FerryMon is a collaborative project between the NC Dept. of Environment and Natural Resources, the NC Department of Transportation (Ferry Division), UNC-Chapel Hill, and Duke University.