

# NEWS RELEASE

Media Contacts: Dr. JoAnn Burkholder, 919/515-2726 or  
joann\_burkholder@ncsu.edu  
Dr. David Eggleston, 919/515-7840 or eggleston@ncsu.edu  
Mick Kulikowski, News Services, 919/515-3470 or  
mick\_kulikowski@ncsu.edu

June 14, 2004

## Study: Eastern N.C. Ecosystem Bounces Back From Hurricanes

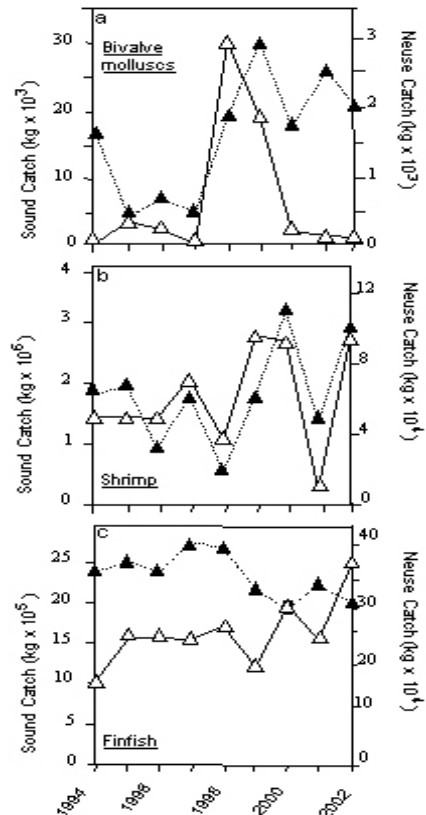
EMBARGOED FOR RELEASE UNTIL 5 P.M. EST ON MONDAY, JUNE 14

After receiving the brunt of powerful hurricanes in 1996 and 1999, the Neuse River and Estuary and western Pamlico Sound in eastern North Carolina appear to have suffered few long-term ill effects from the storms, and have actually benefited ecologically in some ways from the storms' scouring effects.

Those are the findings of a team of North Carolina State University scientists and collaborators from various North Carolina universities and government agencies.

Dr. JoAnn Burkholder, NC State professor of botany and director of the Center for Applied Aquatic Ecology, says the research shows that water quality, numbers and health of most of the area's shellfish and finfish, and the overall health of the surveyed water systems – though initially acutely affected by storms, especially Hurricane Fran in 1996 – have over the long run returned to normal, suggesting the resilience of estuarine systems such as the Neuse and Pamlico Sound. Some harmful organisms that took hold before the storms are now in abeyance, suggesting the storms beneficially flushed the areas studied. The one major estuary dweller that has been slow to recover is the blue crab, the researchers say, although its numbers are now creeping back toward average abundances.

The research is published online this week (June 14) in *Proceedings of the National Academy of Sciences (U.S.A.)*.



Annual commercial catch of bivalve molluscs (a), shrimp (b), and finfish (c) in Pamlico Sound (filled triangles) and the Neuse River Estuary (open triangles), 1994-2002 (N.C. Department of Environment and Natural Resources data).

- more -

After the storms, predictions abounded that Pamlico Sound, of the Albemarle-Pamlico Estuarine System – the largest lagoonal estuary in the United States – would be devastated by the cumulative effects of Hurricane Fran in 1996 and Hurricanes Dennis, Floyd and Irene in 1999.

But the longer-term data presented in this study show the remarkable recovery and resilience of the water quality and the finfish and shellfish inhabitants.

The paper shows that although less water volume was delivered by Hurricane Fran, large amounts of fish kills were reported due to oxygen depletion and high concentrations of contaminants like nitrogen, phosphorus and fecal bacteria. After the 1999 hurricane season, however, contaminant loads were about the same as in 1996, but no major fish kills were reported due to the enormous amount of flooding that diluted the pollution, Burkholder says.

Diminished levels of dissolved oxygen were documented after both storms. But those levels returned to normal shortly after the storms, the research shows.

Burkholder added that the storms displaced undesirable organisms – like the toxic alga *Pfiesteria*, linked to massive fish kills in the 1990s – to areas of the estuary that are less conducive for growth. *Pfiesteria* populations have shown minimal recovery.

The paper also states that commercial catch numbers of shrimp or bivalve molluscs such as clams and scallops did not suffer long-term effects from the storms.

The one species affected negatively for a longer period of time by the storms was the blue crab, the paper asserts. Reductions in the number of blue crabs can be attributed, says Dr. David Eggleston, professor of marine science at NC State and co-author of the paper, to the relationship between hurricane floodwaters, the crabs' migration response to the floodwaters and the subsequent overfishing of the mass-migrating crabs.

“We feel the historically low abundances of blue crabs in 2000 and 2001 are a direct result of the interactions between floodwaters and overfishing,” Eggleston said. “The blue crabs migrated en masse, which concentrated them and made them more vulnerable to fishing.”

Another piece of the puzzle involved the areas where the blue crabs colonize, Eggleston says. Floodwaters from the rivers impeded the movement of post-larval stages of the blue crab from seawater inlets to their nursery habitats along the western shore of Pamlico Sound.

Eggleston says, though, that his new stock assessments of the blue crabs will shed further light on its status in Pamlico Sound.

“The overall story we see is of estuarine resilience to impacts from these types of major storms,” Burkholder said. “The negative predictions about long-term devastation of water quality and fisheries, made right after the storms, were not borne out.”

- more -

Funding for the study was provided by the Environmental Protection Agency, the N.C. General Assembly, the National Science Foundation and N.C. Sea Grant.

- kulikowski -

**Note to editors:** An abstract of the paper follows.

## **“Comparative Impacts of Two Major Hurricane Seasons on the Neuse River and Western Pamlico Sound Ecosystems”**

*Authors:* JoAnn Burkholder, David Eggleston, Howard Glasgow, Cavell Brownie, Robert Reed, Gerald Janowitz, Greg Melia, Carol Kinder, Nora Deamer and Jeffrey Springer, North Carolina State University; Martin Posey and Troy Alphin, University of North Carolina-Wilmington; Reide Corbett, East Carolina University; David Toms, of NC State at the time of the study, now at the N.C. Department of Environment and Natural Resources Division of Water Quality

*Published:* The week of Monday, June 14, 2004, in the online version of *Proceedings of the National Academy of Sciences (U.S.A.)*

**Abstract:** Ecosystem-level impacts of two hurricane seasons were compared several years after the storms in the largest lagoonal estuary in the United States, the Albemarle-Pamlico Estuarine System. A segmented linear regression flow model was developed to compare mass-water transport and nutrient loadings to a major artery, the Neuse River Estuary, and to estimate mean annual versus storm-related volume delivery to the Neuse River Estuary and Pamlico Sound. Significantly less water volume was delivered by Hurricane Fran (1996), but massive fish kills occurred in association with severe dissolved oxygen deficits and high containment loadings (total inorganic nitrogen, total phosphorus, suspended solids, fecal bacteria). The high water volume of the second hurricane season (Hurricanes Dennis, Floyd, Irene in 1999) delivered generally comparable but more dilute contaminant loads, and no major fish kills were reported. There were no discernable long-term adverse impacts on water quality. Populations of undesirable organisms such as toxic dinoflagellates were displaced down-estuary to habitats less conducive for growth. The response of fisheries was species-dependent: There was no apparent impact of the hurricanes on commercial landings of bivalve molluscs or shrimp. In contrast, interacting effects of hurricane floodwaters in 1999 and intensive fishing pressure led to striking reductions in blue crabs. Overall, the data support the premise that in shallow estuaries frequently disturbed by hurricanes, there can be rapid recovery in water quality and biota, and benefit from the scouring activity of these storms.