Tides at the mouth of the Roanoke River are well correlated with tides in Croatan Sound. Even during periods of falling water levels in Albemarle Sound, the tidal signal at Croatan Sound is transmitted upstream to the mouth of the Roanoke River. There is about a 9-hour lag between the time of high tide in Croatan Sound and high tide at the mouth of the Roanoke River, but the observed tidal amplitude in Croatan Sound and at the mouth of the Roanoke generally was about 0.45 foot.

INTRODUCTION

In 1990, a 3-year investigation was begun to (1) develop a model for computing flows in the lower Roanoke River between Williamston and Albemarle Sound, and evaluate flow distributions in the Roanoke River delta, (2) characterize water-quality conditions in Albemarle Sound, and (3) describe the circulation regime of Albemarle Sound, particularly in relation to inflows.

The Roanoke River is one of North Carolina's most important surface-water resources. The Roanoke River drainage basin includes 9,666 mi^2 in southern Virginia and northern North Carolina (fig. 1). The annual average discharge of the Roanoke to Albemarle Sound is estimated to be about 8,900 ft^3/s (Giese and others, 1985). Interest in the lower Roanoke River (between Roanoke Rapids and Albemarle Sound) has increased recently because of the creation of the Roanoke River National Wildlife Refuge, the decline of striped bass and herring fisheries in the river (Manooch and Rulifson, 1989), the potential for increased wastewater discharges to the river, and the possibility of the transfer of additional water out of the Roanoke basin.

The Roanoke River flows into Albemarle Sound (fig. 1) through a complex system of distributaries in the river delta. Albemarle Sound is an extensive, permanent oligohaline estuary that is unique on the East Coast (Copeland and others, 1983). The sound receives drainage from an 18,359-mi^2 basin, including the Roanoke River basin, and has a surface area of 480 mi^2. Seven lateral estuaries (Chowan, Perquimans, Pasquotank, Little, North, Alligator, and Scuppernong Rivers) and Currituck Sound contribute an additional 500 mi^2 of open water to the system. Albemarle Sound is an important nursery area for estuarine-dependent fish and serves as a pathway for anadromous fish spawning in the freshwater tributaries of Albemarle Sound. Albemarle Sound contributes more than half of the total freshwater inflow to Pamlico Sound, which is connected to Albemarle Sound by Croatan and Roanoke Sounds.

Despite the importance of these resources, the Roanoke-Albemarle system has been identified as an area in which hydrologic and water-quality information is sorely deficient for characterization and management of the resource (Copeland, 1989). Because of severe water-quality problems in the 1970's, the Chowan River, the second largest tributary to Albemarle Sound, has been the subject of numerous hydrologic and water-quality studies. However, little information on flow and transport in the lower Roanoke River is available. Likewise, comprehensive studies have not previously been conducted on circulation and transport in Albemarle Sound, or on the relation between Albemarle Sound circulation and Roanoke River inflows.