

# Water-Quality Assessment of the New England Coastal Basins in Maine, Massachusetts, New Hampshire, and Rhode Island: Environmental Settings and Implications for Water Quality and Aquatic Biota

By Sarah M. Flanagan, Martha G. Nielsen, Keith W. Robinson, *and* James F. Coles

## Abstract

The New England Coastal Basins in Maine, Massachusetts, New Hampshire, and Rhode Island constitute one of 59 study units selected for water-quality assessment as part of the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) program. The New England Coastal Basins study unit encompasses the fresh surface waters and ground waters in a 23,000 square-mile area that drains to the Atlantic Ocean. Major basins include those of the Kennebec, Androscoggin, Saco, Merrimack, Charles, Blackstone, Taunton, and Pawcatuck Rivers. Defining the environmental setting of the study unit is the first step in designing and conducting a multi-disciplinary regional water-quality assessment. The report describes the natural and human factors that affect water quality in the basins and includes descriptions of the physiography, climate, geology, soils, surface- and ground-water hydrology, land use, and the aquatic ecosystem.

Although surface-water quality has greatly improved over the past 30 years as a result of improved wastewater treatment at municipal and industrial wastewater facilities, a number of water-quality problems remain. Industrial and municipal wastewater discharges, combined sewer overflows, hydrologic modifications from dams and water diversions, and runoff from urban land use are the major causes of water-quality

degradation in 1998. The most frequently detected contaminants in ground water in the study area are volatile organic compounds, petroleum-related products, nitrates, and chloride and sodium. Sources of these contaminants include leaking storage tanks, accidental spills, landfills, road salting, and septic systems and lagoons. Elevated concentrations of mercury are found in fish tissue from streams and lakes throughout the study area.

## INTRODUCTION

The National Water-Quality Assessment (NAWQA) program of the U.S. Geological Survey (USGS), is designed to assess the status and trends in the quality of the Nation's ground- and surface-water resources and aquatic biological communities, and to develop an understanding of the major factors that affect water-quality conditions (Hirsch and others, 1988; Leahy and others, 1990). Investigations of water quality in more than 50 major hydrologic basins and aquifer systems, referred to as NAWQA study units, form the building blocks of the program. The NAWQA study units include 60 to 70 percent of the Nation's water use and population served by public-water supplies (Leahy and Wilber, 1991). The first group of 20 study-unit investigations as part of the NAWQA program began in 1991. A second group of 16 study-unit investigations was initiated in 1994; and a third group of 12 investigations began in 1997. This last group includes the New England Coastal Basins study unit.

The New England Coastal Basins study unit (referred to as the study area in the remainder of the report) encompasses 23,000 mi<sup>2</sup> in western and central Maine, central and eastern New Hampshire, eastern Massachusetts, most of Rhode Island, and a very small part of Connecticut (fig. 1). The major islands of Martha's Vineyard, Nantucket Island, and Block Island are also part of the study area. The study area includes the drainage basins of the Kennebec, Androscoggin, Saco, Merrimack, Charles, Blackstone, Taunton, and Pawcatuck Rivers, as well as small coastal drainage basins between these major river basins. Almost two-thirds of New Hampshire is in the study area, as well as a third of Maine, half of Massachusetts, and 95 percent of Rhode Island (fig. 1). In addition, a very small part (1.1 percent) of Connecticut in New London and Windham Counties is in the study area. Every county in New Hampshire and Rhode Island lies either entirely or partly within the study area. In Maine, the study area includes all of five counties (Franklin, Oxford, York, Cumberland, and Androscoggin) and parts of seven more (Somerset, Piscataquis, Penobscot, Waldo, Kennebec, Lincoln, and Sagadahoc). In Massachusetts, the study area includes all of Barnstable, Bristol, Norfolk, Suffolk, Plymouth, Dukes, and Nantucket Counties and parts of Worcester, Middlesex, and Essex Counties (fig. 1).

The quality of surface and ground waters in the New England Coastal Basins study area will be assessed intensely by the USGS for 6-7 years. Assessment activities will include a review of existing water-quality information, collection and analysis of water-quality and aquatic organism samples, and preparation of reports and other summaries describing the results of work performed (Ayotte and Robinson, 1997).

## **Purpose and Scope**

This report describes the environmental setting of the New England Coastal Basins study area, including its physical and cultural characteristics. The influence of the environmental setting on water quality will also be discussed. The description of the environmental setting will be based primarily on a review of existing reports, research, and data.

Information presented in this report will serve as the basis for the design of a water-quality monitoring and assessment program of the study area. This water-quality monitoring and assessment program will attempt to define how these environmental settings influence ground- and surface-water quality and aquatic ecology.

## **Acknowledgments**

The authors gratefully acknowledge the assistance provided by members of the Liaison Committee of the New England Coastal Basins study area, and the organizations they represent, for the data and information provided during the preparation and review of this report. The authors would like to recognize Marc Loiselle and Thomas Weddle of the Maine Geological Survey for providing information and guidance on bedrock and surficial geology, and Amy Rolfs, a U.S. Geological Survey intern, for her contributions to the report. Robert Rourke, University of Maine at Orono, and Steve Hundley, U.S. Department of Agriculture, provided data on soil chemistry in Maine and New Hampshire, respectively. James Omernik, U.S. Environmental Protection Agency, provided data on ecoregions, total alkalinity in streams and lakes, and the 22 District Conservationists of the U.S. Department of Agriculture Natural Resources Conservation Service provided information on agricultural activities.