

## Ecological Regions and Fisheries

The dominant ecological systems and regions in the study area are described in this section. The biological and physical components of these ecological systems have been grouped into relatively homogeneous ecological regions and systems and into site-specific aquatic habitat types by previous investigators.

### Ecoregions

General patterns of vegetation and aquatic habitat can be broadly defined by ecoregions (Omernik, 1987; U.S. Environmental Protection Agency, 1997). These ecoregions were developed for the conterminous United States to divide the landscape into areas having relatively similar characteristics of landform, land use, soil, and "potential natural vegetation" (considered to be the type of climax forest that would develop upon removal of humans and their activities).

The study area includes parts of three national ecoregions (U.S. Environmental Protection Agency, 1997; fig. 15 and table 5). Two of these, Northeastern Highlands and Northeastern Coastal Zone, make up more than 95 percent of the area. These ecoregions generally separate the inland mountainous forested regions from the coastal lowland hills and plains. A small area in the extreme southeastern part of the study area is within the Middle Atlantic Coastal Plain ecosystem. This area is the northernmost section of a coastal area extending through Long Island, New York, and from New Jersey south to Georgia and emphasizes the unique ecological characteristics of the Cape Cod area and the islands of Massachusetts and Rhode Island.

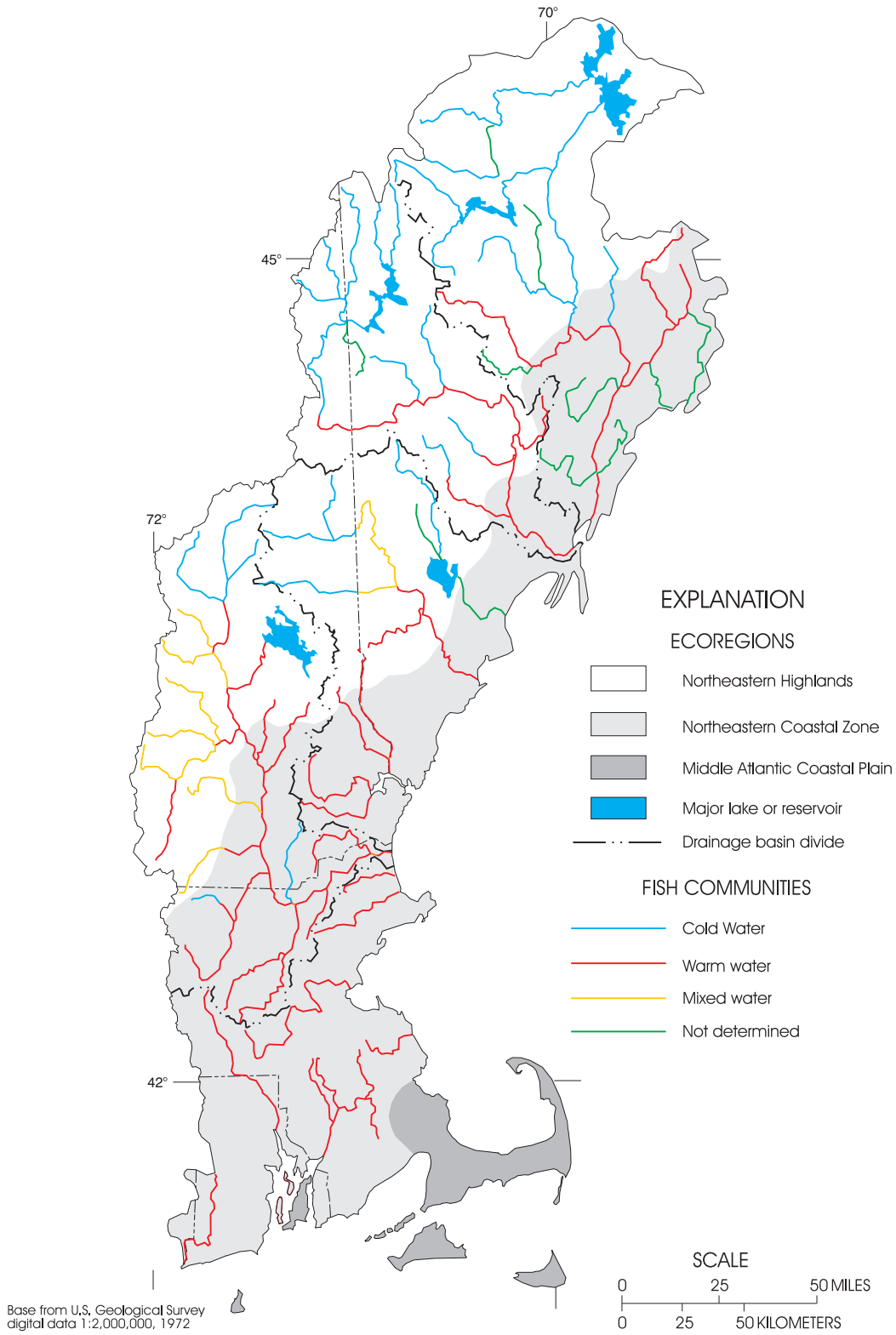
### Fisheries

Surface waters have been classified according to whether they contain predominantly warm-water fish species, cold-water fish species, or a mixture of both (fig. 15). Streams and lakes considered to have cold-water fisheries can be loosely defined as waters that support, on a year-round basis, wild and stocked brook trout (*Salvelinus fontinalis*) or other species requiring similar conditions. Generally, a cold-water designation is determined from a fish survey of the stream in question. For example, when a viable population of brook trout is found in a stream it is considered a cold-

water fisheries. Massachusetts is the only state in the study area that has a formal definition of cold-water fisheries—waters in which the maximum mean monthly temperature generally does not exceed 20° C and, when other ecological factors are favorable (such as habitat), are capable of supporting a year-round populations of cold water stenothermal aquatic life such as trout (Massachusetts Department of Environmental Protection, 1995a). Warm-water fish streams and lakes support fish species such as smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), and chain pickerel (*Esox niger*). Warm-water streams and lakes can also contain stocked trout or salmon but these fish may not survive year-round. Streams and lakes considered to be a mixture of cold- and warm-water fisheries contain species and habitat that are suitable for both types of fisheries. Furthermore, a stream may be considered a mixed fishery when there is a transition from a cold to a warm-water fishery along its stream reaches.

Streams and lakes in Maine were classified in the Inland Fisheries River Management Plan (Maine Department of Inland Fisheries and Wildlife, 1982). Streams and lakes in New Hampshire were classified using information provided by State fisheries biologists (Jonathan Greenwood and Charles Thoit, New Hampshire Department of Fish and Game, oral commun., 1994). Information regarding fisheries in Rhode Island was provided by a State fisheries biologist (Dennis Erkan, Rhode Island Department of Environmental Management, Division of Fish and Wildlife, oral commun., 1997).

In the study area, the geographical distinction between cold- and warm-water fisheries closely follows the distinction between the Northeastern Highlands and Northeastern Coastal Zone ecoregions (fig. 15). The landform surface also is important in determining the temperature of a stream because of differences in elevation. The landform surface of the Northeastern Highlands is low mountains and typically have lower water temperatures than the valleys in the Northeastern Coastal Zone. Kimball (1986) showed that for Massachusetts the location of cold-water streams was closely dependant on elevation. Cold-water fisheries generally were limited to streams throughout the state that had a minimum mean basin elevation of 190 ft; the maximum mean monthly temperature of streams at this elevation typically did not exceed 20° C. Elevation, however, can not be used exclusively to determine which



**Figure 15.** Ecoregions and fish communities in the New England Coastal Basins, in Maine, Massachusetts, New Hampshire, and Rhode Island.

**Table 5.** Descriptions of ecoregions in the New England Coastal Basins study area in Maine, Massachusetts, New Hampshire, and Rhode Island

[mi<sup>2</sup>, square miles; --, no data; from Omerik, 1987]

Ecoregion name	Area, in mi <sup>2</sup> (percent of study area)	Landforms	Potential natural vegetation	Land cover	General soils
Northeastern Highlands	12,500 (54)	Low mountains, open low mountains	Northern hardwoods/spruce, northeastern spruce/fir, northern hardwoods	Forest and woodland (mostly ungrazed)	Spodosols (frigid and cryic)
Northeastern Coastal Zone	9,850 (42.5)	Irregular plains, plains with low hills, open hills (no extremes)	Appalachian oak forest	Woodland and forest with some cropland and pasture, urban	Inceptisols
Middle Atlantic Coastal Plain	860 (3.5)	Flat plains	Oak/hickory/pine	Woodland and forest with some cropland and pasture, swamp	--

streams are cold-water fisheries. Anthropogenic changes can alter streams from cold- to warm-water fisheries. Conversely, cold-water fisheries can be found at low elevations in protected headwater streams. These streams are able to support cold-water species because they are primarily fed by ground water, have dense vegetative cover, and have high gradient slopes—all of which contribute to cool water with high dissolved oxygen. For these reasons, state biologists prefer to determine the status of a stream, with regard to the fish it can support, by sampling the fish community along a designated segment rather than by elevation only.

Despite the widespread modification of aquatic habitat that has taken place over the 200 years as a result of dams, water pollution, shoreline develop-

ment, and the introduction of exotic species, the rivers and lakes of the study area continue to support varied fisheries. Efforts to restore Atlantic salmon, American shad, and alewife to many rivers and streams began in the early 1970's. These efforts have included providing upstream passages in streams that were formerly blocked, the release of juvenile fish, and assessing potential habitat (Technical Committee for Anadromous Fish Restoration in the Merrimack River, 1990; and U.S. Fish and Wildlife Service, 1987). Maine, New Hampshire, Massachusetts, and Rhode Island have routine fish stocking programs that focus on important freshwater-game fishes. These stocking programs help to support fish populations that are often depleted by recreational fishing.