

# Development of an Index of Biotic Integrity for Macroinvertebrates in Freshwater Low Gradient Wadeable Streams in Southeast New England

## FINAL REPORT



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## Executive Summary

Under the Clean Water Act, state environmental agencies are charged with monitoring and assessment of streams and rivers. Currently, the Massachusetts Department of Environmental Protection (MassDEP) and the Rhode Island Department of Environmental Management (RIDEM) collect water chemistry data and sample biological communities to characterize the condition of streams. Where available, these data are compared against water quality standards and biological criteria that have been developed to quantify water quality conditions. Along the coast of southeast New England, non-tidal, low gradient, slow-moving streams that either lack or have infrequent riffle habitat are fairly prevalent. Yet, until recently, stream assessment efforts in New England have largely focused on moderate to high gradient, rocky-bottom streams with riffle habitats.

MassDEP and RI DEM have collected macroinvertebrate samples from riffle habitats for many years and have developed riffle habitat multimetric indices to assess the effects of anthropogenic stress on macroinvertebrate assemblages (Jessup et al. 2012, Jessup and Stamp 2020). Multimetric indices (also referred to as Indices of Biotic Integrity (IBIs)) are numeric representations of biological condition based on the combined signals of several different assemblage measurements (Karr 1981). The raw measurements are recalculated or standardized as biological metrics, or numerical expressions of attributes of the biological assemblage (based on sample data) that respond to human disturbance in a predictable fashion. The index scores provide a measure of how far conditions at a site have deviated from the expected state of the macroinvertebrate community, which is based on comparisons with reference sites.

Because there are natural differences in the structure and function of macroinvertebrate assemblages in low gradient versus faster-moving, rocky-bottom streams, the collection methods and riffle habitat multimetric indices that MassDEP and RI DEM have developed cannot be effectively applied in the low gradient, slow-moving streams that occur along the coast of southeast New England. To address this, MassDEP developed a low gradient, multihabitat collection method for macroinvertebrates in 2013. The multihabitat method allowed for effective sampling of snags, root wads, leaf packs, aquatic macrophytes, undercut banks, overhanging vegetation, fine sediments, and hard substrates. In 2019, with funding from the U.S. Environmental Protection Agency (U.S. EPA) Southern New England Program (SNEP), the multihabitat collection method was used to sample over 50 sites in low gradient, non-tidal, wadeable streams in MA and RI. The sites were located in the SNEP region, which consists of coastal watersheds in Cape Cod, Narragansett Bay, Buzzards Bay, and the Islands. The intent of collecting these data was to obtain a dataset that could be used to calibrate a low gradient IBI for macroinvertebrate assemblages in the SNEP region. The Low-Gradient Coastal Index of Biotic Integrity (IBI) for Wadeable Waters in Southern New England project is supported by the Southeast New England Program (SNEP) Watershed Grants. SNEP Watershed Grants are funded by the U.S. Environmental Protection Agency (EPA) through a collaboration with Restore America's Estuaries (RAE) and awarded to the NEIWPCC. For more on SNEP Watershed Grants, see [www.snepgrants.org](http://www.snepgrants.org).

In this report, we describe the development of a low gradient multihabitat IBI for the SNEP region. The IBI calibration dataset included data from 109 sites in Massachusetts (MA) and Rhode Island (RI). This work was done concurrently with the development of a statewide low gradient IBI for Massachusetts, which utilized data from an additional 69 low gradient sites located outside the SNEP region. There was overlap across the MassDEP and SNEP datasets and several staff members from MassDEP participated in both projects. Thus, the two projects were not completely independent and often were informing one another.