MassDEP's Surface Water Monitoring Program

Wastewater Advisory Committee, October 7, 2016

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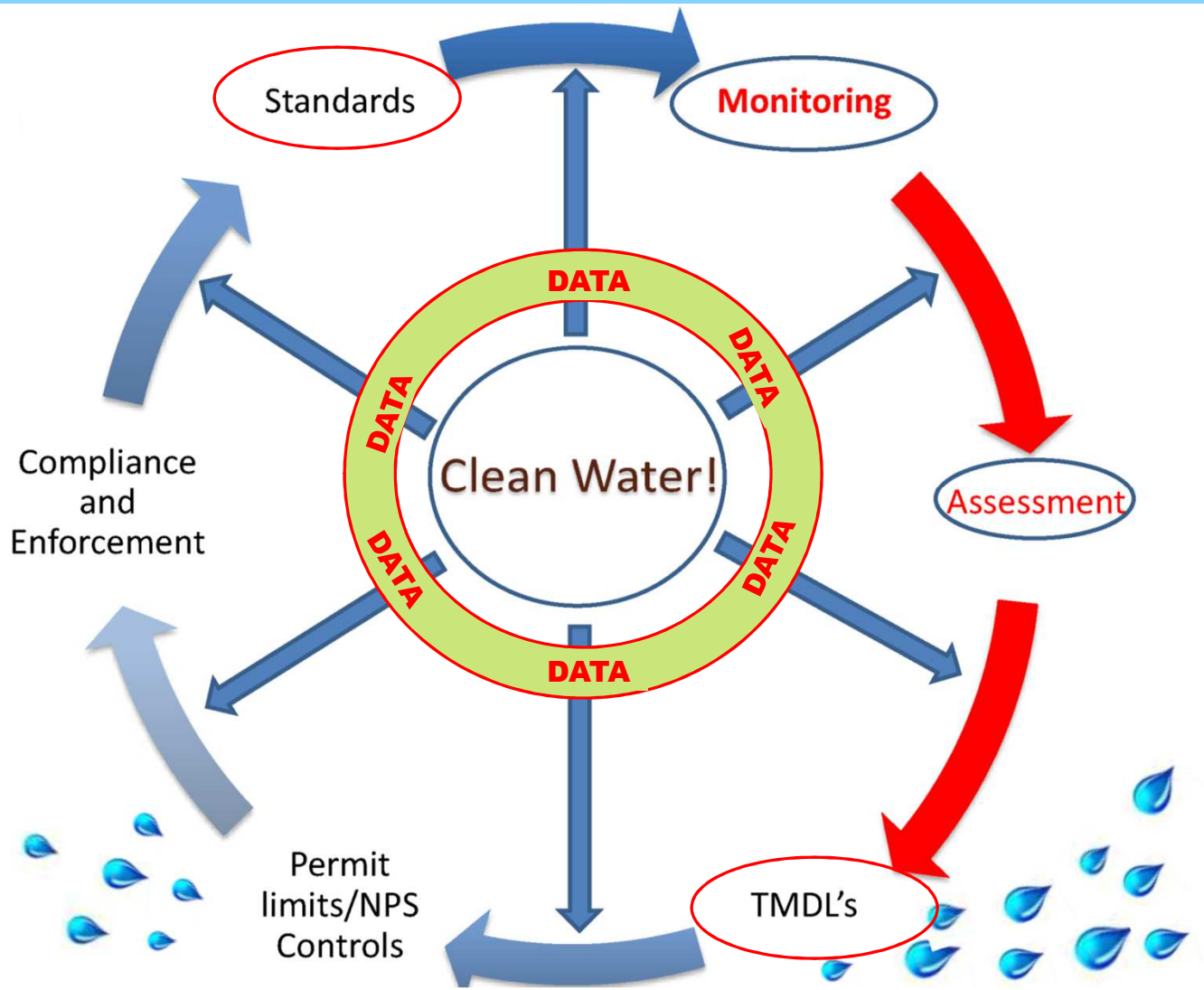
Outline

* Background CWA
* Monitoring Networks
* Probabilistic Monitoring
* Water Resource Management Trends

Background

* CWA goal to restore and maintain integrity of Nation's waters
* MassDEP administers a multi-faceted water quality management program
* Program relies on credible water monitoring data to inform decision-making
* States allowed flexibility to design and carry out water monitoring programs

MassDEP Watershed Planning Program Scope



Monitoring Program Objectives

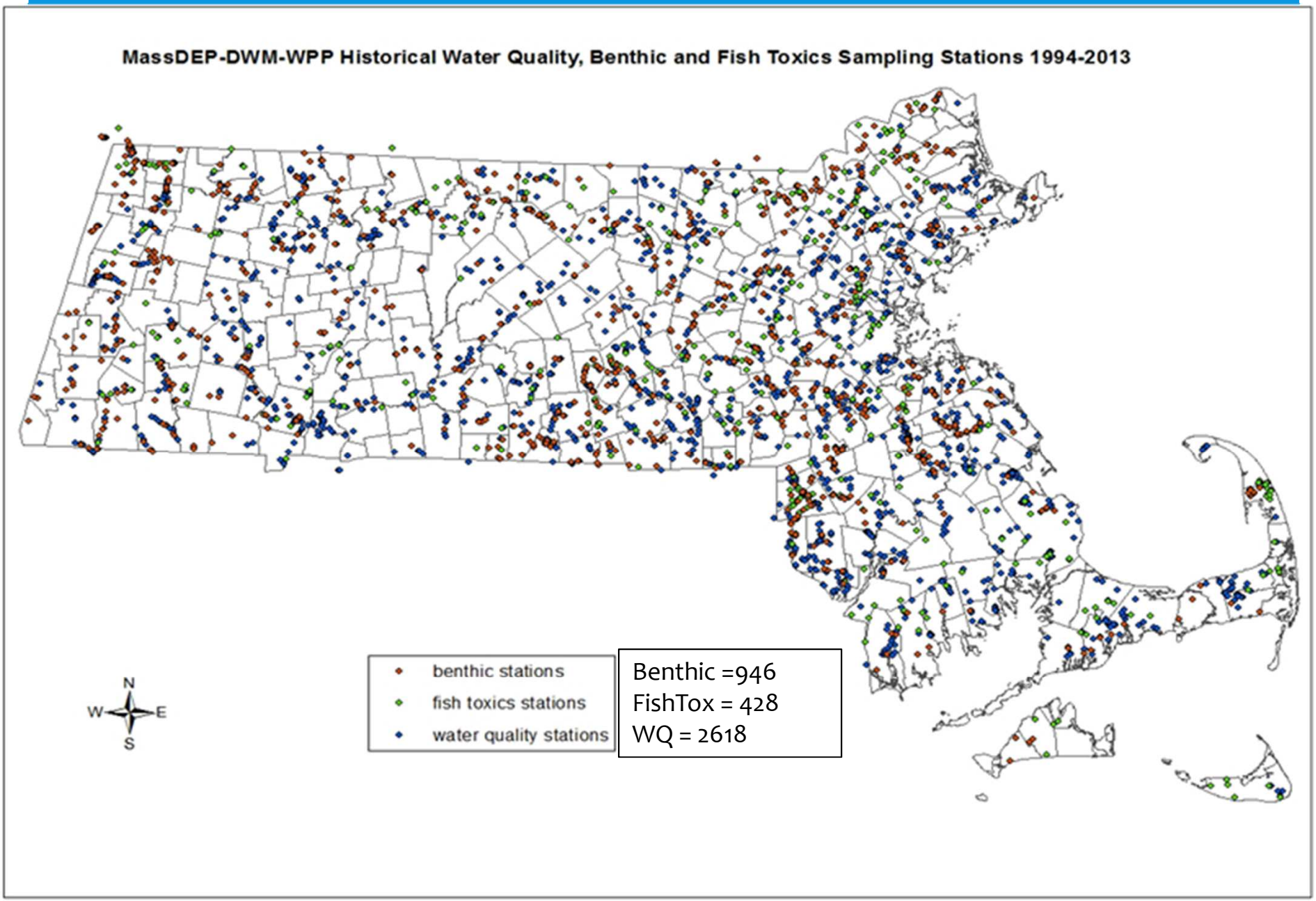
* Assess the status or condition of Massachusetts' waters: *Water is the current condition relative to management goals?*
* Develop, implement and evaluate pollution control strategies: *Watershed plans, total maximum daily loads (TMDL), wastewater permit effluent limits*
* Review standards: *cold water fisheries, EPA Guidance toxics (cadmium (2016); EPA Recreation Criteria (2012)*
* Measure the effectiveness of water quality management programs – *Are we meeting water Quality Standards?*

Monitoring Networks

* **Deterministic** ("Targeted") Site- or Issue-specific Networks implemented on rotating watershed or priority-driven schedules
* **Fixed-site Networks** of strategic sites sampled long-term at regular intervals to assess loadings and trends
* **Statistically-valid** ("Probabilistic") Networks employ randomly selected sites to provide unbiased assessments to be applied at larger scales (state-wide)

Monitoring Networks

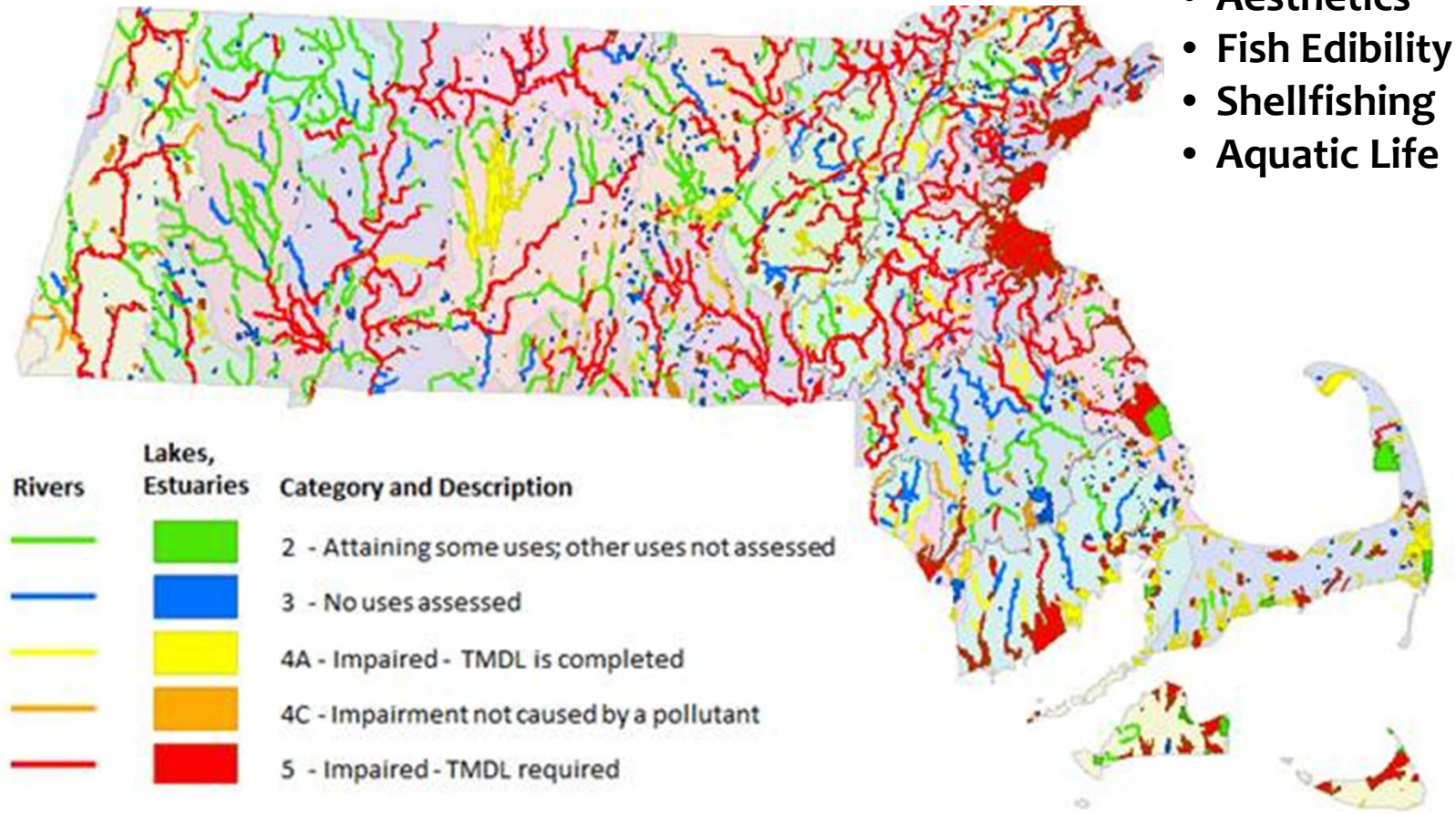
* Deterministic – “Targeted” [1994-2011]:
  - 5-year rotating basin
  - Location specific assessment
  - Condition of surface water
  - Many locations Co-located with WWTP discharges


MassDEP-DWM-WPP Historical Water Quality, Benthic and Fish Toxics Sampling Stations 1994-2013
benthic stations
fish toxics stations
water quality stations
Benthic =946
FishTox = 428
WQ = 2618
N
W
E
S

Water Quality Assessment

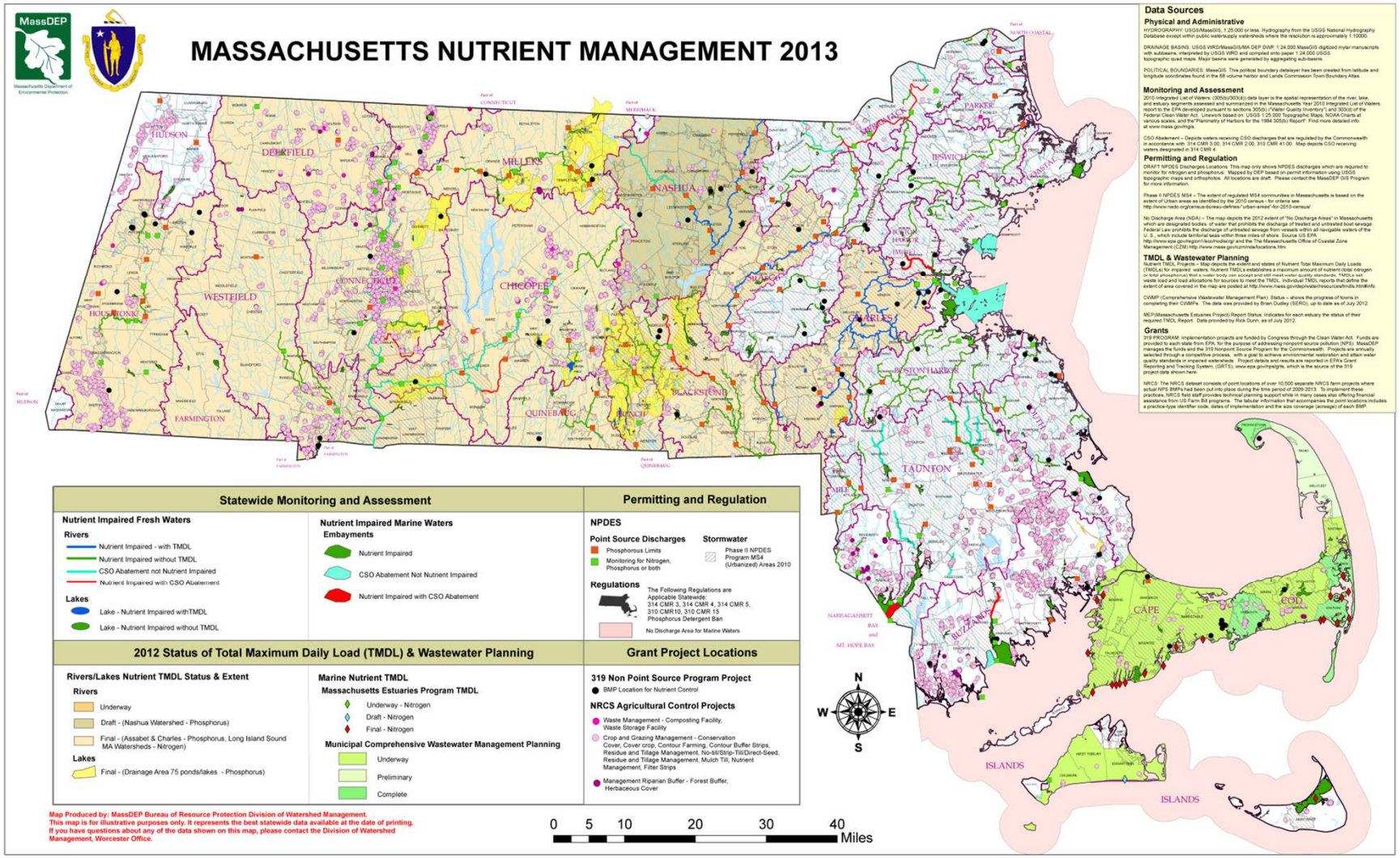
MassDEP Integrated List of Waters

- Primary Contact
- Secondary Contact
- Aesthetics
- Fish Edibility
- Shellfishing
- Aquatic Life



Pollution Control Nutrient TMDLs

http://www.mass.gov/eea/agencies/massdep/water/watersheds/massachusetts-nutrient-management-report-2013.html



What is Probabilistic Monitoring?

Uses a randomly selected subset of a defined target population to provide an unbiased estimate on the condition of the target population along with a statement on the uncertainty of the estimate.

* Randomly selected subset – ensures "representativeness" or unbiased estimate
* Target populations – Lakes, wetlands, wadeable streams, cold water fisheries, large rivers, marine and coastal etc.
* Uncertainty statement – ex. 53% +/- 3%of lakes support aquatic life

EPA Rationale for Probabilistic Monitoring

* Clean Water Act (CWA) Section 305(b) – condition of all waters
* Cost-effectiveness – Census vs. Probability surveys
* Provides a more complete and less biased assessment of water quality condition in the state **(sample clean and dirty)**
* Potential to improve resource allocation among competing monitoring objectives
* Potential to streamline CWA Section 305(b) reporting
* Encouragement from EPA to include statistical surveys in the state monitoring strategy = **Funding**
* **National Assessment of Water Quality**

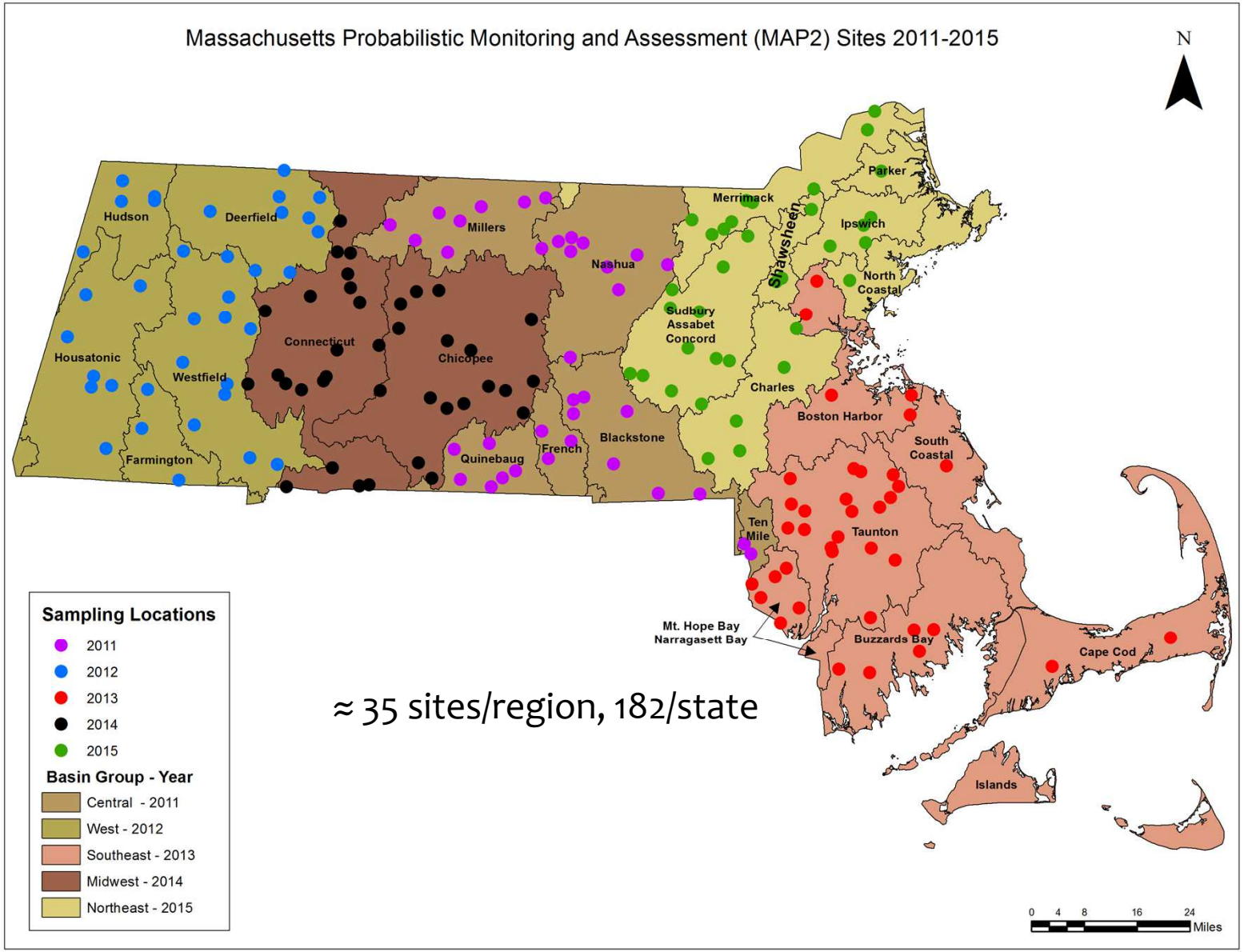
Massachusetts Probabilistic Monitoring and Assessment Program (streams)

* Objectives
  * Provide an unbiased assessment (Support/Impaired)
  * Provide an unbiased estimation of the major causes & sources of impairments
  * Potential to provide an analysis of trends (repeat sampling of random sites)
  * Continue to explore opportunities for other data analysis that will provide insight into the water quality condition of the target population (e.g. biological criteria development)

Wadeable Streams (2011-2015)

* Design
  * **Target Population:** All wadeable 1st – 4th Strahler Order non-tidal perennial rivers and streams within MA
  * **Sample Frame:** National Hydrography Dataset (NHD) (1:24,000)
  * **Stratification:** Sites stratified by 5 basin groups
  * **Sites Selected:**
    * 35 base and 128 oversample per basin group
    * 182 base sites statewide

Wadeable Stream Sites Sampled (2011-2015)

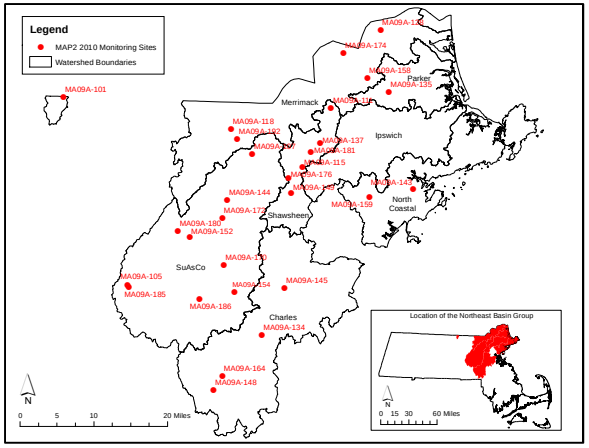


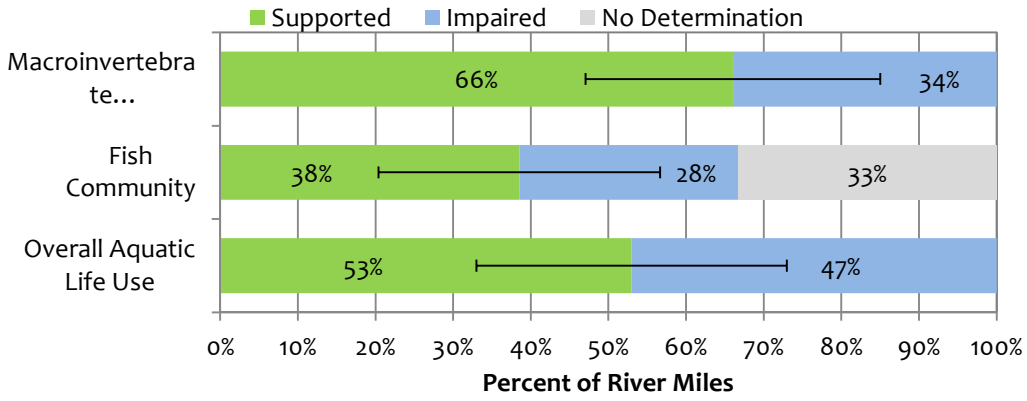
MA Wadeable Streams (2011-2015)

Sampling Plan

* Water Quality: monthly (May - September)
  * E. coli, total phosphorus, total nitrogen, ammonia, chloride, color, turbidity
* Dissolved metals: monthly (June - August)
* Deployed multi-probes: variable (May - Sept)
  * Continuous dissolved oxygen and temperature
* Macroinvertebrate community: once (July - August)
* Fish community: once (August – September)

Example Results

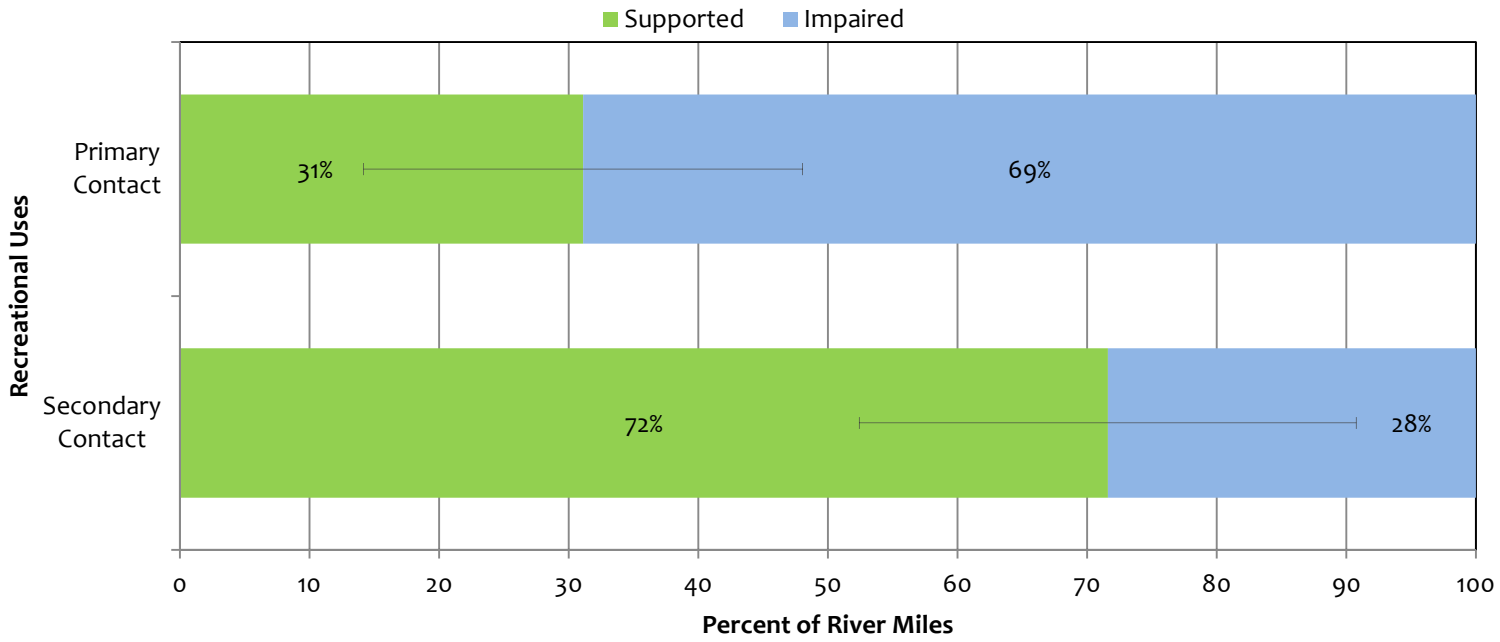




Extent of *Aquatic Life Use* stressors violating water quality criteria or guidance values in the target population. Error bars represent the 95% confidence interval.

Example Results

Percentage of river miles in the target population supporting *Primary Contact Recreational Use and Secondary Contact Recreational Use*. Error bars represent the 95% confidence intervals.

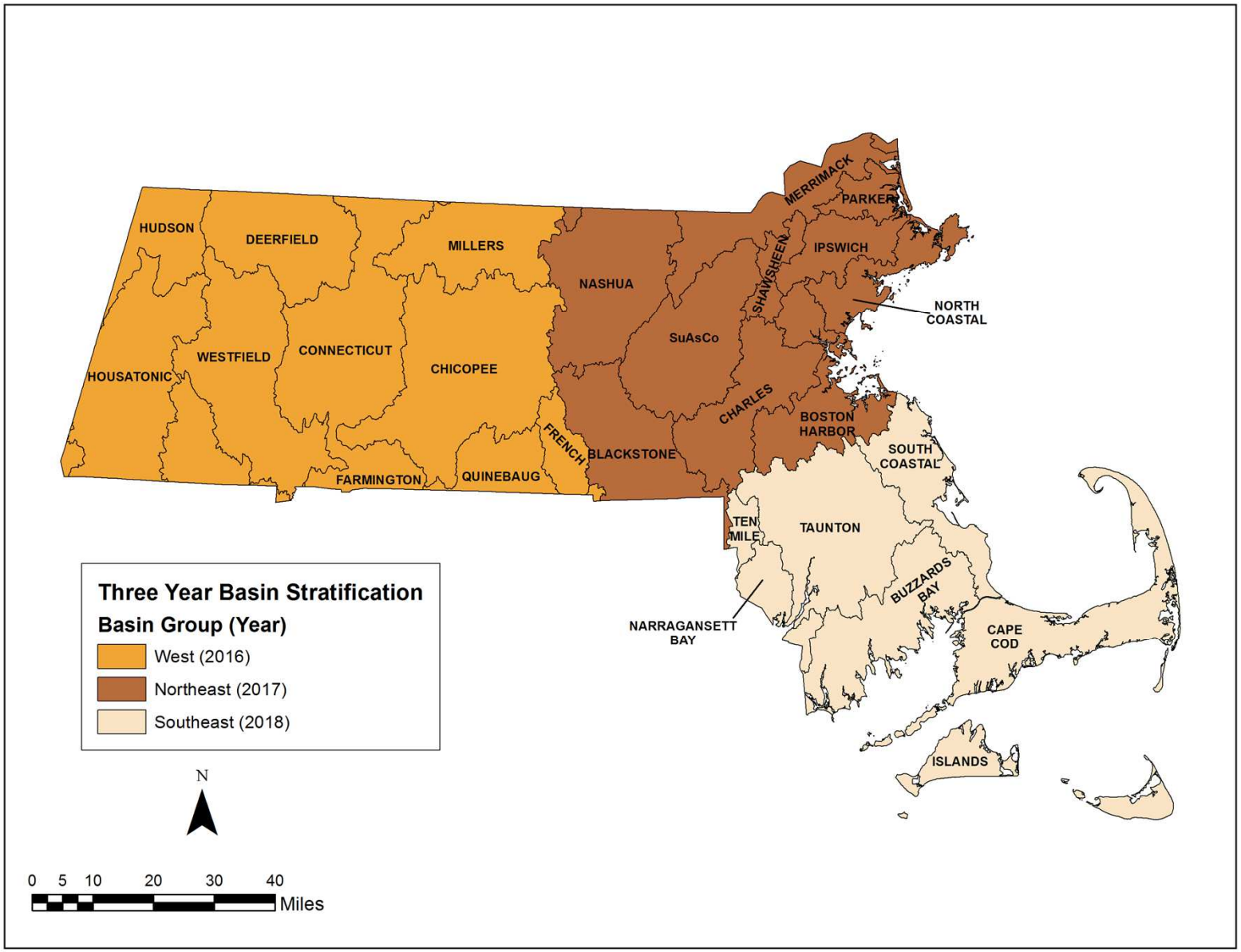


Lakes (2016-2018)

Design

* **Target Population:**
  * All permanent freshwater lakes, reservoirs, & ponds in MA
  * > 2 hectares in surface area and > 2 meters at max depth
* **Sample Frame:** National Hydrography Dataset (NHD) (1:24,000)
* **Stratification:** Sites stratified by 3 basin groups
* **Sites Selected:**
  * 25 base and 100 oversample per basin group
  * 75 base sites statewide

Lakes Three Year Basin Stratification



Lakes (2016-2018)

Sampling Plan

Index Site (max lake depth)

* Frequency - every 6 weeks (June - September)
* Secchi disk
* Depth profiles - dissolved oxygen, temperature, pH, and specific conductivity
* Epilimnion – total phosphorus, total nitrogen, chloride, alkalinity, hardness, dissolved organic carbon, dissolved silica, color and turbidity
* Hypolimnion – total phosphorus and total nitrogen
* Photic zone composite – chlorophyll a, phytoplankton community

Lakes (2016-2018)

* Sampling Plan (Continued)
  * Shoreline Site - site of probable public recreation (e.g. beach, boat ramp)
    * E. coli: monthly (May - September)
    * Algal toxins (microcystin and anatoxin a): monthly (July – September)
    * Phytoplankton community: monthly (July – September)
  * Whole Lake
    * Fish tissue – mercury, organochlorine pesticides, and metals
    * Littoral macroinvertebrate community
    * Macrophyte – biovolume, percent cover and non-natives
    * Bathymetry

Water Resource Management Trends:

* Solving Water quality problems expensive
* Requires science-driven solutions
* Technology allows for data sharing
* Increasing number of data collectors (federal, state, NGO, regulated, private)
* Increasing need to leverage partnerships in data collection
* Data collection is expensive, get it right to optimize usability

Water Quality Data Sources

Massachusetts State Agencies

- Department of Environmental Protection - Drinking Water Program, Wetlands and Waterways Program, Watershed Planning, Wastewater Management Program and Permitting
- Department of Environmental Protection/UMass Dartmouth - Massachusetts Estuaries Project (MEP)
- Office of Coastal Zone Management (CZM)
- Department of Conservation and Recreation (DCR)
- Department of Fish and Game - Division of Marine Fisheries
- Department of Fish and Game - Division of Fisheries and Wildlife
- Department of Public Health (DPH)
- **Massachusetts Water Resources Authority (MWRA)**
- MassGIS data layers pertaining to land use, percent impervious cover, pollution sources, etc.

Federal Agencies

- U.S. Geological Survey
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers
- National Oceanographic and Atmospheric Administration

Other Sources

- Massachusetts Water Resources Research Center
- Colleges, Universities and associated academic institutions
- Watershed and lake associations
- Citizen monitoring programs
- Municipal Conservation Commissions (nonpoint source assessment)
- WWTPs- NPDES Permit Monitoring Requirements
- Municipal Facilities Plans
- Environmental consultants

Questions?

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Data Submission Guidelines

www.mass.gov/eea/agencies/massdep/water/watersheds/external-data-submittals-for-the-wpp.html

WPP-Guidance_external data guidance sheets\CN 000.72a - Guidance_External Data Submittal & Review_1-29-14.doc