Biological Assessments of Maine Wetlands

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Maine DEP Biological Monitoring Program

Evaluates ecological health of aquatic resources

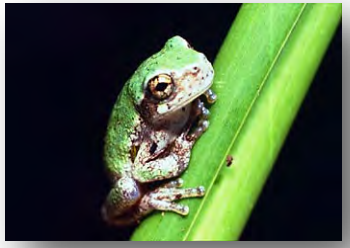
Determines if water bodies meet State aquatic life criteria ("biological criteria")

Provides data and technical support to other programs to protect and restore Maine waters

Integrated assessment approach for wetlands, rivers, and streams

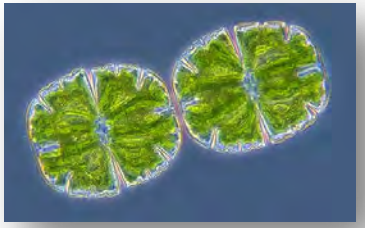
Clean Water Act

Objective: Restore and maintain chemical, physical, and biological integrity of the Nation's waters.



State Responsibilities (all waters, including wetlands):

- Develop monitoring and assessment programs
- Adopt water quality standards
- Report to EPA on condition of waters every two years



Water Quality Standards

- Management goals (“designated uses”) - goals vary depending on water body type and local conditions (existing licensed discharges, land use, etc.)

- Appropriate criteria (chemical, physical and biological) to protect designated uses
  - Narrative
  - Numeric

- Anti-degradation policy – protects existing uses, high quality waters, Outstanding National Resource Waters

Narrative Biological Criteria

Fresh Surface Waters (rivers/streams, associated wetlands)

AA Habitat natural and free flowing (no dams allowed). Aquatic life as naturally occurs.

A Habitat natural. Aquatic life as naturally occurs.

B Habitat unimpaired. Must support all indigenous aquatic species. No detrimental changes to resident biological community.

C Must support all indigenous fish species and maintain structure and function of resident biological community.

GPA **Lakes and Ponds** (and associated wetlands)
One class, equivalent to Class A)

How do we decide if wetlands meet narrative biological criteria?

Sampling Habitat

Areas of emergent, floating or submerged aquatic vegetation (≤ 1 meter deep)

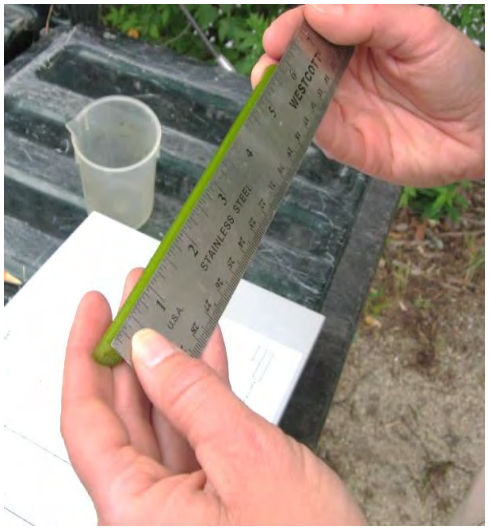
Includes shallow vegetated areas in and along slow-moving rivers and streams, ponds and lakes

Aquatic Macroinvertebrates

Three 1 meter D-net sweeps

Wetland Epiphytic Algae

Clip 5 plant stems at each of 3 replicate sites,

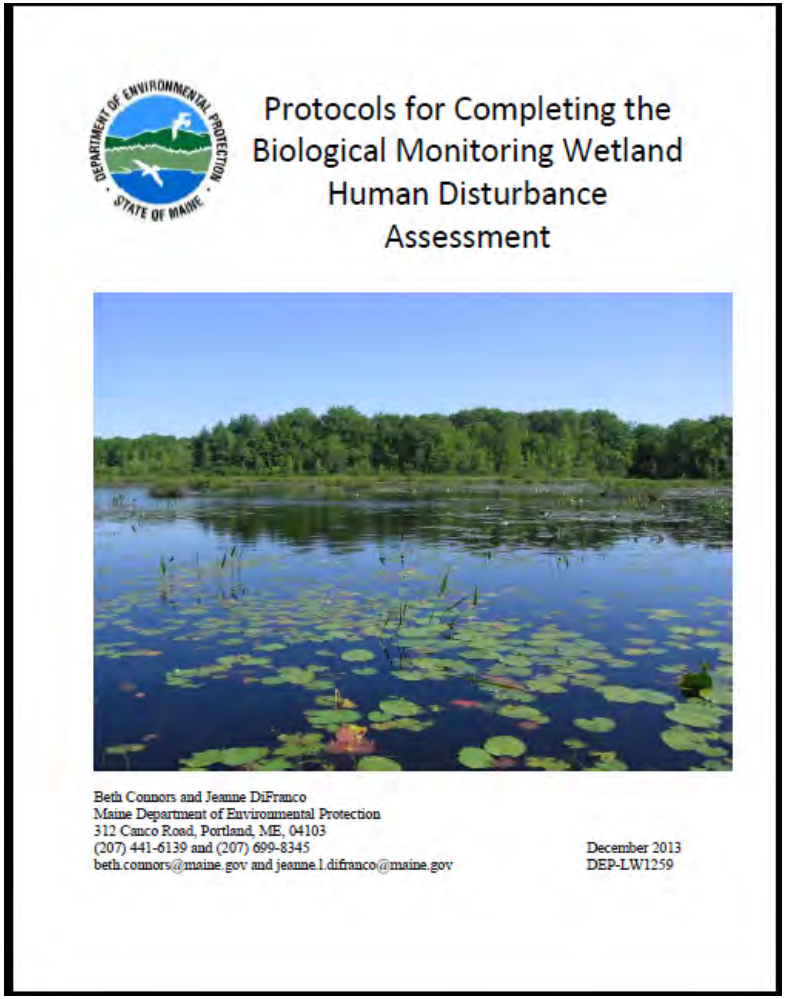


Water Quality

Wetland Human Disturbance Assessment

Field-based rapid stressor assessment:

- Hydrologic modifications
- Vegetative modifications
- Evidence of chemical pollutants
- Watershed characterization



Wetland Statistical Models

- Help DEP biologists decide if wetlands meet narrative biological criteria
- Predict aquatic life class attained (AA/A, B, C) using biological monitoring data
- Standard assessment method, objective, based on quantitative data
- Separate models for wetland macroinvertebrates and algae
- Model results will become numeric biological criteria once implemented in rules

Wetland Macroinvertebrate Model Metrics

Metric	Description
Total mean abundance	Number of individuals
Mayfly, Dragonfly/Damselfly and Caddisfly taxa - richness	Number of genera (all groups combined)
Dragonfly/Damselfly - relative abundance	Abundance compared to all taxa
Mayfly abundance	Number of individuals
Sensitive taxa - richness	Based on Maine taxa tolerance values
Intermediate taxa - relative richness	Richness compared to all taxa. Based on Maine taxa tolerance values
Maine Tolerance Index	Weighted-average community index
Ratio of sensitive to eurytopic taxa - abundance	Based on Maine taxa tolerance values. Eurytopic taxa are adopted to a wide range of environmental conditions.

Wetland Epiphytic Algae Model Metrics

Metric	Environmental significance
Eunotiaceae (diatom family) – relative richness	Prefer oligotrophic to mesotrophic, somewhat acidic conditions
Eutrophentic diatoms – relative abundance	Prefer eutrophic (high nutrient) conditions
Oligosaprobic diatoms - relative richness	Prefer low organic enrichment
Sensitive taxa – relative richness	Based on Maine taxa tolerance values
Intermediate taxa – relative richness	Based on Maine taxa tolerance values
Maine Tolerance Index	Weighted-average community index

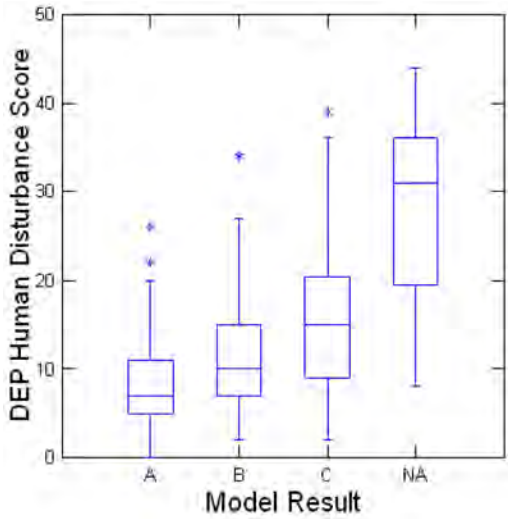
Landscape Context

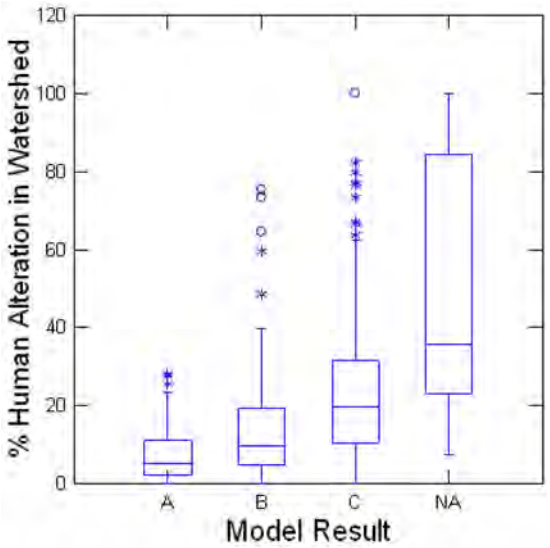
Relation to Class Attainment for Macroinvertebrates

Field-based rapid stressor assessment

GIS analysis: % watershed not forest or wetland

Increasing disturbance





Includes samples from 2000-2016. NA = non-attainment of any class

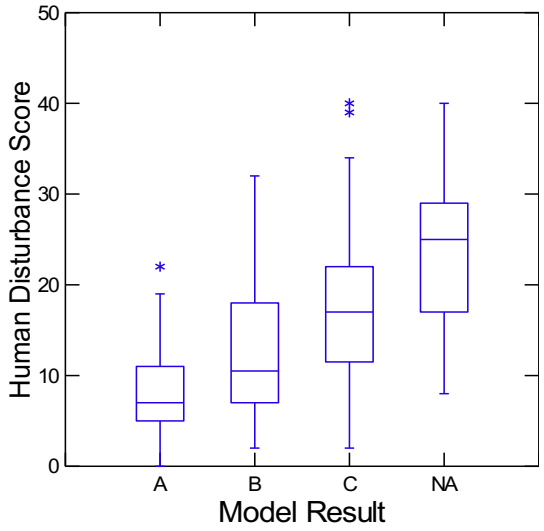
Landscape Context

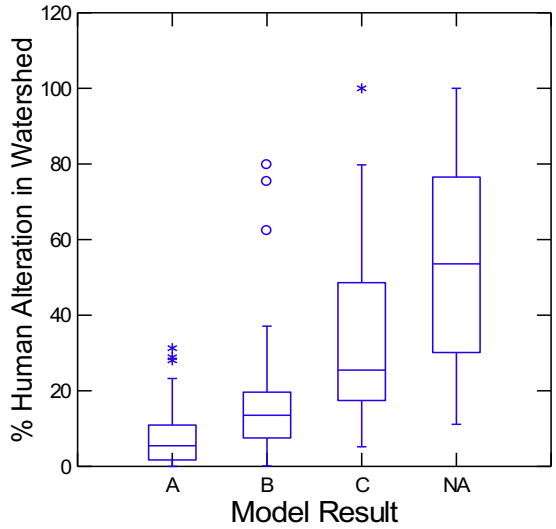
Relation to Model Results for Epiphytic Algae

Field-based rapid stressor assessment

GIS analysis: % watershed not forest or wetland

Increasing disturbance





Includes samples from 2002 -2014. NA = non-attainment of any class

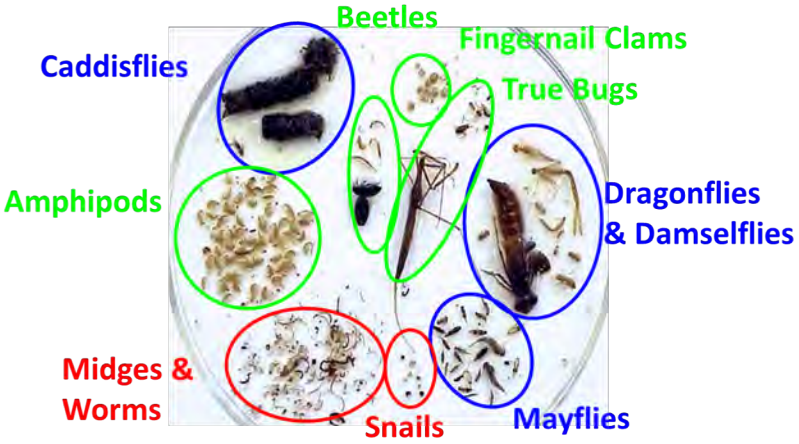
Monitoring Wetland Mitigation Sites: Pilot Study

- Tested biological monitoring protocols to evaluate wetland mitigation projects
- 9 sites: Restored, created, and/or preserved to compensate for permitted wetland loss
- Project age and wetland types varied (all included some aquatic habitat)
- Macroinvertebrates, algae, water quality, plant community assessment (qualitative)
- Compared study sites to minimally-disturbed reference sites

How did study sites compare with "natural" reference wetlands?

Macroinvertebrates

- Fewer numbers and types of sensitive taxa, more "eurytopic" taxa (adapted to wide range of conditions)
- Significant difference in Maine Tolerance Index scores (community-level pollution-tolerance index)



Healthy wetland

Impacted wetland

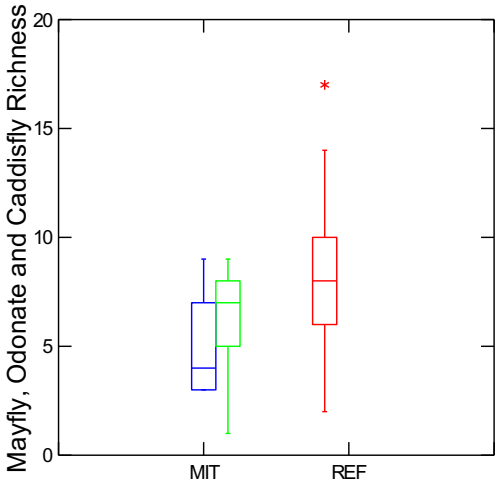
Comparing Reference and Mitigation Sites

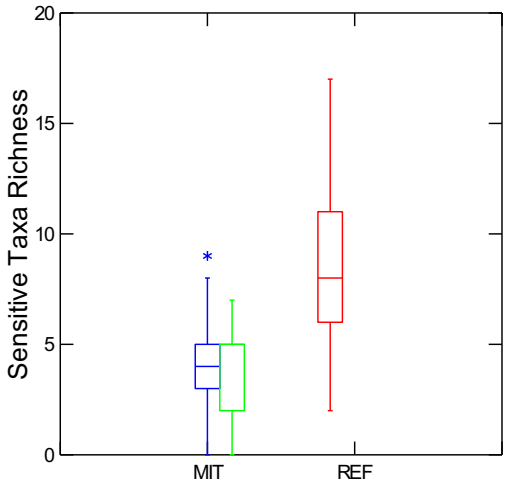
Selected Macroinvertebrate Metrics

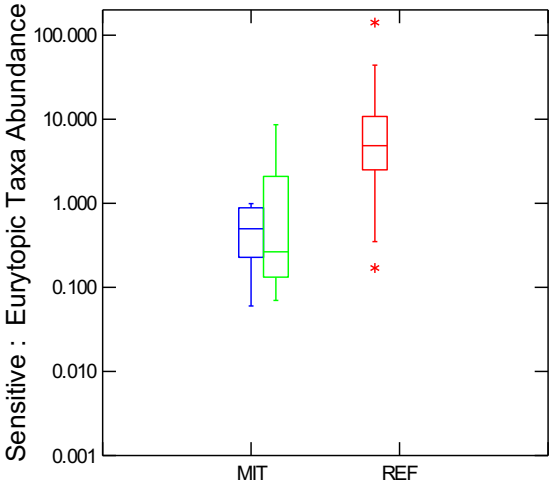
Reference sites
N=57

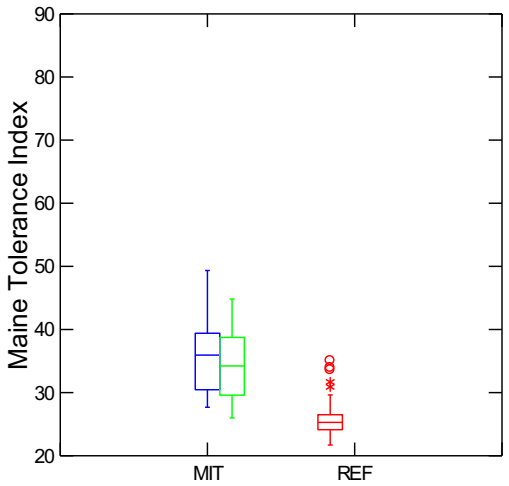
Year 1 (2008) mitigation sites
N=9

Year 2 (2013/2015) mitigation sites
N=9









How did study sites compare with "natural" reference wetlands?

Plant Community

- Cattails abundant or dominant in most study sites (range of 13% – 80% emergent plant cover in assessment area)
- Cattails uncommon in reference sites, not dominant

Diverse plant community

Cattail-dominated wetland

How did study sites compare with "natural" reference wetlands?

Water Quality Parameters

Significant differences in:

- specific conductance
- nutrients
- chlorophyll a
- pH
- Alkalinity

Algae:

- Significant differences in community structure (final class determinations pending)

Class Attainment Results - Macroinvertebrates

Station Number	Assigned class of associated waters	Attained class - Year 1 (2008)	Attained class - Year 2 (2013 or 2015)	Meets criteria for assigned class in Year 2?	Change in biological community (year 1 to year 2)
W-171	B	C	A	Yes	improved
W-173	B	NA	C	No	improved
W-174	C	C	C	Yes	no change
W-175	B	C	C	No	no change
W-179	B	indeter-minate	C	No	unknown
W-180	B	B	NA	No	declined
W-181	C	C	B	Yes	improved
W-182	B	NA	C	No	improved
W-184	B	B	C	No	declined

Factors Affecting Water Quality, Biological Communities and Class Attainment

- Landscape setting and land use
- Habitat complexity
- Connectivity to other wetlands and water bodies
- Water quality and biological condition in associated watershed
- Presence of adequate buffers

Advantages of DEP's Biological Monitoring and Assessment Approach

- Focus is on integrity of biological communities compared to reference ("natural") conditions
- Standard sampling, analysis and assessment protocols produce quantitative data and objective results
- Results expressed in relation to statutory tiered criteria for assigned water quality class (AA/A, B, C)
- Class attainment results comparable among different water body types and taxa groups
- Tiered criteria allow us to detect incremental changes in resource condition, identify improving/declining trends
- Applicable to other wetland types and taxa groups

How We Use Wetland Data

- Evaluate ambient condition, diagnose stressors
- Evaluate impacts from non-point sources, permitted activities, violations of water quality/natural resource laws
- Inform permit decisions and management strategies (discharges, water levels, wetland/stream alterations)
- Evaluate restoration projects (dam removals, mitigation sites)
- Evaluate wetland health in State Parks and Wildlife Management Areas, National Wildlife Refuges, etc.
- Conduct watershed-level assessments (wetlands/streams/lakes)
- Support water body re-classification recommendations
- Support TMDLs and other restoration plans
- Report on wetlands to EPA in biannual Integrated Water Quality Monitoring and Assessment Report

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