
Maine Biological and Nutrient Criteria
Tom Danielson and Dave Courtemanch
Maine DEP

Overview

- **Introduce the Biological Monitoring Program**
  - **How we evaluate the health of streams and rivers with aquatic life.**
- **Introduce our efforts to develop new tools to better inform management decisions.**

Classes and Criteria

	Numeric Criteria		Narrative Criteria	
	Dissolved Oxygen	Bacteria (*E. coli*)	Habitat	Aquatic Life (Biological)
Class AA	as naturally occurs	as naturally occurs	free flowing and natural	as naturally occurs
Class A	7 ppm; or 75% sat.	as naturally occurs	natural	as naturally occurs
Class B	7 ppm; or 75% sat.	236/100 ml (instan-taneous)	unimpaired	support all aquatic species indigenous to the receiving water; no detrimental changes to the resident biological community
Class C	5 ppm; or 60% sat.	236/100 ml (instan-taneous)	habitat for fish and other aquatic life	maintain the structure and function of the resident biological community

Non-attainment (NA) stream does not meet minimum criteria

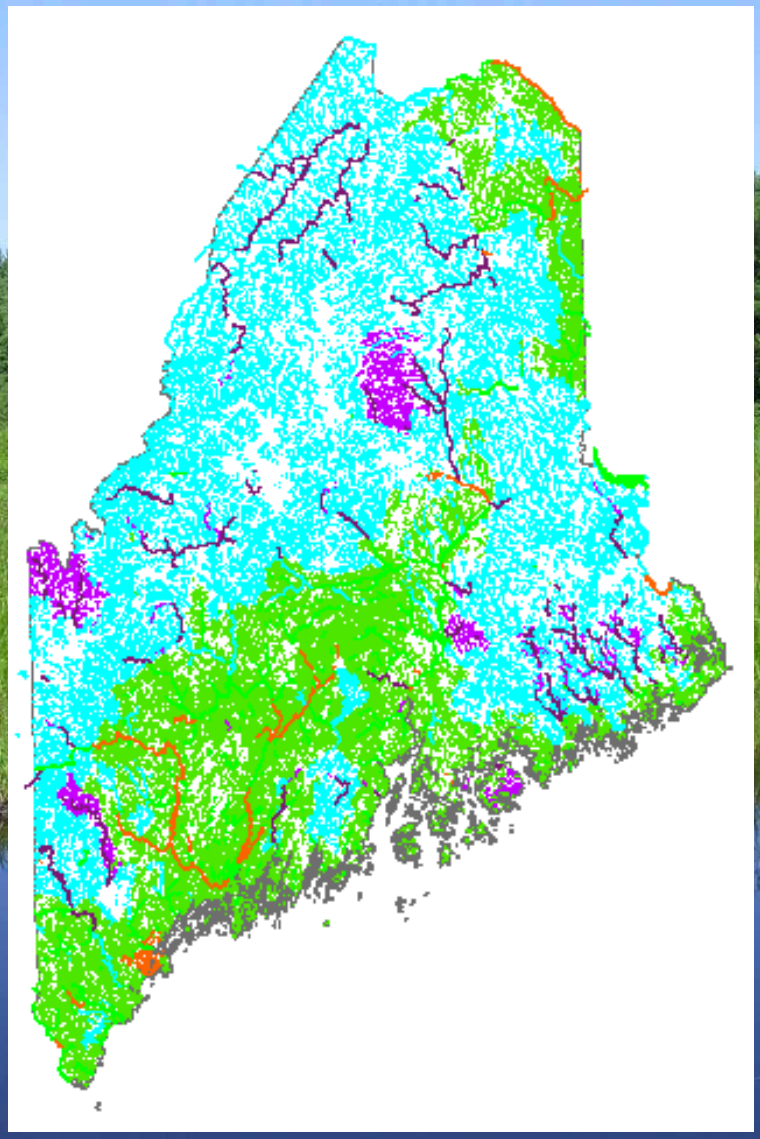
Stream Classes

AA

A

B

C



Maine DEP's Biological Monitoring Unit

- **Determine if streams, rivers, and wetlands are attaining aquatic life criteria**
- **Provide water quality data for many other programs**
- **24 years with stream macroinvertebrates.**
- **8 years with stream and wetland algae and wetland macroinvertebrates.**

Leon Tsomides

Beth Connors

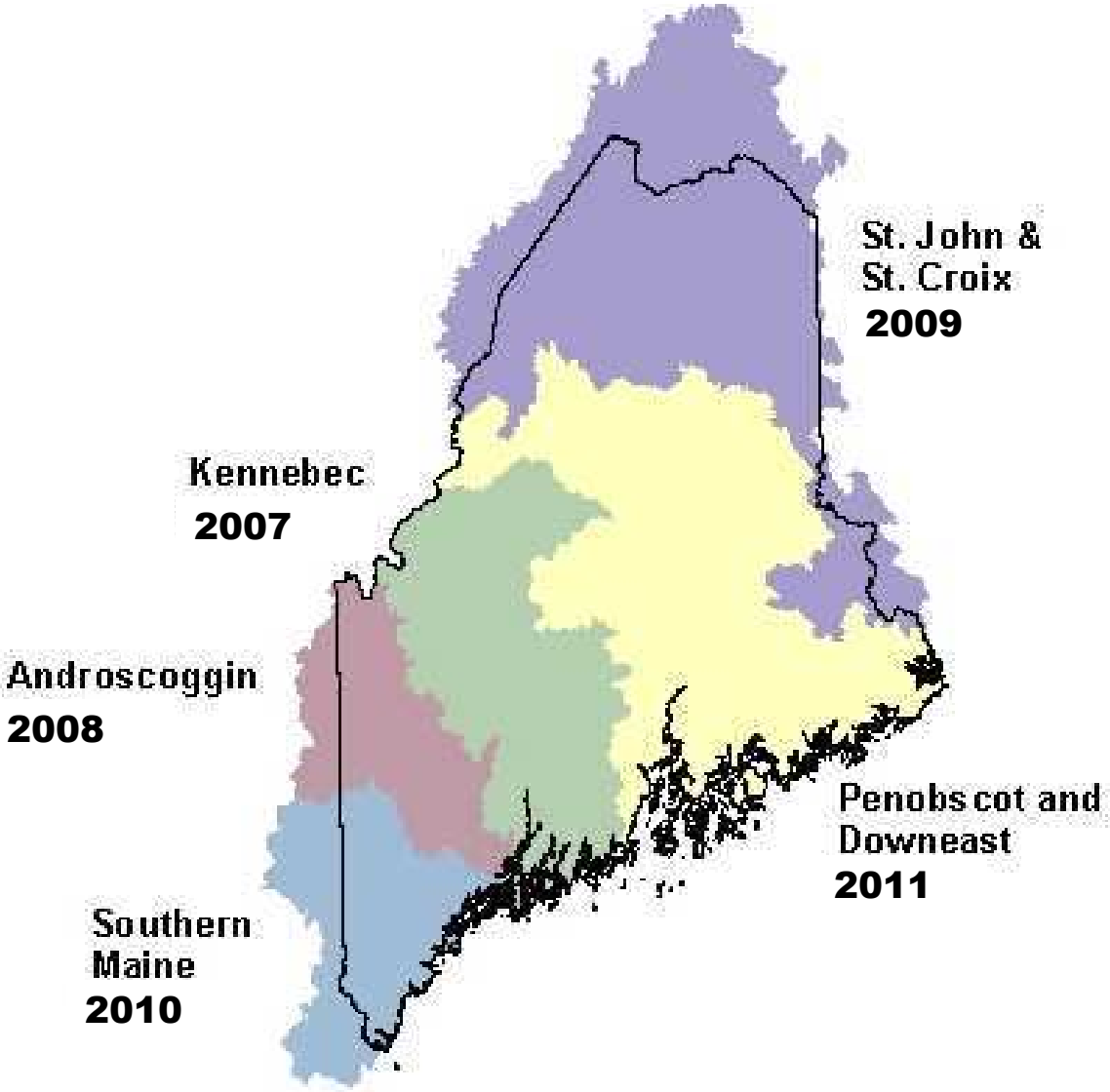
Jeanne DiFranco

Tom Danielson

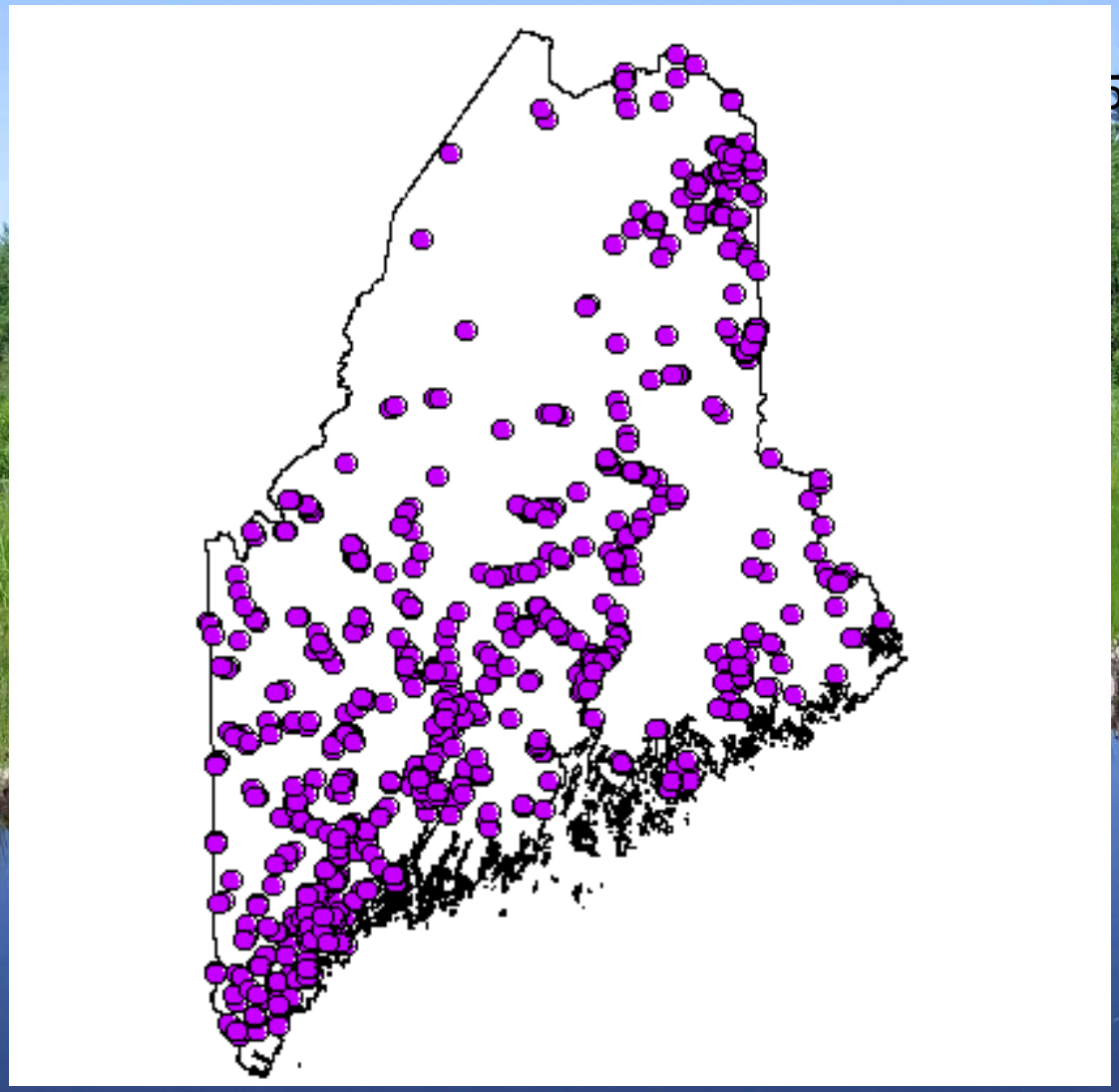
Why Monitor Aquatic Life?

- **Much better indicator of stream health than sampling chemicals.**
  - **There are too many chemicals to monitor.**
  - **We may not measure the "right" chemical.**
  - **We may not measure at the "right time".**
  - **Many stressors can damage streams:**
    - **Pollution, changes in hydrology, habitat degradation, invasive species, increased temperature, etc.**
- **Aquatic life reflect a time-integrated, holistic measure of stream health.**

Maine DEP Biomonitoring Program
Rotating Basin Approach



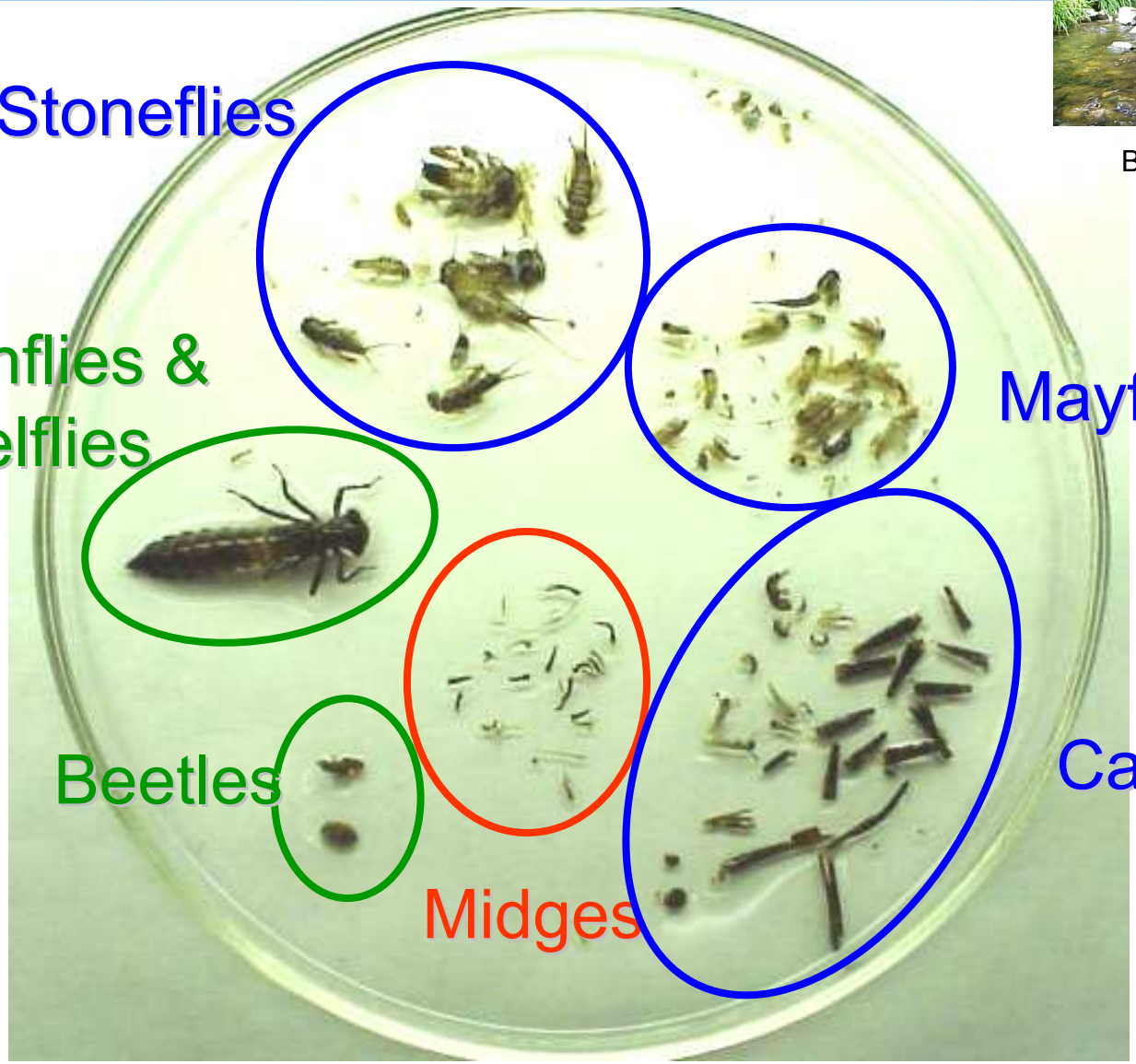
Sample Locations



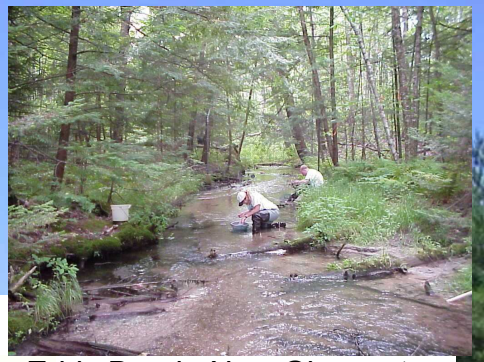
Macroinvertebrate Sampling

Class A Stream

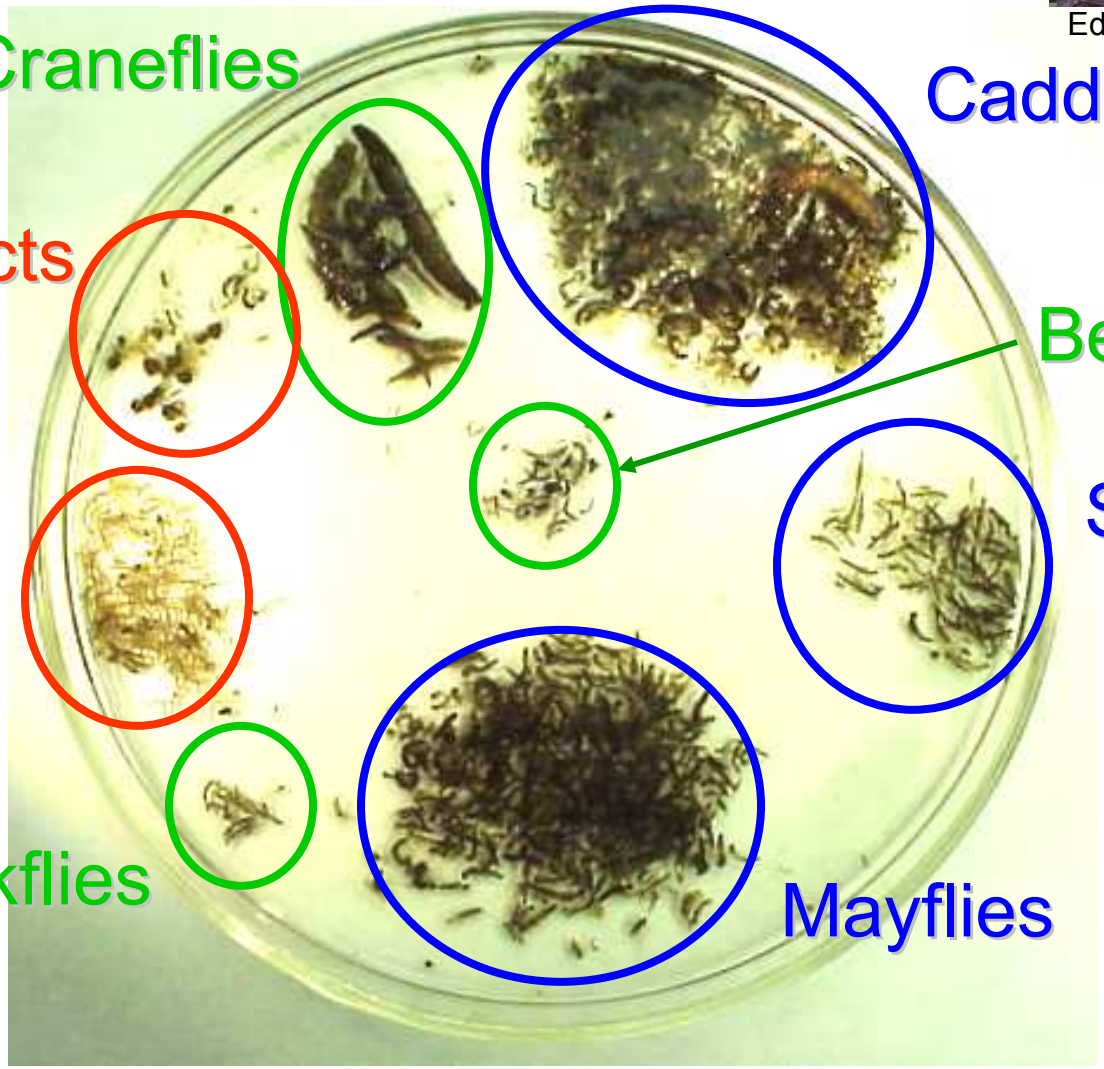
Babel Brook, T5 R9 NWP



Class B Stream

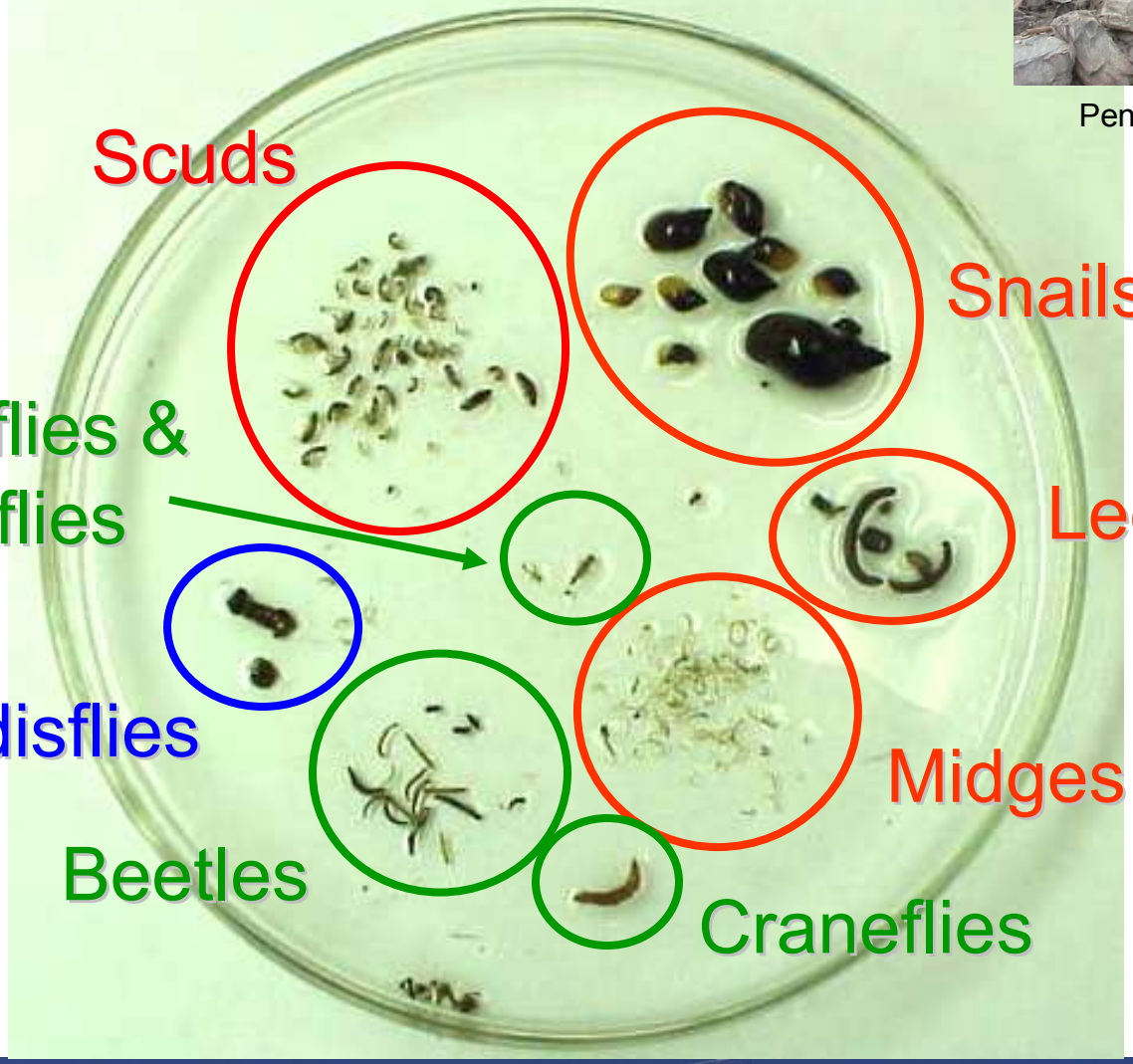


Eddy Brook, New Gloucester



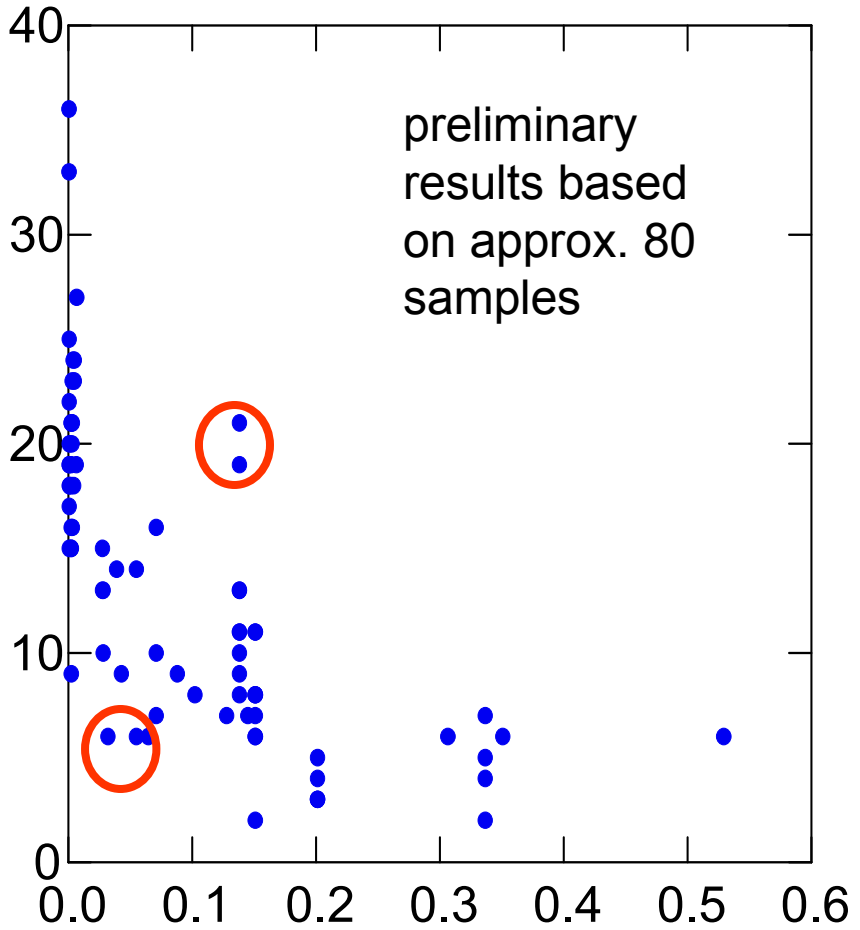
Non-Attainment Stream

Penjajawoc Stream, Bangor



Relationship between Impervious Surfaces and Stream Macroinvertebrates

Number of Mayfly, Stonefly, and Caddisfly Genera



Determining if a Stream Attains its Class

- **Statistical model**
  - **26 variables, such as the richness of mayflies, stoneflies, and caddisflies.**
  - **Predicts the probability of a stream attaining Class A, B, or C conditions.**

Classification Attainment

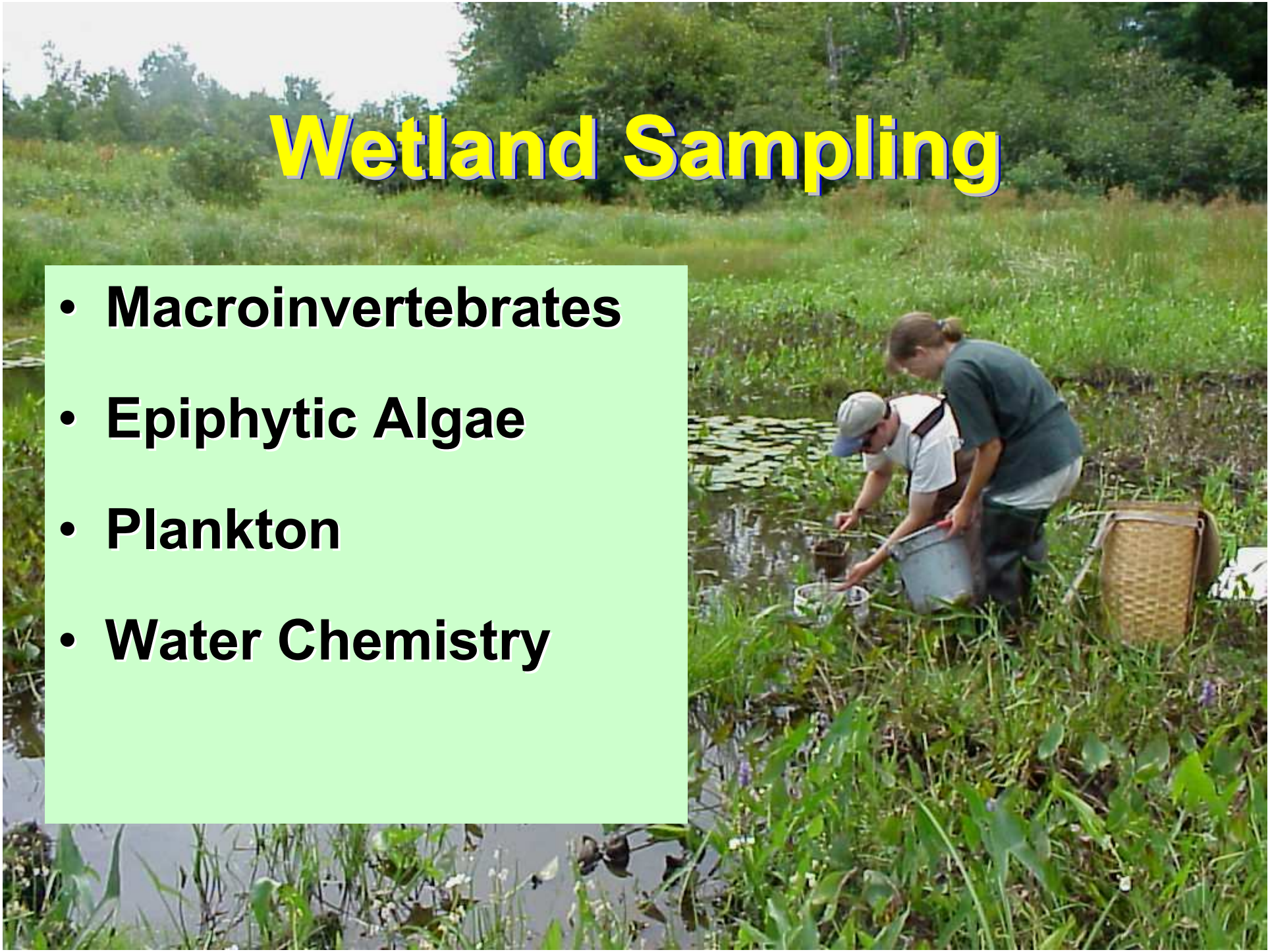
Statutory Class	Monitoring Result	Attains Class?	Next Step
A	A	Yes	--
C	B	Yes	Upgrade ?
A	B	No	TMDL
B	NA	No	TMDL

Developing New Tools

- **Wetland Macroinvertebrates and Algae**
  - **since 1998**
- **Stream Algae**
  - **since 1999**
- **Nutrient Criteria**

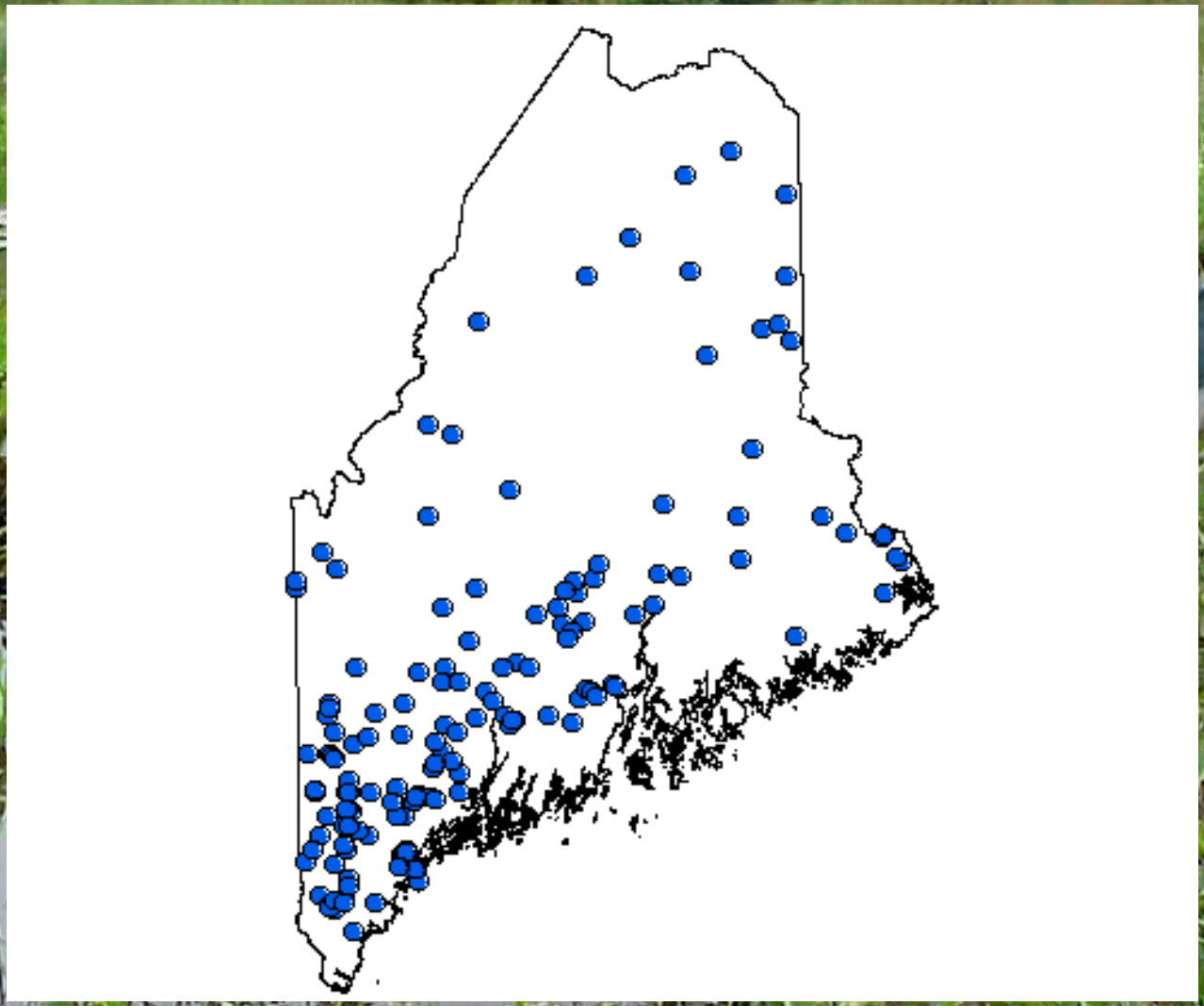
Wetland Sampling

- Macroinvertebrates
- Epiphytic Algae
- Plankton
- Water Chemistry

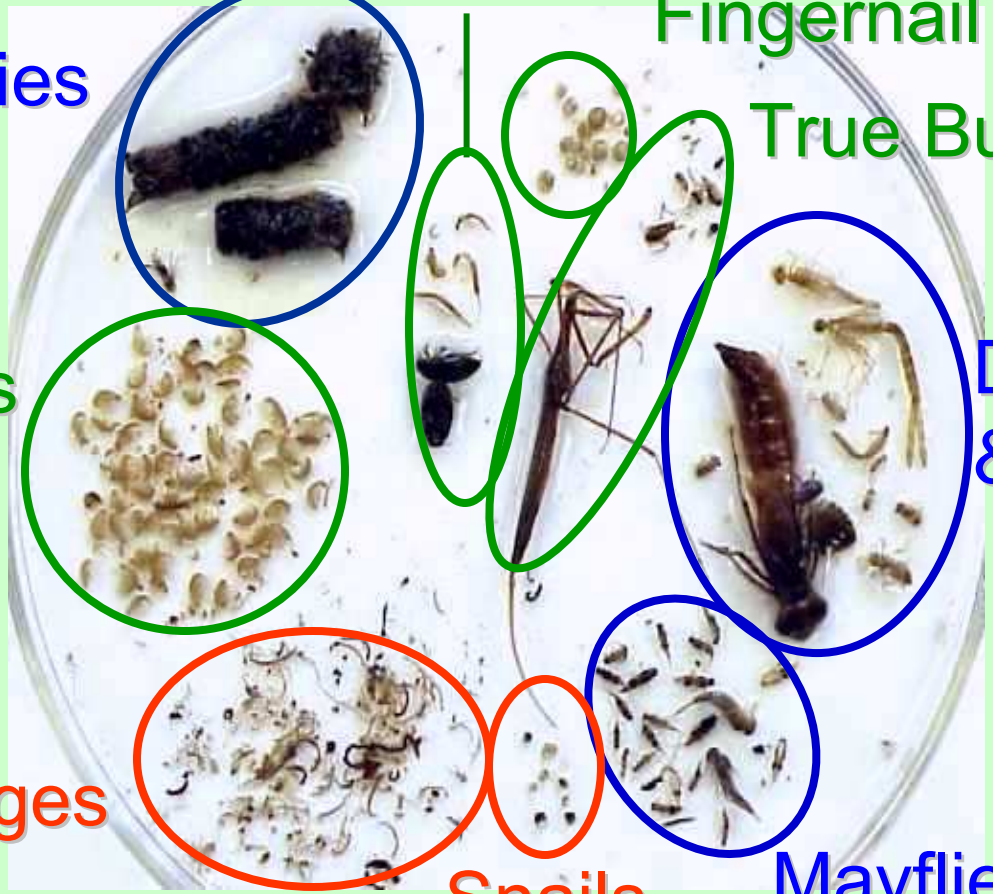


Measuring Stream Velocity

Wetland Sample Locations



Healthy Wetland



Unhealthy Wetland

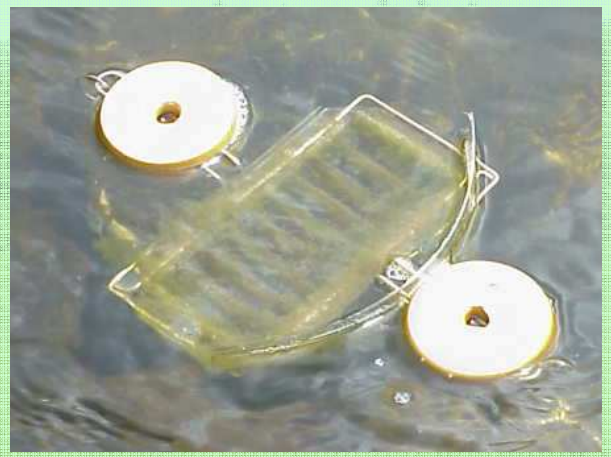
Other

Midges and Worms

Stream Algae Sampling

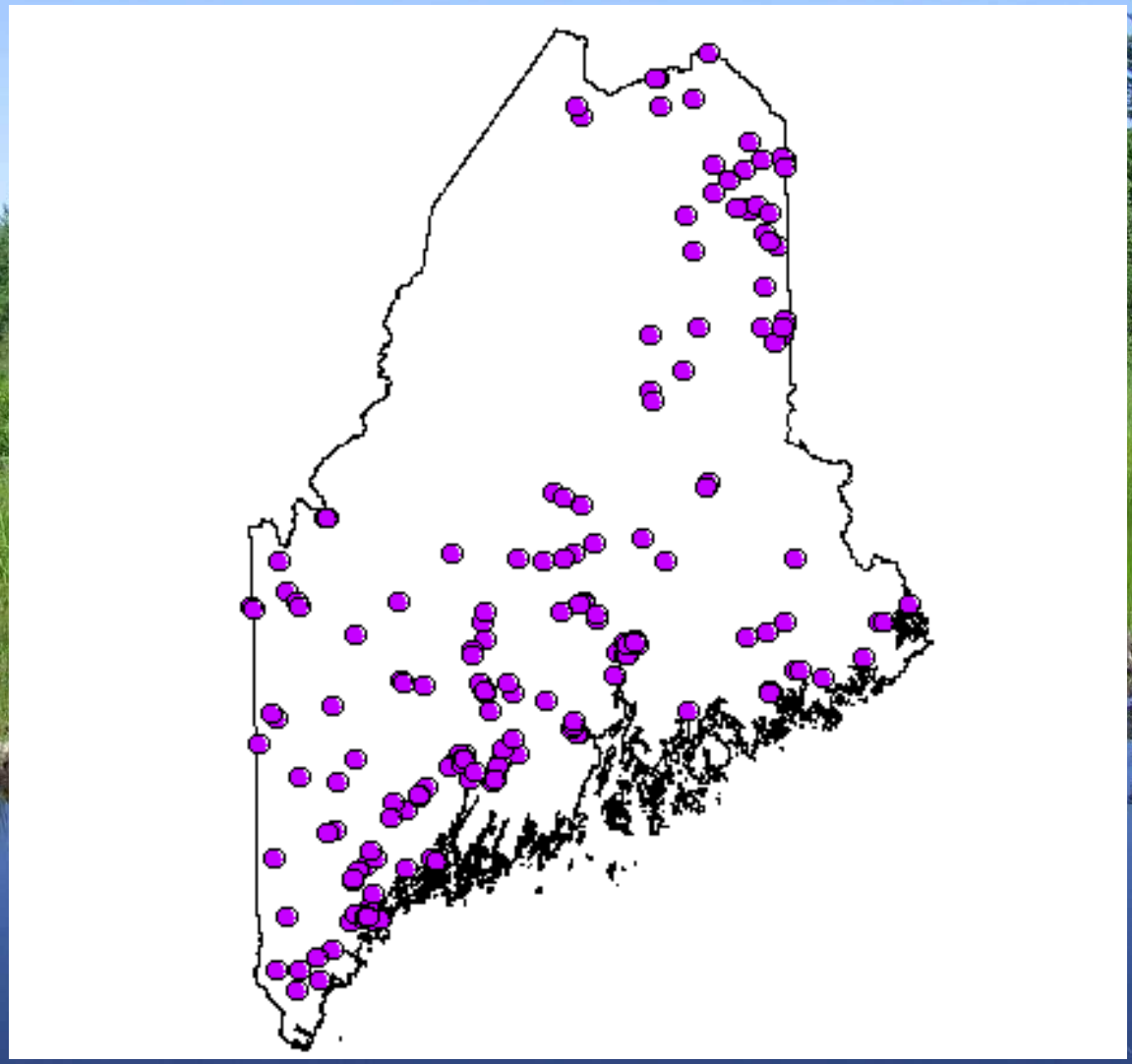
Natural Substrate

Artificial Substrate

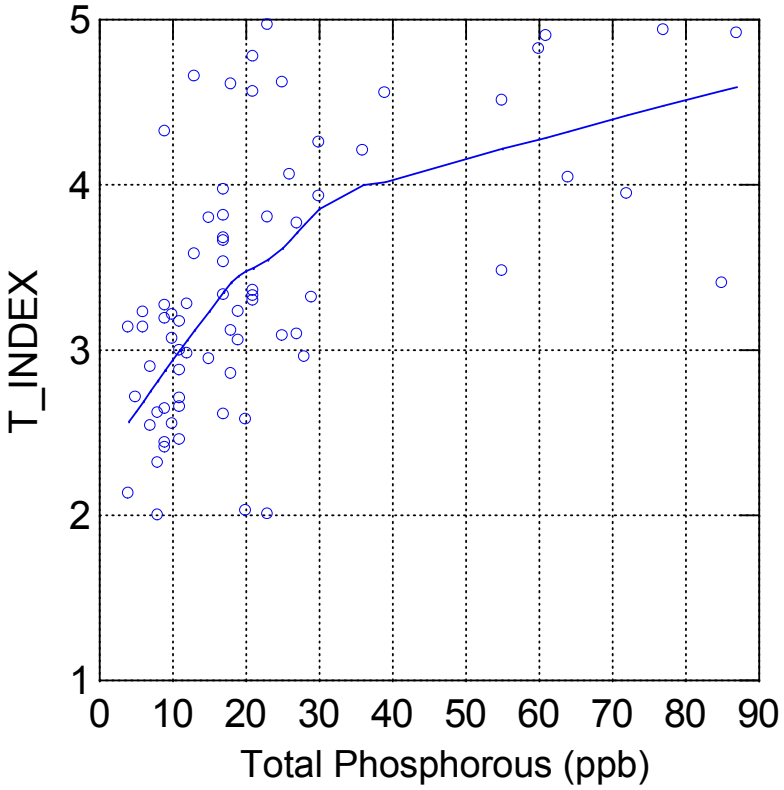


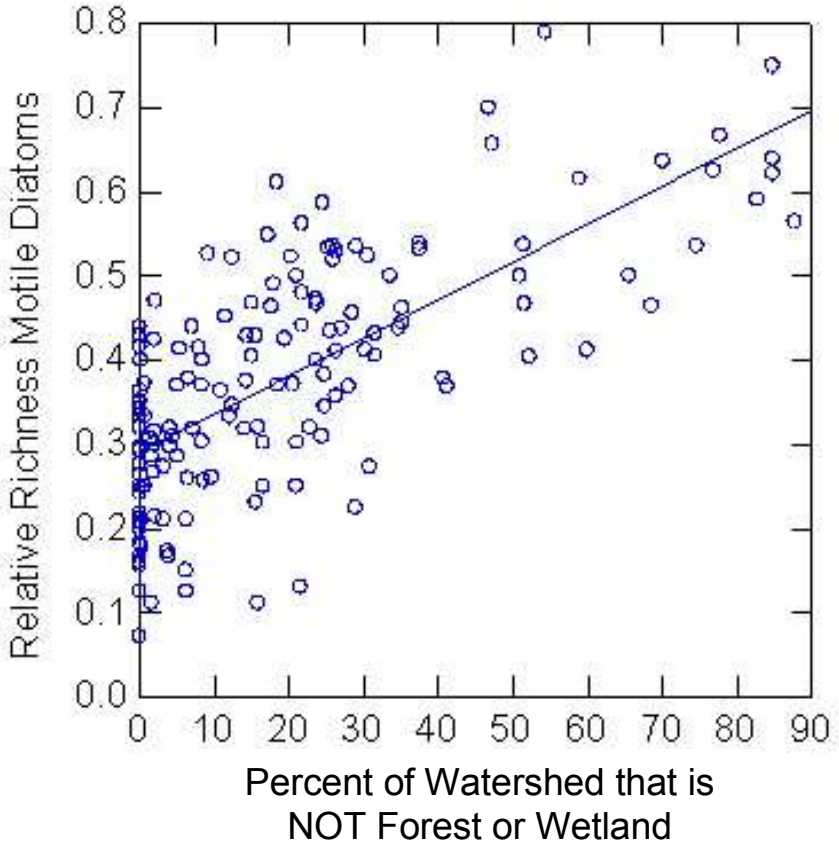
Viewing Bucket Survey

Stream Algae Sample Locations



TP vs. Algal Attributes





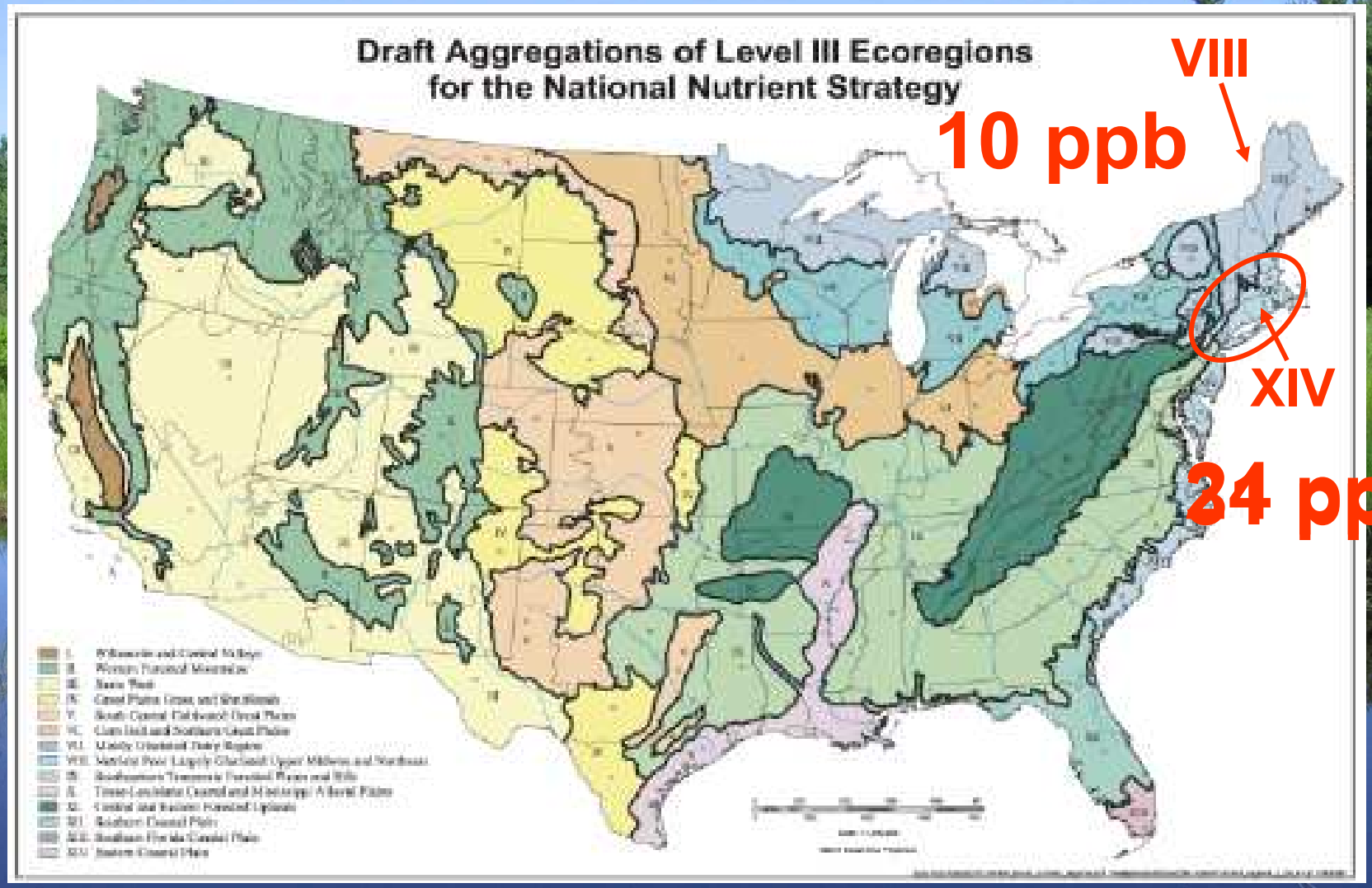
Nutrient Criteria

- U.S. EPA requires states to adopt nutrient criteria
- States can develop own criteria or adopt EPA's criteria
  - Lakes
  - Rivers & Streams
  - Wetlands (future)
  - Estuaries (future)

U.S. EPA Interim Criteria

- Divided country into nutrient regions
- Set criteria at 25th percentile of available data
- Included few data points from Maine
- Used the “one size fits all” approach

U.S. EPA Interim TP Limits for Streams and Rivers



Maine DEP's Approach

- **Set nutrient limits for each Class (AA/A, B, and C)**
- **Use biological information to help set nutrient limits**
- **Develop a nutrient criteria decision framework that incorporates both nutrient limits and ecological response variables**

Nutrient Criteria Decision Framework

- **Combines the nutrient limits with ecological response variables.**
- **Goal is to improve management decisions.**

DRAFT TP Limits

Class	TP Limit	Rationale
AA/A	20 ppb	Most minimally disturbed streams have TP concentrations less than 20 ppb.
B	33 ppb	Most streams with > 33 ppb TP do not attain class B aquatic life criteria (based on macroinvertebrates).
C	40 ppb	Most streams with >40 ppb TP do not attain class C aquatic life criteria (based on macroinvertebrates).
GPA Lakes	15 ppb	Most lakes with TP concentrations below 15 ppb do not have algal blooms.

Ecological Response Variables

Nutrient Criteria Framework for Each Class

	Concentration of nutrient is BELOW limit	Concentration of nutrient is ABOVE limit
Ecological response is acceptable	Attains Nutrient Criteria	
Ecological response is NOT acceptable		Violates Nutrient Criteria

Indeterminate Results

	Concentration of nutrient is BELOW limit	Concentration of nutrient is ABOVE limit
Ecological response is acceptable	(1) Attains Nutrient Criteria	
Ecological response is NOT acceptable	(3) Collect more data	(2) Violates Nutrient Criteria

Acceptable Ecological Response

	TP ≤ 40 ppb	TP > 40 ppb
Ecological response is acceptable		**Attains** • site specific criteria? • downstream effects?
Ecological response is NOT acceptable		

Atypical Situations

- **Naturally high nutrient levels**
- **Site specific criteria**
  - **Nitrogen or carbon**
  - **Establish site-specific limits when necessary to maintain or restore a waterbody**

Conclusions

- **Aquatic life are better indicators of stream and wetland health than chemical measurements.**
- **DEP uses macroinvertebrates to evaluate the health of streams.**
- **DEP is developing other tools to measure:**
  - **Stream algae**
  - **Wetland bugs and algae**
  - **Nutrient Criteria**