What effects the quality of the wetlands we are sampling?
The Five Major Factors Which Determine the Integrity of Wetlands

- Flow Regime
  - Velocity
  - Land Use
  - Ground Water
  - Precipitation & Runoff
  - High/Low Extremes

- Chemical Variables
  - Alkalinity
    - Temperature
    - D.O.
    - pH
    - Turbidity
    - Hardness

- Biotic Factors
  - Disease
    - Reproduction
      - Competition
    - Parasitism
      - Predation
  - Feeding
    - Predation
  - Nutrients
    - Sunlight
    - Organic Matter Inputs

- Energy Source
  - Solubilities
    - Adsorption
      - Nutrients
        - Organics
      - Parasitism
        - Predation
  - Hardness
  - Turbidity
  - pH
  - D.O.
  - Temperature
  - Solubilities
  - Adsorption
  - Nutrients
  - Organics

- Habitat Structure
  - Riparian Vegetation
    - Seasonal Cycles
  - Sinuosity
  - Siltation
  - Current Substrate
  - Canopy
  - Gradient
  - Instream Cover
  - Width/Depth
  - Bank Stability
  - Channel Morphology

INTEGRITY OF THE WATER RESOURCE

Principal Goal of the Clean Water Act
What is so great about biological data?

Biological Data Reveals the Effects of

Multiple Stressors
Integrated
Through
Time
Space
The Big Picture

**Biological Quality**

- **Chemical Variables**
  - D.O.
  - pH
  - Turbidity
  - Hardness
  - Temperature
  - Metals
  - Nutrients
  - Organics

- **Habitat Structure**
  - Substrate
  - Channel morphology
  - Riparian vegetation
  - Gradient
  - Instream cover
  - Sinuosity
  - Bank Stability
  - Canopy
  - Channel width/depth

- **Energy Source**
  - Nutrient availability
  - Sunlight
  - Organic Matter inputs
  - Primary production
  - Seasonal Patterns

- **Flow Regime**
  - Velocity
  - Runoff
  - Volume
  - Ground water
  - Precipitation
  - Watershed characteristics

- **Biotic Interactions**
  - Disease
  - Reproduction
  - Feeding
  - Competition
  - Predation
  - Parasitism
  - Exotics
Why Macroinvertebrates?

- Invertebrates are commonly and widely distributed in many types of wetlands.
- Invertebrates respond with a range of sensitivities to many kinds of pollution.
- Many aquatic invertebrates complete their life cycles in wetlands, so they are exposed directly to the physical, chemical, and biological conditions within the wetland.
- Aquatic invertebrates are important in wetland food webs for wildlife.
Evaluating the health of a wetland requires a measure that integrates multiple factors.
Economists rely on an integrative tool to assess economic condition

Index of Leading Economic Indicators

- Length of work week, unemployment claims, new manufacturing orders, vendor performance, net business formation, equipment orders, building permits, change in inventories, stock prices, and money supply
Doctors use multiple measures to assess human health

- Urine chemistry, blood-cell count, blood chemistry, blood pressure, heart-rate, cholesterol levels, body temperature, throat culture, weight, chest x-ray.
The Index of Biological Integrity (IBI)

- Biologist have developed the IBI as a multiple factor measure to assess the health of streams and wetlands.
- The factors (metrics) that comprise the IBI are measures of different components of the biological community that have been selected based on their ability to reflect human induced changes.
IBI Metrics

- Taxonomic Diversity (biodiversity)
- Number of Intolerant Groups
- Percentage of Tolerant Groups
- Percentage of Dominant Groups
- Trophic Structure (feeding behavior)
- Individual Health
Invertebrate IBI Metrics

- **Leech Taxa Metric** – Number of kinds of leeches
Invertebrate IBI Metrics

- **Corixidae Proportion Metric** – Ratio of water boatman, to other hemipterans and beetles in the bottle trap sample
Invertebrate IBI Metrics

- **Dragonfly-Damselfly Metric** – Number of kinds of dragonflies and damselflies (odonata)
Invertebrate IBI Metrics

- **ETSD Metric** – Number of kinds of Mayflies and Caddisflies, and the presence of odonata and fingernail clams

- **Snail Taxa Metric** – Number of kinds of snails
**Invertebrate IBI Metrics**

- **Total Taxa Metric** – Number of kinds of invertebrates
Invertebrates are sampled in the month of June or early July.
- Samples are taken during this “index period” in order to ensure that the macroinvertebrates are at size that makes them easy to identify.
- This index period also ensures that the majority of the invertebrates collected spent their lives maturing in the wetland being sampled and did not fly in from another nearby wetland.
Where to sample?

- Invertebrate samples are collected in the shallow, near-shore area not deeper than 3 feet.
- Bottle-traps samples and dip-net samples are collected in the same general area of the wetland
If very little vegetation is present, sample close to shore and any vegetation that might present.
Where to sample?

- If there is a vegetated border around the wetland, sample throughout the vegetated zone, from near shore up to 1 meter deep.
Where to sample?

- If the wetland has dense vegetation throughout, try to find open pockets in which to sample in the near shore area.
How to sample?

- **Bottle Traps**

- **Dip-netting**
Bottle Trap
Place 6 bottle traps in 3 pairs along shoreline.

The members of each pair should be 3-6 feet apart.

Pairs should be spaced 20 ft apart.

At least one pair should be in very shallow water (1 foot or less), the others should be in water 2-3 feet deep.
Bottle traps are set out for 2 nights
Bottle traps should be placed in water horizontally with no air bubbles inside.
Funnel should be snapped in securely, clamp should be tightened.
The top of the bottle trap should be 3-5 inches below the water surface.
Collect each pair of bottle traps into one jar (3 jars total for 3 pairs of bottle traps)

Turn the bottle trap in the water the opening is facing upwards

Raise the trap up dowel, remove the funnel, and pour the contents of the trap through a sieve.
Bottle Trap Sample - Retrieval

- Dislodge any critters stuck on the inside of the trap.
- Collect the second trap and pour into sieve.
- Flush the sieve a sample jar with 95% alcohol.
- If the sample takes up more than a third of the sample jar it should be split between two jars.
- Label the outside and the inside of the jar, using a media that resists alcohol (india ink or pencil)
Dip netting Tray

Two small pans, 7 7/8 x 10 x 2 5/8" deep interior with edges overlapping

Water filtered through 200 micron net

1/2" hardware cloth screen framed by 3/4 x 2" wood to receive sample, outside dimensions of frame 11 3/4 x 15 7/8"

12 x 18" kitty litter pan x 4 1/8" deep
Each dipnet sample consists of two dipnetting efforts.

- Dipnet in the near shore area in water up to one meter.
- Sample close to the edge and into vegetation.
- Using strong strokes, sweep the dipnet through the vegetation towards your body 3-5 times or until the net is full of vegetation.
Empty the contents of the net on the hardware cloth screen.
Spread the vegetation out, and pour some filtered site water over it.
Spread the vegetation and repeatedly loosen it and tease through it for 10 minutes. Remove the vegetation and repeat.
After the second dipnetting process, empty the contents of the trays into a sieve.

Backflush the sieve into a sample jar with 95% alcohol.

If the sample takes up more than a third of the sample jar it should be split between two jars.

Label the outside and the inside of the jar, using a media that resists alcohol (india ink or pencil)
Urban Wetlands: Not always impaired

Mud Lake, Plymouth

Lost lake, Plymouth

72  Invert IBI  30
(Support) Non-Support
50  Plant IBI  18
(Support) (Non-Support)
Agricultural wetlands: Not always impaired

Wright County

70
(Support)

Le Sueur County

30
(Non-Support)

Invert IBI

51
(Support)

Plant IBI

18
(Non-Support)