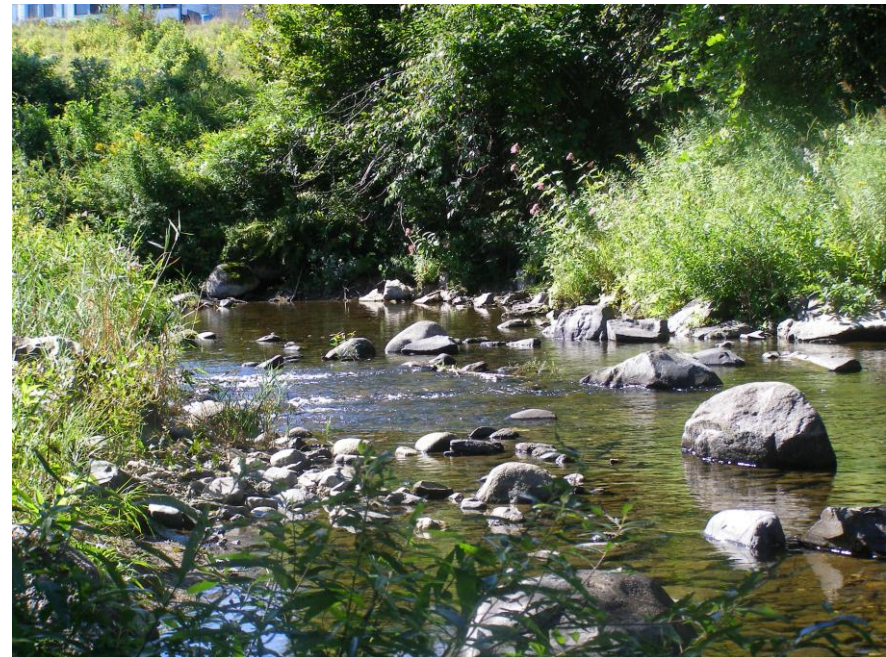


Macroinvertebrates and the Assessment of Water Quality

- Types of Macroinvertebrates
- Biological Surveys
- Advantages to sampling



What are Aquatic Macroinvertebrates?

- **What are aquatic macroinvertebrates?**
 - Animals with out backbones, large enough to be seen by the unaided eye, and live at least part of their life cycles within a waterbody
 - Crayfish, snails, clams, aquatic worms, and larval forms (and some adults) of several insect orders

Why Macroinvertebrates?

- They form permanent, relatively immobile stream communities
- They can be easily collected in large numbers
- Acute and Chronic reactions to environmental changes
- Occupy all stream habitats and display a wide range of functional feeding preferences
- They inhabit the middle of the aquatic food web and are a major source of food for fish and other aquatic and terrestrial animals.

Intolerant Organisms

- EPT Taxa – most are considered “intolerant” of environmental pollution
 - Ephemeroptera (Mayflies)
 - Plecoptera (Stoneflies)
 - Trichoptera (Caddisflies)

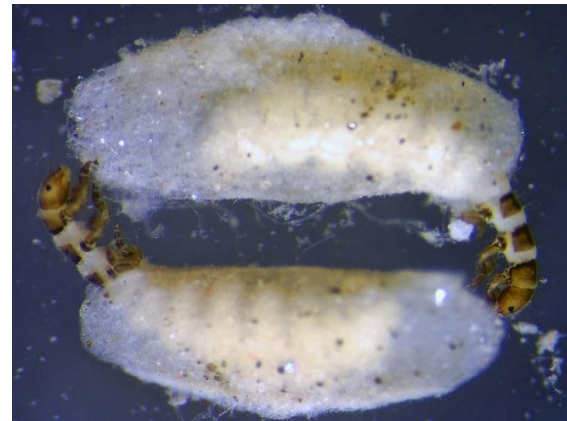
Mayflies (Ephemeroptera)



Stoneflies (Plecoptera)



Caddisflies (Trichoptera)



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Tolerant Organisms

- Some organisms, such as certain fly larvae (Diptera), aquatic worms (oligochaets) and leeches are indicative of polluted conditions and are considered “tolerant organisms”



Why Sample?

- Demonstrate water quality in a section of stream
- Determine watershed water quality
- Biomonitoring
- Set and Monitor Restoration Goals
- Determine impacts to stream systems from spills or other disturbances
- As part of NPDES permitting
- Use designations and attainment status

- Data for regulatory applications must be collected by Level 3 Qualified Data Collectors in order to be credible.

Stream Examples

Poor habitat



Good Habitat



Level 3 – Sampling

- Biological Surveys conducted using Ohio EPA methodology
- Credible Data is suitable for regulatory uses
(TMDLs, use designations, water quality standards, etc.)
- Macroinvertebrates, fish, habitat, chemistry
- All sampling must be conducted or directly supervised by a Level 3 Qualified Data Collector (QDC) for each specialty

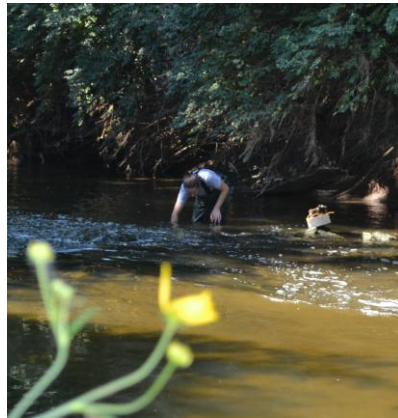
Steps to Collecting Level 3 Data

- Study Plan
- Field Sampling
- Data Analysis
- Report

Study Plan

- Guidelines found in OAC Rule 3745-4-06 App. A
- Sampling objectives, methods, parameters, personnel, locations, maps, equipment, schedule, etc.
- Project Study Plan must be submitted for approval to Ohio EPA.
- May take up to 60 days for final approval

Field Sampling Season



- Sampling season for macroinvertebrates is from June 15th – September 30th
- Until October 15th for fish

Macroinvertebrate Methodology

- Macroinvertebrates are collected with quantitative and qualitative methods

Quantitative: Hester-Dendy multiple-plate artificial substrate samplers - 6 week colonization period



Macroinvertebrate Methodology

- Qualitative: multi-habitat composite samples are collected from all available macrohabitats (riffles, pools, margins, etc.)
 - D-frame net, visual inspections, and hand-picking
- If there is insufficient stream flow or depth for Hester-Dendy deployment then only a qualitative sample will be collected



Additional Field Methodology

- Fish sampling conducted at the same sites as macroinvertebrate sampling
- Measure stream flow, in-field water chemistry
 - pH, temperature, specific conductance, DO
- May include analytical sampling
- Habitat Characterization - QHEI

Laboratory Processing

- Samples collected in the field preserved with 95% ethanol
- Sub-sampling
- Benthic macroinvertebrates sorted from debris and identified to genus/species

Data Analysis

- Macroinvertebrate data collected from HD samplers is analyzed by using Ohio EPA's methods for calculating the Invertebrate Community Index (ICI)
- When HDs are not collected qualitative samples are analyzed using Qualitative Community Tolerance Values and other community metrics

Invertebrate Community Index

- The ICI is a summary of 10 metrics representing aquatic macroinvertebrate community integrity
- The ICI is evaluated and scored in relation to conditions at specific ecoregion reference sites

Metrics in the ICI

1. Total Number of Taxa
2. Number of Mayfly Taxa
3. Number of Caddisfly Taxa
4. Number of Dipteran Taxa
5. % Mayfly Composition
6. % Caddisfly Distribution
7. % Tribe Tanytarsini Midge Composition
8. % Other Dipteran and Non-insect Composition
9. % Tolerant Organisms
10. Number of Qualitative EPT Taxa

ICI scoring

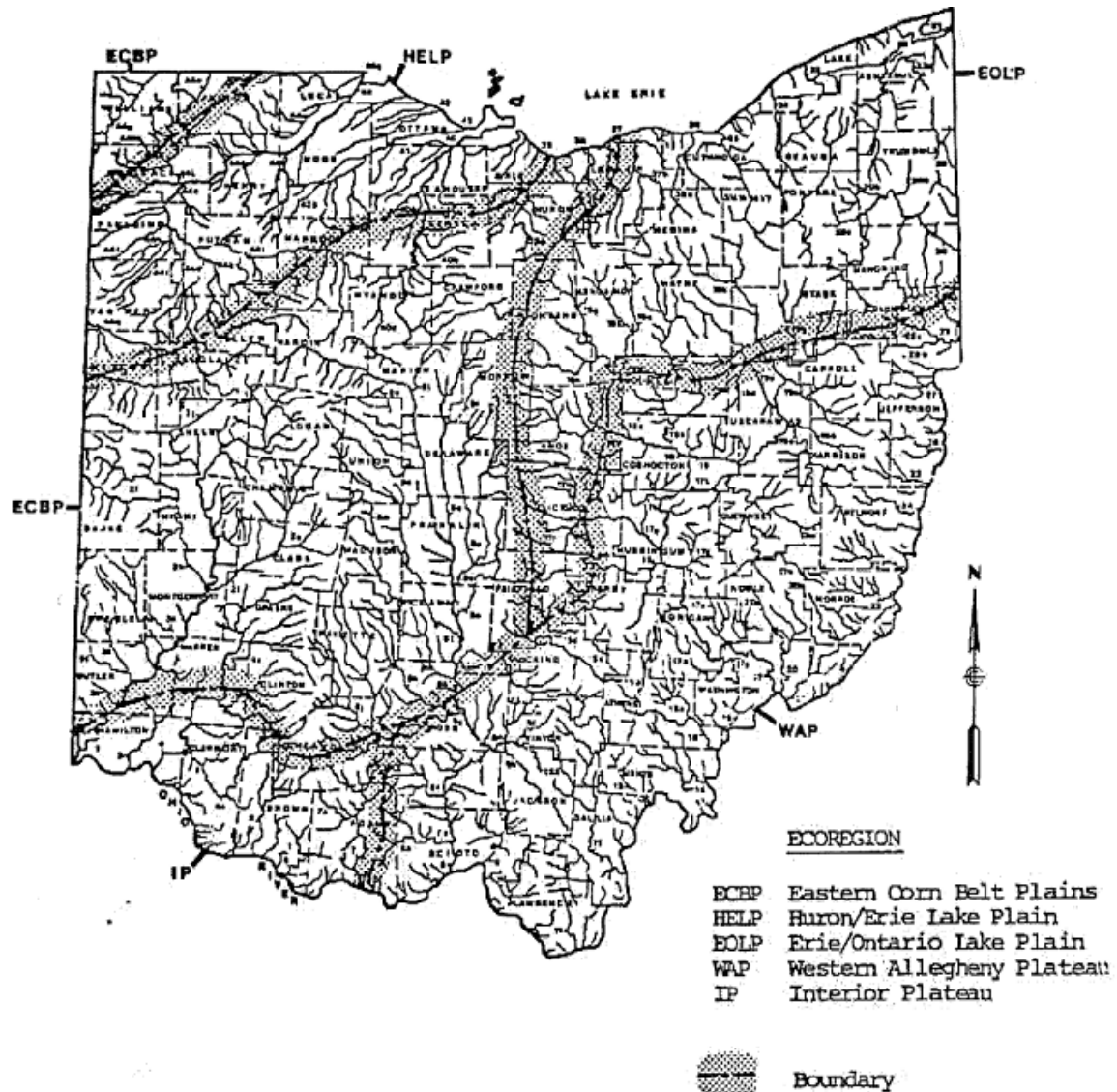
- Each metric has four scoring categories of 6, 4, 2, or 0 points
 - Six points are scored if a given metric has a value comparable to those of exceptional stream communities and 0 points for metric values strongly deviating from the expected range of good values
- Most metric scores are calibrated to stream drainage area
- The maximum total score is 60 and the minimum is 0
- Metrics 1-9 are generated from the HD sampler while Metric 10 is based on qualitative sample data only

Fish and Habitat Analysis

- Fish are evaluated using the Index of Biotic Integrity (IBI) and Modified Index of Well Being (MIWB)
- Habitat Analysis – evaluated using the Qualitative Habitat Evaluation Index (QHEI)

Narrative Ranges

- Once an ICI score is calculated it is compared to the narrative range table for that ecoregion
- Five Ecoregions in Ohio
 - Interior Plateau, Erie Ontario Lake Plain, Western Allegheny Plateau, Eastern Corn Belt Plains, Huron Erie Lake Plain
- Possible Narrative Ranges
 - Exceptional, Very Good, Good, Marginally Good, Fair, Poor, Very Poor



WWH Biocriteria

Ecoregion	ICI Scores					Narrative Evaluation
	<i>IP</i>	<i>EOLP</i>	<i>WAP</i>	<i>ECPB</i>	<i>HELP</i>	
	46-60	46-60	46-60	46-60	46-60	Exceptional
	42-44	42-44	42-44	42-44	42-44	Very Good
	30-40	34-40	36-40	36-40	34-40	Good
	26-28	30-32	32-34	32-34	30-32	Marginally Good
	14-24	14-28	14-30	14-30	14-28	Fair
	2-12	2-12	2-12	2-12	8-12	Poor
	0	0	0	0	≤6	Very Poor

- WWH biocriteria is “Good” or higher
- Scores in the ranges of “Marginally Good” are considered Non-Significant Departure

Use Attainment

- Assessing aquatic use attainment status primarily relies on the Ohio EPA biological criteria
- Biological criteria are based on multimetric biological indices (IBI, MIwB, ICI)
- Three attainment status results are possible
 - Full, Partial or Non-Attainment

Attainment Status

- Full attainment – all applicable indices meet the biocriteria
- Partial attainment – if one or two biological indices indicate attainment, biological indices that fail to meet the biocriteria must be at least within the fair range of performance.
- Non-attainment – none of the applicable indices meet the biocriteria or one of the organism groups is rated “poor or very poor”

Advantages of direct biological monitoring

- Detects problems that periodic chemical sampling may miss or underestimate
- Aids in the identification of unknown or unregulated chemicals and altered physical habitats
- Set restoration goals
- Current attainment status (not historical)

Questions

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