

**Taxonomic Resolution: Are Family  
Level Determinations Sufficient for  
Biomonitoring Purposes in Low  
Gradient Northern Prairie Streams?**

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# Purpose

- Open dialogue about sampling and processing issues
- Open discussion about these issues across the basin
- Propose some future directions

# Background

- VCSU Macroinvertebrate Lab
- Do sample identification for a variety of groups:
  - North Dakota Department of Health (NDDH)
  - South Dakota Game and Fish
  - Standing Rock Environmental Protection Agency
  - Various county agencies

# Background

- Biomonitoring for water quality
  - Identify which organisms are living in a particular area of a river or stream
  - Couple this with knowledge of what conditions those organisms can tolerate, it gives you an indication of water quality

# Background

- Unfortunately, this type of knowledge is not sufficiently documented for many taxa
- It also has not been done in this geographic area
  - We rely on numerical analysis to overcome this
    - Multivariate analysis
    - Development of Metrics

# Background

- Benthic Metrics are a measurement of some aspect of macroinvertebrates living in their aquatic environment
- It is important that the values of a metric change when a stream or river is degraded
- For some metrics the value will decrease, for others it will increase
  - It is important to know which way a metric will “move” with increased degradation

# Background

- Five most common categories are
  - Richness measures
  - Composition measures
  - Tolerance/Intolerance measures
  - Feeding measures
  - Habit measures

# Background

- Examples of richness metrics
  - Total Number of Taxa – one of the simplest and most common metrics
    - Just a measurement of how many different types of organisms that were found in a sample
    - The higher the number, the healthier the river

# Background

- Number of EPT taxa – a metric that looks at three common insect groups that are sensitive to pollution
  - E is for Ephemeroptera, the mayflies
  - P is for Plecoptera, the stoneflies
  - T is for Trichoptera, the caddisflies
  - Once again, the higher the number, the healthier the river

# Background

- There has been a focus on trying to utilize these numbers for predictive purposes
  - Development of IBIs
  - Identification of reference sites
- Lets stop and examine the information that generates these numbers
- What level of taxonomic resolution generates useful information?

# Taxonomic Resolution

- Taxonomic resolution refers to what taxonomic level you are going to identify organisms to
- These refer to the taxonomic ranks such as order, family, genus, and species
- Species determinations would seem to give the best information
  - Species determinations are very difficult for many aquatic macroinvertebrates

# Taxonomic Resolution

- Even genus level resolutions are difficult for some macroinvertebrate groups
  - The amount of effort required to make these determinations may not be cost effective
- “Lowest possible taxon”
  - Most common
- Family level

# Advantages of Family level

- Easier to do
  - Somewhat cheaper – less time spent identifying
- Fewer mistakes
- Makes it more applicable to citizen and student groups

# Advantages of Family level

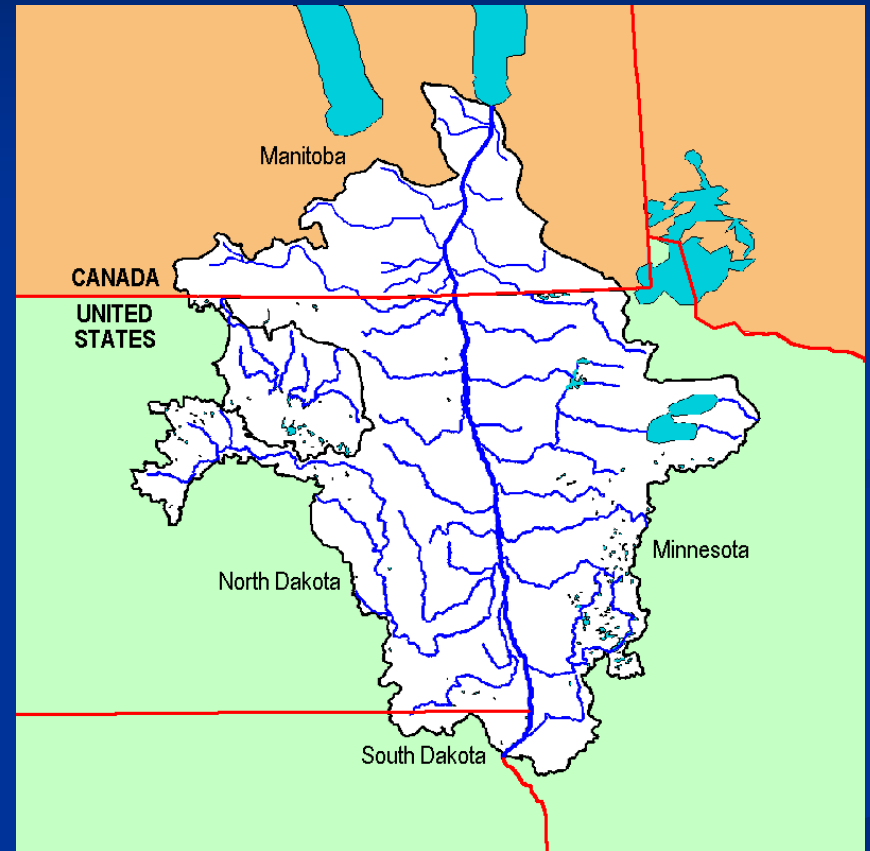
- Disadvantage of genus or lower determinations
  - “Redundant” or “artificial” taxa
    - Damaged specimens
    - Immature specimens

# Advantages of Genus level

- Provides biological and distribution data
  - Increase our knowledge about the aquatic biodiversity in the region
- It may provide the best possible data for water quality determinations

# Red River Valley Inverts

- 48 samples collected in 2005 by the NDDH
- All samples were located in the lake Agassiz Plain ecoregion
- These samples were collected to provide data on sampling methods



From: <http://www.rrbdin.org/data/>

# Red River Valley Inverts

- Low gradient northern prairie streams
  - Families are usually not genera rich
  - Exceptions:
    - Chironomidae
    - Dytiscidae
    - Corixidae



# Red River Valley Inverts

- EPT Taxa
- Ephemeroptera
  - Four genera
- Plecoptera
  - Two genera
- Trichoptera
  - Four genera

# Red River Valley Inverts

- Family  
Heptageniidae
  - *Stenacron*
  - *Stenonema*
  - *Heptagenia*
  - *Leucrocuta*



# Red River Valley Inverts

- Family  
Hydropsychidae
- *Cheumatopsyche*
- *Ceratopsyche*
- *Hydropsyche*
- *Potomyia*



# Red River Valley Inverts

- NDDH's IBI for the Lake Agassiz Plain ecoregion
- Developed by Neil Haugerud of the NDDH, came out last fall
- Identified 7 metrics:
  - % Diptera, % Swimmers, Collector taxa, burrower taxa, clinger taxa, % Dominant Taxa, and total taxa.

# Red River Valley Inverts

- In examining the data from the 48 samples, the first two metrics would be the same at a family or genus level
- The other five metrics would be impacted to some degree by taxonomic level
  - Total Taxa is decreased from an average of 23.8 to an average of 17.8
- Is it possible to recalibrate these metrics?

# Multivariate analysis

- Is often done at the family level
- Red River Basin Biological Monitoring workgroup did a study in the Basin using Multivariate analysis
  - Trefor Reynoldson (National Water Research Institute, Environment Canada)
- Multivariate analysis is beyond the scope of most citizen and school groups

# Can we have the best of both worlds?

- Investigate and develop family level metrics across the basin
- Improve our taxonomic expertise and share that expertise across the basin
- Develop genus or lower tolerance values for aquatic macroinvertebrates in the Red River Basin