

Methods

- **Modified EPA EMAP protocols**
- **Physical, chemical, biological**
 - Habitat assessment
 - Chemical analysis
 - Macroinvertebrate samples
- **Invertebrate sorting and analysis procedures follow EPA's Rapid Bioassessment Protocols**



| Chemical Parameters | Habitat Parameters | Biological Parameters |
|------------------------|----------------------|------------------------------|
| Nitrate, Ammonia, TKN | Weather | Macroinvertebrate Collection |
| Total Phosphorus | Flow | Fecal Coliform Bacteria |
| Dissolved Oxygen | Bank Slope | |
| Conductivity | Shoreline Vegetation | |
| pH | Canopy Cover | |
| Total Suspended Solids | Substrate Size | |
| Total Dissolved Solids | Bank Erosion | |
| Alkalinity | Snag Counts | |
| Turbidity | | |

Stream Invertebrate Community Characteristics

- **219 taxa**
 - 18 orders
 - 9 orders from Class Insecta
 - 62 families
 - 142 genera

| Order | Families | Genera |
|---------------|----------|--------|
| Diptera | 12 | 68 |
| Coleoptera | 13 | 33 |
| Trichoptera | 9 | 16 |
| Ephemeroptera | 6 | 10 |
| Hemiptera | 8 | 15 |
| Odonata | 6 | 12 |
| Plecoptera | 5 | 8 |
| Collembola | 1 | 1 |
| Megaloptera | 1 | 1 |



Major Taxa - Streams

- **Contributing most to abundance**
 - *Simulium vittatum* (Diptera)
 - *Baetis brunneicolor*, *Tricorythodes sp.* (Ephemeroptera)
 - *Hyalella azteca* (Amphipoda)
 - Chironomidae (*Dicrotendipes sp.*, *Larsia sp.*)
 - *Optioservus sp.*, *Microcyllopus sp.* (Coleoptera)
 - *Perlesta sp.* (Plecoptera)
 - *Lepidostoma sp.* (Trichoptera)

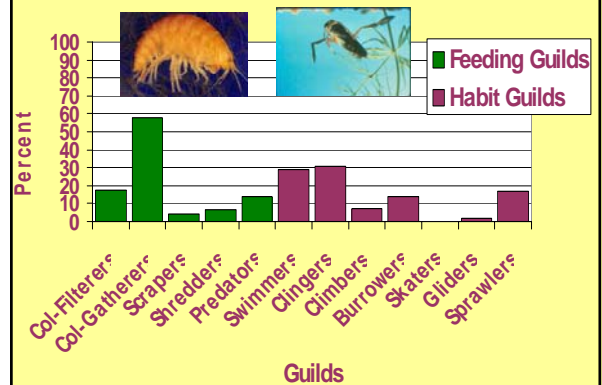


Major Taxa - Streams

- **Widespread Taxa**
 - *Hyalella azteca*
 - *Sphaerium sp.* (Pelecypoda, Bivalve)
 - *Optioservus sp.*
 - *Eukiefferiella sp.* (Chironomidae)
 - *Baetis brunneicolor*
 - *Tricorythodes sp.*
 - *Physa sp.* (Gastropoda)

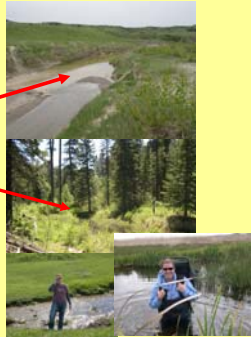


Stream Invertebrate Functional Guilds



Stream Invertebrate Metrics

- **Shannon-Wiener Diversity (H')**
 - Range=0.00-2.80
 - Smallest H' at Sage Creek
 - Largest H' at Beaver Dam Creek
- **Habit Guild H' & FFG H'**
 - Low=Highland Creek (WICA)
 - High=Niobrara (AGFO)



Invertebrate Tolerance - Streams

- **Tolerance Values Ranged 0-10**
 - Most Intolerant – Tolerance = 0
 - Chironomidae – *Heterotrissocladius* sp.
 - Plecoptera – *Acroneuria* sp.
 - Trichoptera – *Anagapetus* sp.
 - Most Tolerant – Tolerance = 10
 - Tubificida – *Eiseniella tetrahedra*
 - Hemiptera – *Hesperocorixa* sp., *Corisella* sp.
 - Odonata – *Sympetrum* sp.

Invertebrate Tolerance - Streams

- **HBI – range = 3.07-9.60**
 - Mean = 5.34
- **MORU and NIOB Streams Lowest HBI**
 - Smith Falls at low end
- **FOLA and AGFO Streams Highest HBI**
 - Highland Creek at high end



River Invertebrate Community Characteristics

| Order | Families | Genera |
|---------------|----------|--------|
| Diptera | 7 | 43 |
| Coleoptera | 12 | 29 |
| Trichoptera | 5 | 9 |
| Ephemeroptera | 8 | 20 |
| Hemiptera | 5 | 9 |
| Odonata | 3 | 7 |
| Plecoptera | 4 | 5 |
| Collembola | 2 | 2 |
| Lepidoptera | 1 | 1 |
| Megaloptera | 1 | 1 |

- **174 taxa**
 - 19 orders
 - 10 orders from Class Insecta
 - 61 families
 - 145 genera



Major Taxa - Rivers

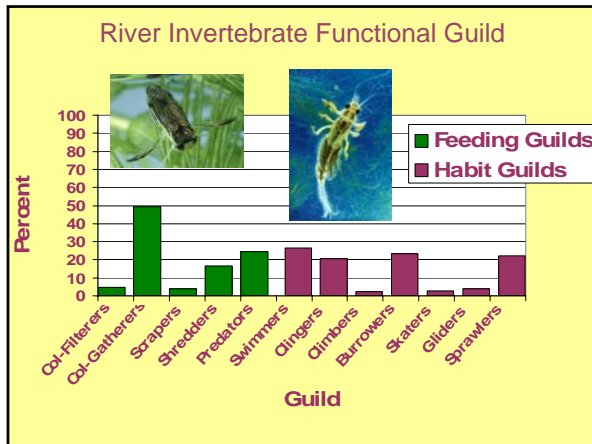
- **Contributing Most to Abundance**
 - *Baetis bicaudatus*, *B. insignificans* (Ephemeroptera)
 - *Simulium* sp.
 - *Physa* sp.
 - *Hyalella azteca*
 - *Traverella albertana* (Ephemeroptera)



Major Taxa

- **Widespread Taxa**
 - *Hyalella azteca*
 - *Tropisternus* sp. (Coleoptera)
 - *Baetis bicaudatus*
 - *Traverella albertana* (Ephemeroptera)
 - *Physa* sp.
 - Chironomidae (*Dicrotendipes* sp., *Cricoptus* sp., and *Eukiefferiella* sp.)





River Invertebrate Metrics

- **Shannon-Wiener Diversity (H')**
 - Range=0.54-2.37
 - Smallest H' at Little Missouri River
 - Largest H' at Laramie River
- **FFG H'**
- **Habit Guild H'**

Invertebrate Tolerance - Rivers

- **Tolerance Values Ranged 0-10**
 - Most Intolerant – Tolerance = 0
 - Ephemeroptera – *Epeorus sp.*
 - Plecoptera – *Acroneuria sp.*
 - Trichoptera – *Glossosoma sp.*
 - Most Tolerant – Tolerance = 10
 - Collembola – *Podura sp.*
 - Hemiptera – *Hesperocorixa sp.*, *Corisella sp.*

Invertebrate Tolerance - Streams

- **HBI range = 2.92-9.00**
 - Mean = 5.46
- **SCBL and FOUS Rivers Lowest HBI**
 - Niobrara River
- **KNRI and MNRR Rivers Highest HBI**
 - Missouri River (KNRI) at high end

Conclusions

- **Diverse systems**
 - 50 taxa unique to streams
 - 33 taxa unique to rivers
- **Diverse Landscapes/Land-uses=Diverse Invertebrate assemblages**
 - Tolerance and Shannon-Wiener Index reflect habitat quality and water quality

Considerations

- Macroinvertebrates ranked in the top ten of 120 vital signs considered by park staff, and staff of state, federal agencies, and academic institutions
- Macroinvertebrate monitoring by parks would contribute data for several partners
- National Parks could be considered one of the least human impacted areas in the regions where they are found
 - Regional reference conditions?



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