

Aquatic macroinvertebrate community response to regional sediment loads in the littoral zone of a Prairie Pothole Lake



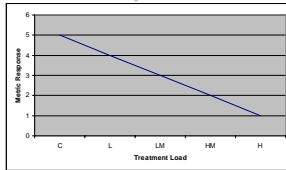
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Sediment Effects on Aquatic Invertebrates

- Smothering
 - Chou et al. 2004; Koel and Stevenson 2002; Wood et al. 2001
- Clogging of respiratory and feeding apparatuses
 - Donohue and Irvine 2004; Shaw and Richardson 2001; Hanson and Butler 1994; Lemly 1982
- Habitat reduction
 - Suren and Jowett 2001; Lenat et al. 1981
- Metal contamination
 - Ali et al. 2002; Courtney and Clements 2002; Borgmann et al. 2001; Moore et al. 1979
- Scouring of exoskeleton
 - Crowe and Hay 2004



Load Response Curve



- A load response curve will generate baseline data that can be used in TMDL projects
 - The differences in metric values will demonstrate the communities present at the different loads
 - So a community at the high treatment load will be the more impacted community
 - A goal for the TMDL process may be to reduce load to obtain the invertebrate community of a low-medium load

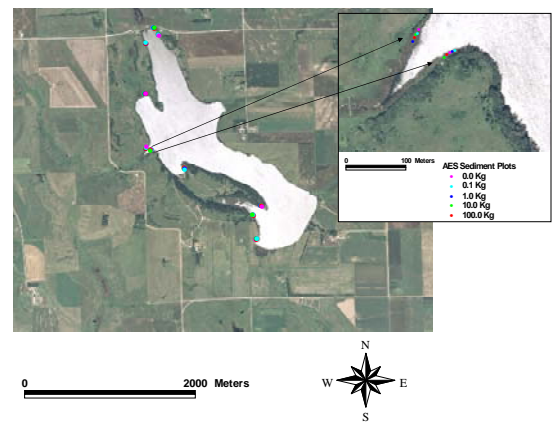
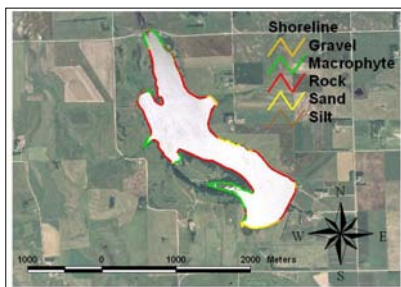
Objectives

- Generate a load-response relationship between sediment load and invertebrate communities
- Determine differences in invertebrate communities between two habitat types
 - Macrophyte Beds
 - Rocky Shores

Shore Habitats

Macrophyte beds (Year 1/Green Lines)~30%

Rocky shores (Year 2/Red Lines)~60%



Methodology

- 10 replicate experimental locations
- Five treatment plots (Carroll 2005)
 - one control, four treatment levels
 - Numbers generated using Mississippi River loads (Dunne and Leopold 1978)
 - 0.1 kg
 - 1.0 kg
 - 10 kg
 - 100 kg



Methodology

- Plot Size
 - 1m x 4m plots
 - Placed at 0.5 meter water depth
 - Constructed of silt fence
- Treatments were randomly assigned at each location
- Samples were collected (150 total)
 - One week prior to treatment
 - One and two weeks following treatment



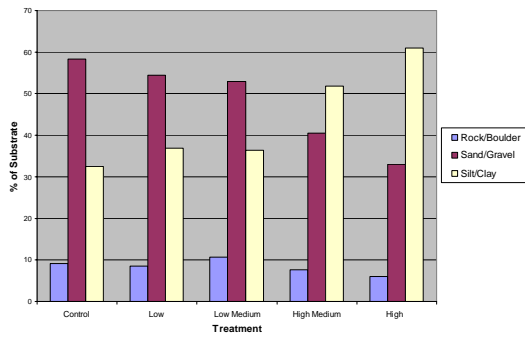
Laboratory Methodology

- A sub-sampling approach was used to sort and identify invertebrates
 - Samples were placed in gridded sorting trays
 - Random grids were sampled
- Sort invertebrates
 - 300 invertebrates were sorted (EPA 2004)
 - After 300 organisms were collected, large and rare organisms were collected
- Invertebrate Identification
 - Identified to the lowest practical taxonomic level
 - Identifications will aid in the calculations of metric values

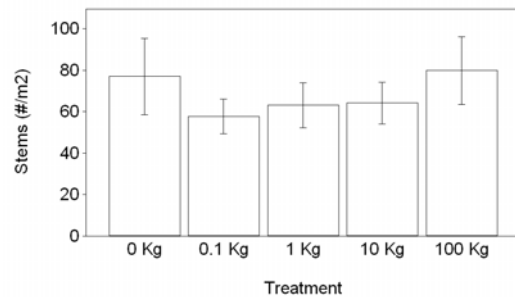
Chemical Results

Treatment Loads	Turbidity (NTU)	Water Temperature (°C)	Conductivity (µS/cm)	Dissolved Oxygen (mg/l)	pH
0 Kg	39	24.4	558	6.8	8.26
0.1 Kg	36	24.5	553	7.3	8.15
1.0 Kg	35	24.4	557	6.8	8.24
10.0 Kg	34	24.5	560	6.6	8.18
100.0 Kg	45	24.4	561	6.6	8.15

Substrate Particle Size



Macrophyte Stem Densities



Invertebrate Results

- The average total numbers of macroinvertebrates is 3802 organisms
 - Average Insecta: 1539
 - Average Crustacea: 154
 - Average Mollusca: 208
 - Average Annelida: 1825
 - Average Other: 76
- A total of 22 taxa have been identified

Taxonomic List

- Insecta (17 taxa)
 - Ephemeroptera
 - *Caenis latipennis*
 - *Caenis diminuta*
 - Odonata
 - *Coenagrionidae*
 - Hemiptera
 - *Neoplea sp.*
 - *Ranatra sp.*
 - Megaloptera
 - *Chauliodes sp.*



Ranatra sp. (www.waterbugkey.vcsu.edu)



Chauliodes sp. (http://efg.cs.umb.edu)

Taxonomic List

- Insecta
 - Trichoptera
 - *Oecetis cinerascens*
 - *Oecetis sp.*
 - *Orthotrichia sp.*
 - Coleoptera
 - *Halipus sp.*
 - *Peltodytes sp.*
 - *Celina sp.*



Oecetis sp. (www.waterbugkey.vcsu.edu)



Peltodytes sp. (www.waterbugkey.vcsu.edu)

Taxonomic List

- Insecta
 - Diptera
 - *Tanytarsus sp.*
 - *Paratanytarsus sp.*
 - *Cladotanytarsus sp.*
 - *Endochironomous sp.*
 - *Ablabsemia sp.*



Chironomidae

Taxonomic List

- Crustacea (2 taxa)
 - Amphipoda
 - *Hyalella azteca*
 - *Gammarus lacustris*
- Mollusca (3 taxa)
 - Gastropoda
 - *Ferrissia sp.*
 - *Menetus sp.*
 - *Physa sp.*



Hyalella azteca



Ferrissia sp.

Summary

- Percent silt and clay ranged from 33% to 61%
 - Highest values found with high treatment
- Turbidity values ranged from 33.7 NTU to 45.1 NTU
 - Highest values found with high treatment
- Macrophyte stem densities were not significantly different between treatment types
- Insecta and Annelida have been the most abundant groups

Future of the Study

- Second Field Season (Summer 2007)
 - Rocky shore habitats will be studied
 - Same methodology as first field season
 - Rocky shores and emergent macrophyte beds comprise over 90% of shoreline littoral habitat
- Load Response curves will be generated from entire study

Acknowledgements

- The authors would like to thank the South Dakota Agricultural Experiment Station for support of this project
- The authors would also like to thank Jeff Emerson for helping throughout the experiment

Any Questions?

