

Macroinvertebrates in the Littoral of a Prairie Pothole, Oak Lake, Brookings County

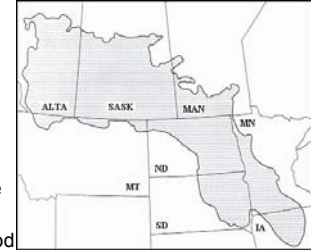


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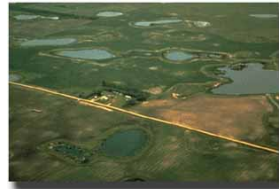
Prairie Pothole Region

- Covers approximately 715,000 km²
- Basin numbers fluctuate between 3 and 6 million depending on the environmental conditions
- 1.78 million acres of wetlands in South Dakota
- 60% less than half an acre
- <5% larger than 5 acres
- Provide water storage, flood control, nutrient storage, waterfowl production



Trends in Prairie Pothole Condition

- Global climate change
- 35% wetland area drained in South Dakota
- ~850,000 acres of wetland landscapes owned by government entities in South Dakota
- Land use practices potentially effect water quality
- Lack of historical studies dealing with identification and collection of invertebrates in the prairie pothole region



Why Littoral Zone?

- Initial land-water interface
- Area initially affected by degradation/pollution
- Strongly affected by abiotic factors
- Zone occupied by macrophytic vegetation



Invertebrate and Biotic Integrity

- Easy to collect
- Sedentary life-style means they are tied to local conditions
- Varying degrees of tolerance to pollution
- Important food source for fish and other organisms
- Some literature suggests that prairie pothole wetlands would be low in invertebrate diversity
- Insufficient information exists regarding the composition and guild structure of pothole invertebrates

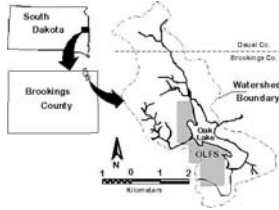


Objectives

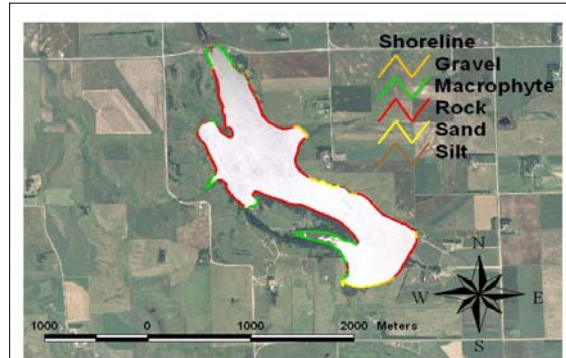
- To describe taxonomic composition and diversity of invertebrates utilizing macrophyte beds of a prairie pothole basin.
- To describe guild structure and range of tolerance to organic pollution displayed by invertebrates utilizing macrophyte beds of a prairie pothole basin.

Study Location

- Oak Lake
 - Intermittently exposed
 - Northeastern Brookings County
 - 44° 30.563 N latitude, 96° 31.432 W longitude
 - Hypereutrophic
 - Average depth 1.1 m
 - 163 ha basin
 - Drains about 1600 ha
 - Mostly agriculture landscape
 - Little shoreline development around perimeter of basin



Shoreline Habitat



Previous Studies

- John Foley (1997)
 - Studied sites prone and not prone to nonpoint source disturbance
- Corey Braskamp (2002)
 - Studied effects of three disturbance treatments to aquatic invertebrates
 - Scour, Sedimentation, and Control
- Damian Carroll (2005) and Kristopher Dozark (2006)
 - Studied experimental effects of sedimentation on invertebrate assemblages

Sampling Methods

- Samples were collected from 1994 to 2006
- A tube sampler was used in 1994 (Foley)
- A standard D-frame net was used from 1997 to 2000 (Braskamp)
- A petite net was used in 2005 and 2006 (Carroll; Dozark)
- All samples were collected in the littoral zone from similar *Typha* dominated habitat



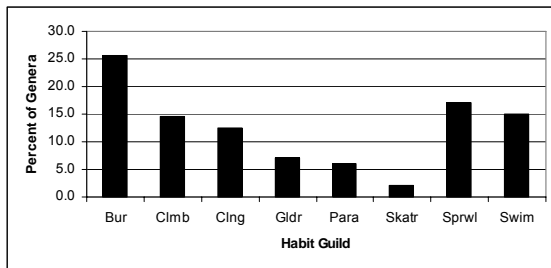
Taxonomic Representation

Phyla	Classes	Orders	Families	Genera
Annelida	2	5	9	28
Arthropoda	4	15	61	134
Cnidaria	1	1	1	1
Mollusca	2	3	6	17
Nematoda	2	7	10	12
Totals	11	31	87	192

Taxonomically Rich Groups

- Diptera (True Flies)
 - 44 genera
- Trichoptera (Caddisflies)
 - 20 genera
- Coleoptera (Beetles)
 - 16 genera
- Hemiptera (True Bugs)
 - 16 genera
- Haplotaxida (Aquatic Earthworms)
 - 15 genera





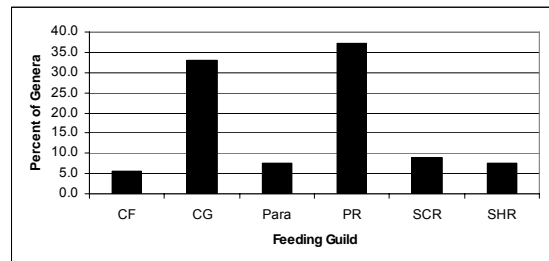
Unique taxa are evenly distributed among a number of habit guilds within macrophyte beds of Oak Lake.

Habit Guilds

- Based on mode of existence of particular organism
 - Locomotion, attachment, concealment
- Burrowers (>25%)
 - Inhabit fine sediments of streams and lakes
 - Diptera, most Chironomidae, Ephemeroptera: Ephemeraeidae
- Sprawlers (17%)
 - Inhabit surface of macrophytes or fine sediments
 - Ephemeroptera: Caenidae, Odonata: Libellulidae

Habit Guilds

- Climbers (15%)
 - Adapted for living on macrophytes with modifications for moving vertically
 - Odonata: Coenagrionidae
- Swimmers (15%)
 - Adapted for “fishlike” swimming
 - Hemiptera: Corixidae, Coleoptera: Dytiscidae
- Clingers (13%)
 - Have behavioral or morphological adaptations for attachment to surfaces
 - Trichoptera: Hydropsychidae, Coleoptera: Halipilidae



Most of the unique invertebrate taxa found within macrophyte beds of Oak Lake were gathering-collectors or predators. However, all the major functional feeding groups were represented within these beds.

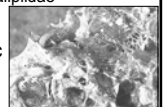
Functional Feeding Groups

- Based on feeding mechanism, dominant food, and particle size of food
- Predators (37%)
 - Dominant food: living animal tissue
 - Attack Prey
 - Coleoptera: Dytiscidae, Odonata: Coenagrionidae
- Gathering Collectors (33%)
 - Dominant food: fine particulate organic matter
 - Actively gather food
 - Ephemeroptera: Caenidae, Amphipoda: *Hyalella*



Functional Feeding Groups

- Scrapers (9%)
 - Dominant food: attached algae
 - Graze on mineral and organic surfaces
 - Trichoptera: Helicopsychidae, Mollusca: *Ferrissia*
- Shredders (8%)
 - Dominant food: vascular plant tissue
 - Chewers of coarse particulate organic matter
 - Trichoptera: Limnephilidae, Coleoptera: Halipilidae
- Filtering Collectors (6%)
 - Dominant food: fine particulate organic matter
 - Filter food
 - Diptera: Culicidae, Trichoptera: Hydropsychidae



Tolerance Values

- Provide a measure of tolerance to organic and nutrient pollution
- Range from 0 to 10 (least tolerant to most tolerant)
- Oak Lake taxa average = 6.59

$$\text{Hilsenhoff Biotic Index} = \frac{\sum n_i a_i}{N}$$

n_i = # of individuals of each species

a_i = tolerance value assigned

N = total # of individuals in sample



0



5



10

Taxa Abundance

	Foley	Braskamp	Carroll	Dozark
Dominant Taxa	Chironomidae Oligochaeta <i>Caenis</i>	<i>Hyalella</i> Oligochaeta <i>Caenis</i>	<i>Hyalella</i> Oligochaeta Chironomidae	Chironomidae Oligochaeta <i>Caenis</i>
Dominant FFG	Gathering Collectors	Gathering Collectors	Gathering Collectors	Gathering Collectors
Dominant Habit Guild	Various Burrower Sprawler	Swimmer Burrower Sprawler	Swimmer Burrower Various	Various Burrower Sprawler

Conclusions

- The invertebrate community, habit guilds and tolerance values in macrophyte beds of Oak Lake are very diverse.
- Invertebrate communities with high diversity will allow monitoring of global climate change, shoreline development, nutrient runoff and other non-point pollution
- Future research should focus on quantifying effects of habitat change on aquatic invertebrate community metrics

Acknowledgements

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