Weather Effects on Invertebrate Abundance in Wetlands in the Prairie Pothole Region

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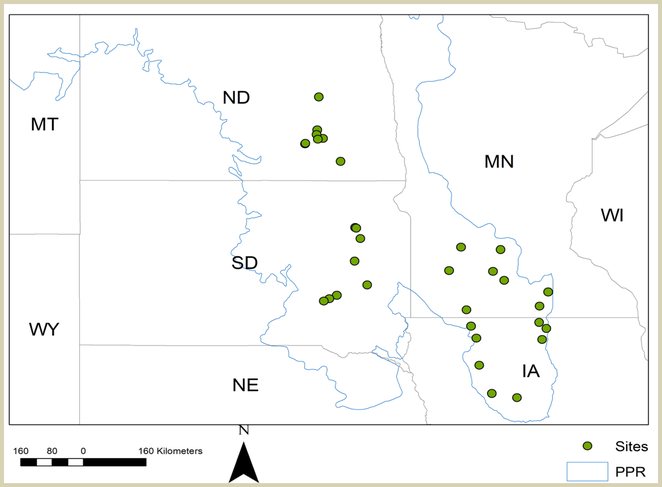
Introduction

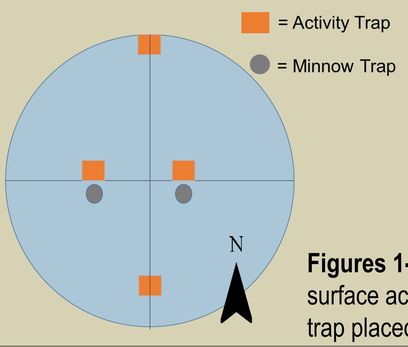
The Prairie Pothole Region of North and South Dakota provides brood rearing habitat for a variety of waterfowl species. Waterfowl broods particularly rely on invertebrates to survive during early weeks of development. Many factors may influence the abundance and species composition of invertebrates on the landscape, including abiotic effects such as weather. Our goal was to evaluate the effects of weather on aquatic invertebrate abundance in prairie wetlands.

Methods

Study Site:

We sampled wetlands for invertebrates in North and South Dakota. Surface activity traps were set at varying distances from the center of the wetland along the four cardinal directions. Traps were left out for 24 hours, invertebrates were collected from sample traps, stored in ethanol, and brought back to the lab for processing.





Figures 1-3. Sampling locations, a representation of surface activity trap arrangement on a wetland, and a trap placed in a prairie wetland.

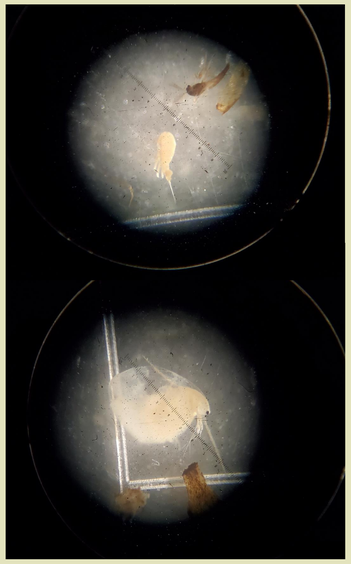


Figure 4. Family Copepoda (top) and Cladocera (bottom).

Figure 5. Ashley Tunstall counting a sample in the lab.

In the lab we enumerated total invertebrate abundance by family. We downloaded weather data corresponding to the date and year of each sample from the nearest NOAA weather station.

Analysis of Weather Data and Invertebrate Data:

We use linear regression to diagnose the effects of weather conditions on log-transformed invertebrate abundance. We evaluated the effects of daily temperature maximums and minimums, average daily wind speed, and percent lunar illumination. We ranked models by AICc score and calculated parameter estimates and confidence intervals.

Results

Parameters	AICc	ΔAICc	Weight
Total Abundance + Temperature Minimum	2473.9	0.00	0.41
Total Abundance + Percent Lunar Illumination	2474.8	0.96	0.26
Total Abundance + Temperature Maximum	2475.7	1.80	0.17
Total Abundance + Average Daily Wind	2475.7	1.82	0.17

Parameter	Estimate	85% CI
Temperature Minimum	-0.012	0.001 to -0.025
Percent Lunar Illumination	-0.137	0.059 to -0.333
Temperature Maximum	-0.003	0.007 to -0.013
Average Daily Wind	0.005	0.024 to -0.014

Tables 1 and 2. AICc model ranks and parameter estimates

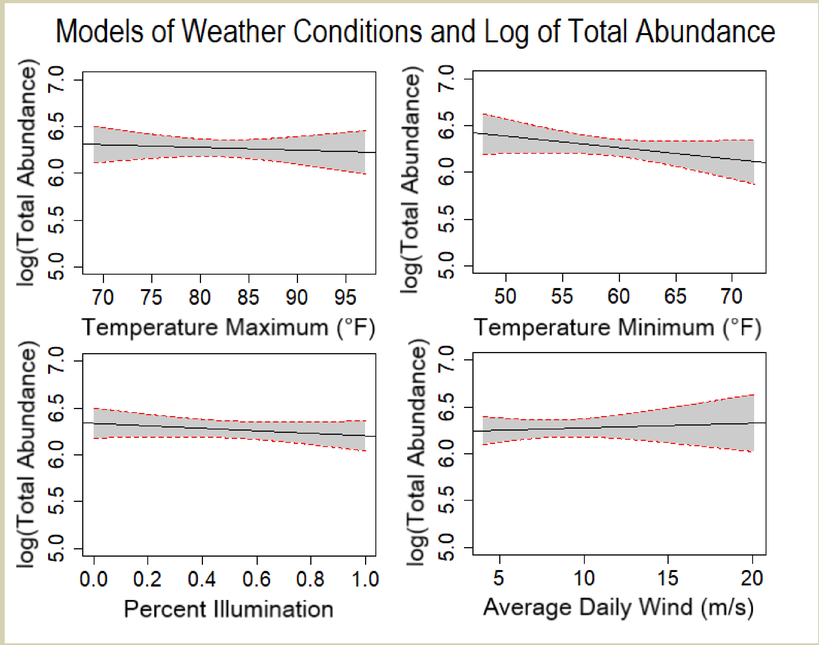


Figure 6. Regression models and confidence intervals.

The best-fitting model was the model of temperature minimums and invertebrate total abundance; however, **no model indicated a relationship between invertebrate abundance and weather conditions.**

Discussion

Given that other studies have uncovered weather effects on invertebrate abundance[1,2], we were surprised to find no significant relationship. This may have been because many samples were collected on the same day, so weather data were poorly distributed relative to invertebrate samples. Samples were initially collected to achieve a different study objective. An alternative experimental design would help parse how weather affects invertebrate family abundance on prairie wetlands.

References

[1]Hodkinson, I.D., S.J. Coulson, N.R. Webb, W. Block, A.T. Strathdee, J.S. Bale, and M.R. Worland. 1996. Temperature and the Biomass of Flying Midges (Diptera: Chironomidae) in the High Arctic. *Oikos* 75: 241-248.

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