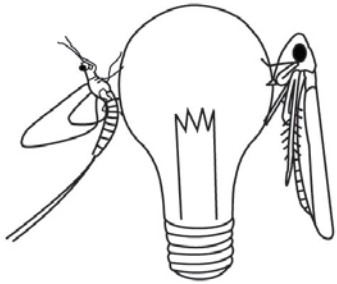


Does the Macroinvertebrate Community of a Restored Delmarva Bay Mimic a Natural Bay?



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The Nature Conservancy



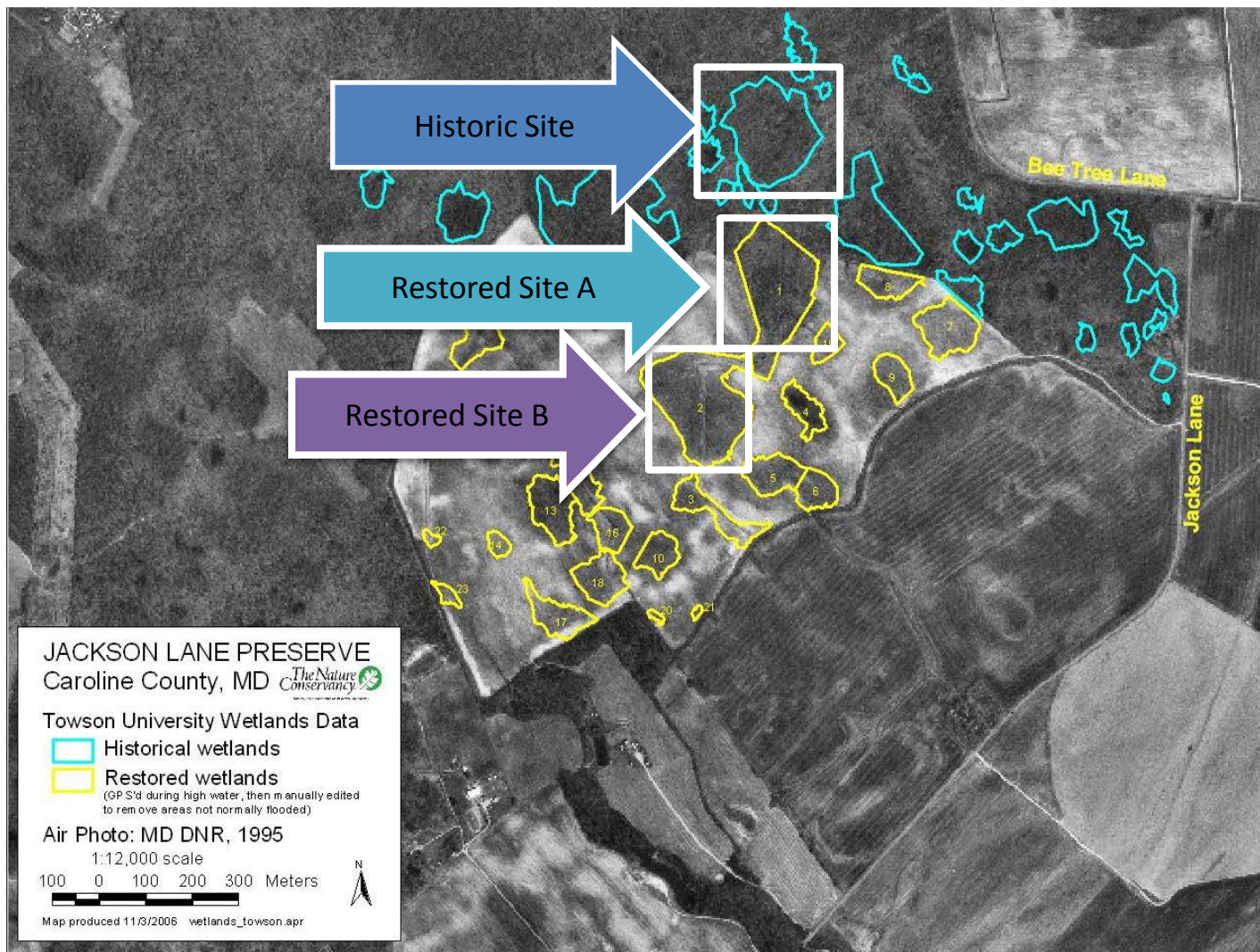
Introduction

Acknowledgements



Introduction

Wetland Restoration



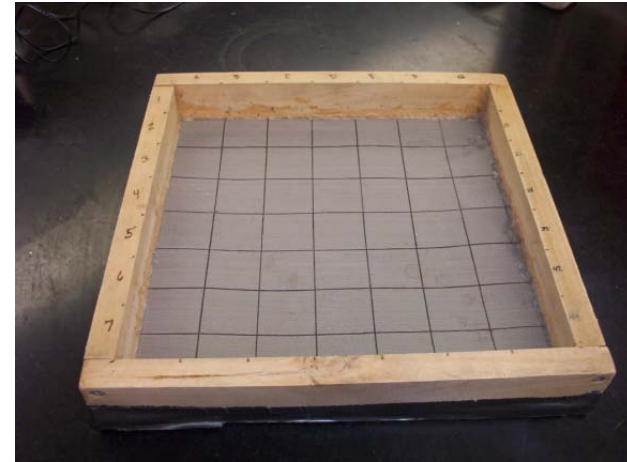
- To compare macroinvertebrate community similarity between historic and restored pools
- To identify taxa with strong associations to each pool

- Four years of data: 2005-2007, and 2012
- Samples collected monthly between March and August
- Macroinvertebrate sampled with 20 d-net sweeps in each pool



Macroinvertebrates

- Sub-sampled to collect at least 300 individuals
- Identified to lowest practical taxonomic level

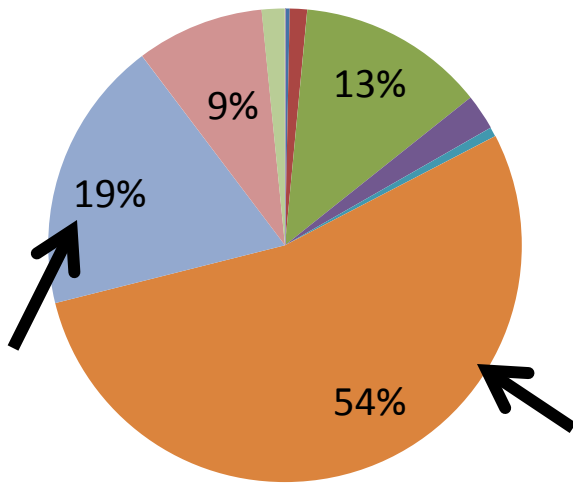


Statistical Analysis

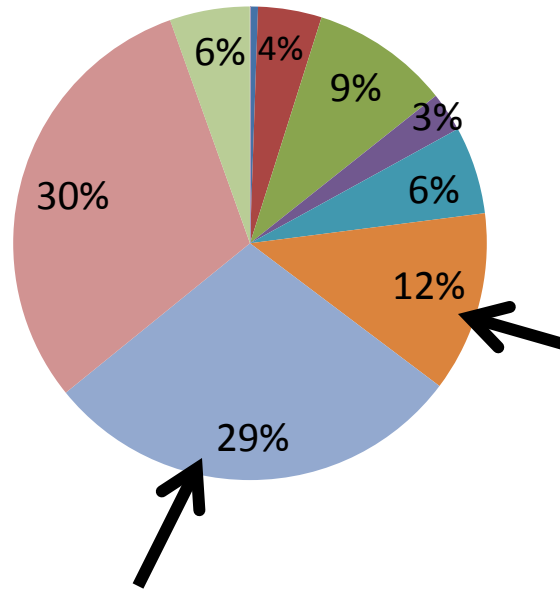
- Dufrene-Legendre Indicator Analysis
- NMDS Ordination



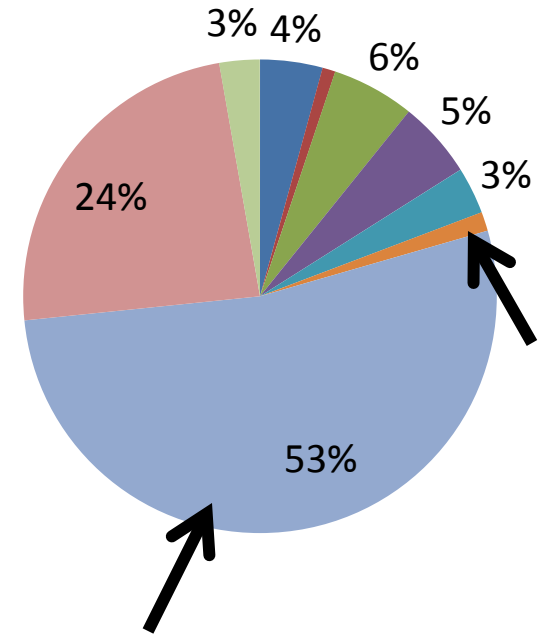
Historic Site



Restored Site A



Restored Site B

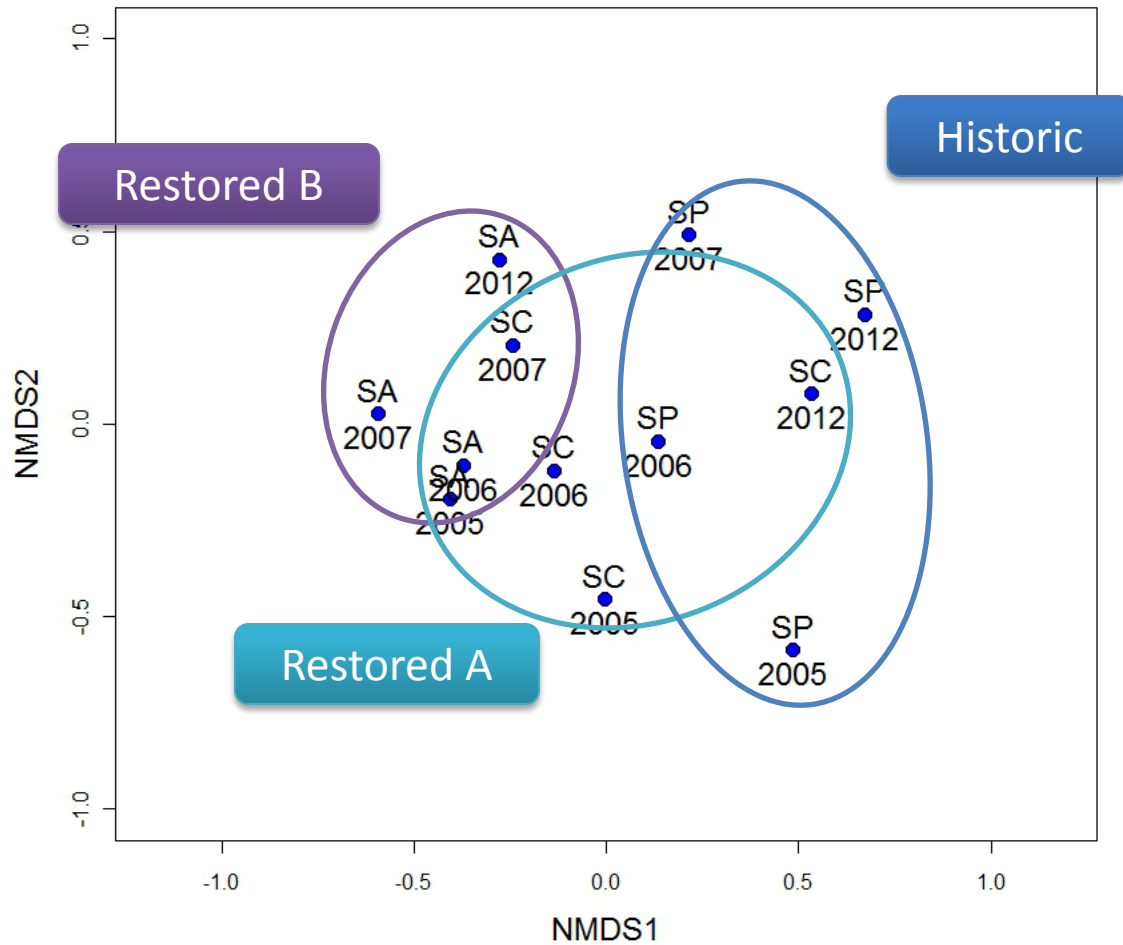


- Acari
- Coleoptera
- Diptera
- Gastropoda
- Hemiptera
- Isopoda
- Midge Larvae
- Nematoda/Oligochaeta
- Odonata
- Ephmeroptera

Results

Community Overview

NMDS Ordination of Community Data



Distance Matrix: Bray Curtis
Stress: 0.16

Historic Site	
Taxa	p-value
Caecidotea	0.001
Gammarus	0.001
Cambaridae	0.003
Palaemonidae	0.034

Restored Site A	
Taxa	p-value
Suphisellus	0.002
Lestes	0.007

Restored Site B	
Taxa	p-value
Caenis	0.001
Planorbidae	0.001
Physidae	0.001
Tanypodinae	0.001
Chironomini	0.001
Tanytarsini	0.001
Sigara	0.001
Oecitis	0.007
Berosus	0.022

Primary consumers,
grazers

Predators

Midge larvae
predominant, other
taxa variable

Results

Indicator Taxa for each pool

- To compare macroinvertebrate community similarity between natural and restored pools

Each pool had different key players

Restored Site A appears to be in transition

- To identify taxa with strong associations to each pool

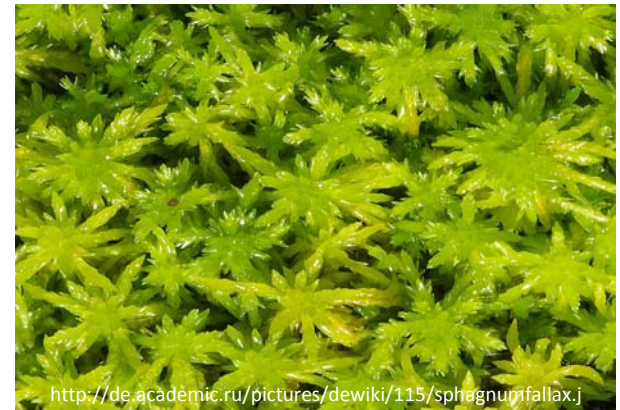
Groups indicate underlying ecology

- Was wetland restoration successful?

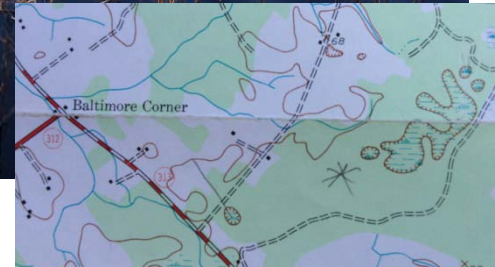
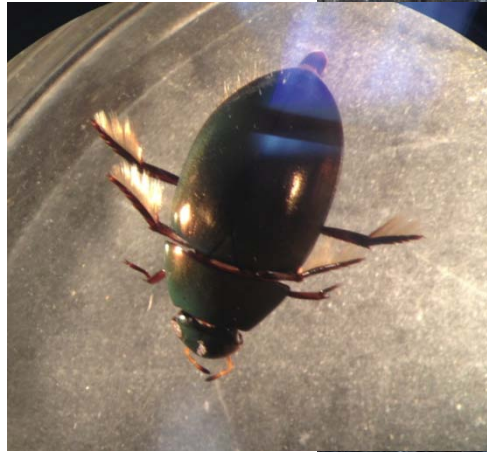
Using the historic site as bench mark, communities seem to be moving in the right direction.

- What caused the shift in macroinvertebrate communities of Restored Site A?

Let's return to the isopods...



Sphagnum moss?



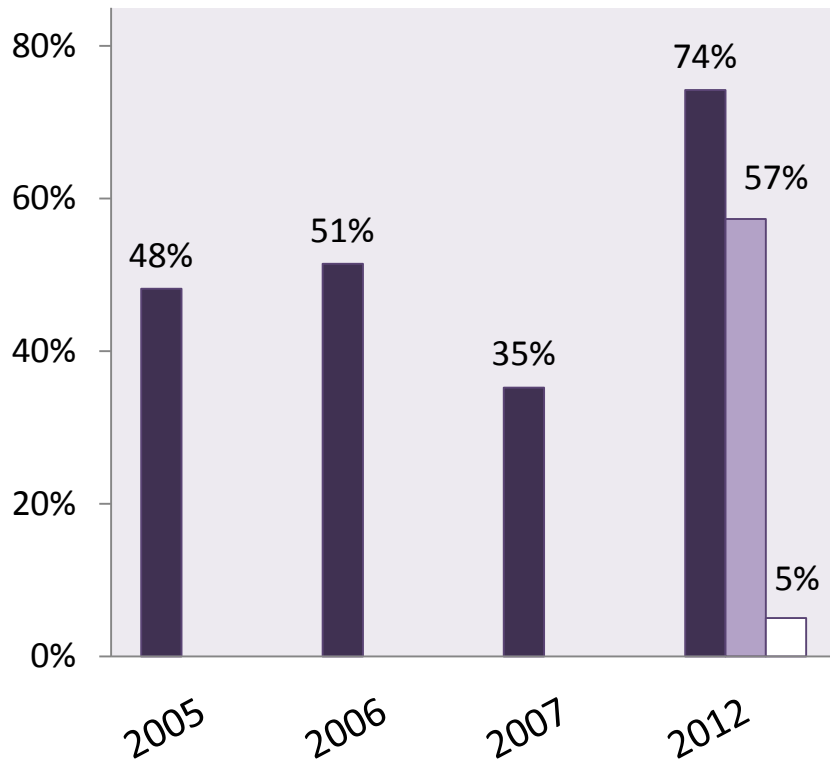
Questions?

- Reduces available nutrients
 - Intercepts nutrient input
 - Prevents microbial activity
- Increases vegetation structure
 - Grows in dense mats
 - Fills the water column



Relative Abundance of Isopods

■ JLL ■ PPD □ Cell 2



Distinguish between sites with and without *Sphagnum* based on dytiscid beetle community

Exploring relationship between isopod abundance and the presence of *Sphagnum*

Conclusion

Future Research

Cell	Size (ac)	CWD added	CWD amount	Straw type	Fish	Hydroperiod	Connected	Ditched
JLL	3.3	N	M	none	Y	82	no	no
PPD	8.2	Y-slash	VH	wheat	Y	66	to 19, 8, 7	medium
2	9.1	Y	L	wheat	Y	94	no	large

Detail of metrics

Size= approximated in GIS using GPS boundary data from Towson Univ., as modified by D. Samson (see map); values probably represent full-pool areas

CWD added= Coarse woody debris added at time of construction; based on field notes provided by Rich Mason

CWD amount= subjective assessment by D. Samson of amount (Low, Medium, High, Very High) or coarse woody debris in the main portion of the cell

Staw Type= type added at time of construction; based on field notes provided by Rich Mason

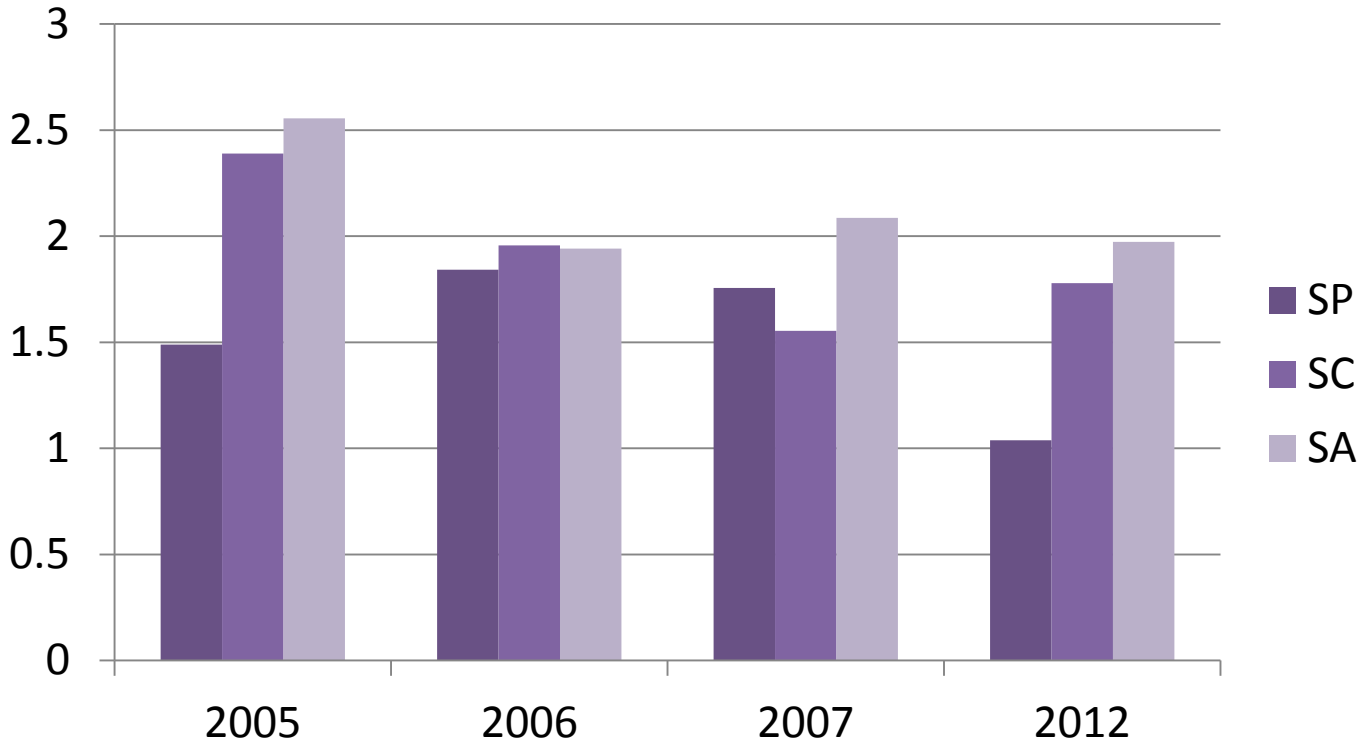
Fish= D. Samson's knowledge, based on Shelly's 2004 field work; THIS INFO SHOULD BE CHECKED BY UMD RESEARCHERS

Hydroperiod= percent of the sample dates (Jan. 2005 to Feb. 2007) when the cell water level was at or above 1/2 the maximum level

Connected= connectivity to other nearby cells at high water levels

Ditched= D. Samson's assessment of whether or not the cell has an ag drainage ditch, and what size

Shannon-Weiner Diversity

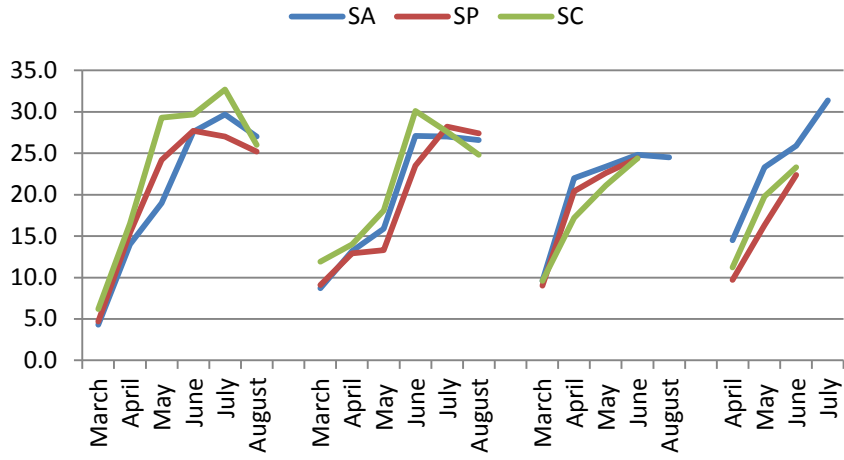


Ephemeroptera		Diptera		Coleoptera	
Baetidae	<i>Callibaetis</i>	Ceratopogonidae	<i>Bezzia-Palpomyia</i>	Dytiscidae	<i>Acilius</i> ²
Caenidae	<i>Caenis</i> ³		<i>Ceratopogon</i> ³		<i>Agabus</i>
	Odonata		<i>Culicoides</i>		<i>Copelatus</i> ²
Aeshnidae	<i>Anax</i>	Chaoboridae	<i>Chaoborus</i>		<i>Cybister</i> ²
	<i>Aeshna</i>		<i>Corethrella</i> ¹		<i>Desmoprachia</i>
Coenagrionidae	sp.	Chironomidae	Chironomini		<i>Dytiscus</i> ³
Libellulidae	<i>Erythemis</i>		Orthocladiinae		<i>Heterostenuta</i> ²
	<i>Libellula</i>		Tanypodinae		<i>Hydroporine</i>
	<i>Pachydiplax</i>		Tanytarsini		<i>Hydroporus</i> ¹
	<i>Plathemis</i>		sp.		<i>Hydrovatus</i>
	<i>Perithemis</i> ³	Culicidae	<i>Aedes</i>		<i>Hygrotus</i>
	<i>Sympetrum</i>		<i>Anopheles</i>		<i>Laccophilus</i>
	Tramea		<i>Culex</i> ²		<i>Laccornis</i> ²
	sp.		<i>Uranotaenia</i>		<i>Matus</i>
Lestidae	<i>Lestes</i>		sp.		<i>Neoporus</i>
	Hemiptera	Dolichopodidae	sp.		<i>Uvarus</i> ²
Belostomatidae	<i>Belostoma</i>	Sciaridae	sp.	Halipilidae	<i>Halipilus</i> ³
Corixidae	<i>Hesperocorixa</i>	Stratiomyidae	sp. ²		<i>Peltodytes</i> ²
	<i>Sigara</i> ³	Tabanidae	<i>Chrysops</i> ³	Hydrophilidae	<i>Anacaena</i> ¹
	sp.		<i>Tabanus</i>		<i>Berosus</i>
Gerridae	sp.	Tipulidae	<i>Helius</i> ²		<i>Enochrus</i>
Naucoridae	sp. ³		<i>Limonia</i>		<i>Hydrochus</i> ³
Nepidae	<i>Ranatra</i> ³		sp. ²		<i>Tropisternus</i>
Notonectidae	<i>Buenoa</i>		Trichoptera		sp.
	<i>Notonecta</i>	Hydroptilidae	<i>Orthotichia</i> ³	Noteridae	<i>Hydrocanthus</i>
	sp.		<i>Oxyethira</i>		<i>Suphisellus</i>
Veliidae	<i>Microvelia</i>	Leptoceridae	<i>Nectopsyche</i> ²	Scirtidae	sp. ²
	Megaloptera		<i>Oecitis</i>		Lepidoptera
Corydalidae	<i>Chauliodes</i> ¹	Phryganeidae	<i>Agrypnia</i> ³	Crambidae	sp.
	<i>Nigronia</i> ¹		<i>Phryganea</i> ²		
			<i>Ptilostomis</i> ²		

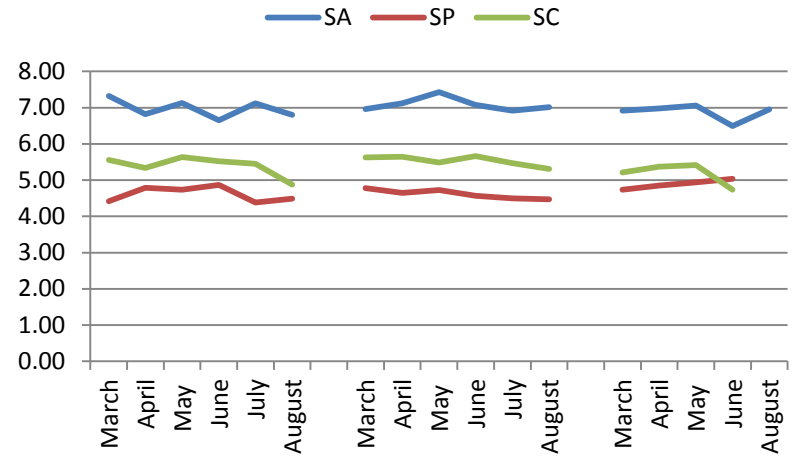
Other Macroinvertebrates

Acari		Decapoda		Isopoda	
Hydrachnidia	sp.	Cambaridae	sp. ¹	Asellidae	<i>Caecidotea</i>
	Amphipoda	Palaemonidae	sp. ¹		Microcrustacea
Gammaridae	<i>Gammarus</i> ¹		Gastropoda	Cladocera	sp.
	Collembola	Ancylidae	sp.	Copepoda	sp.

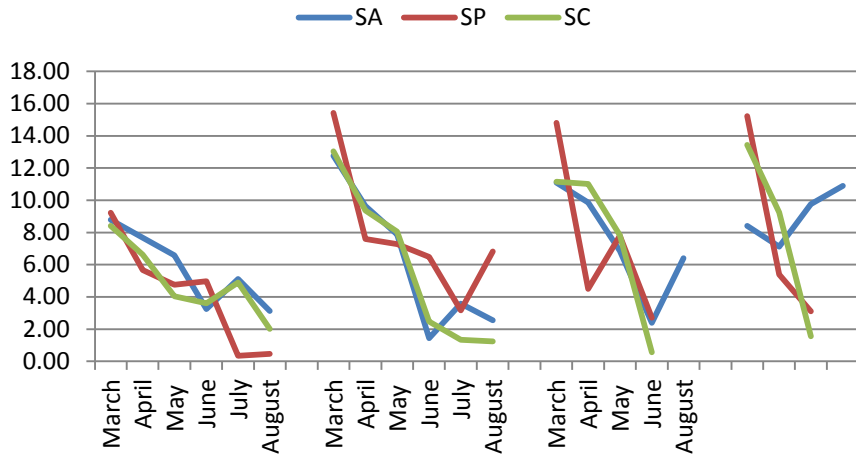
Temperature



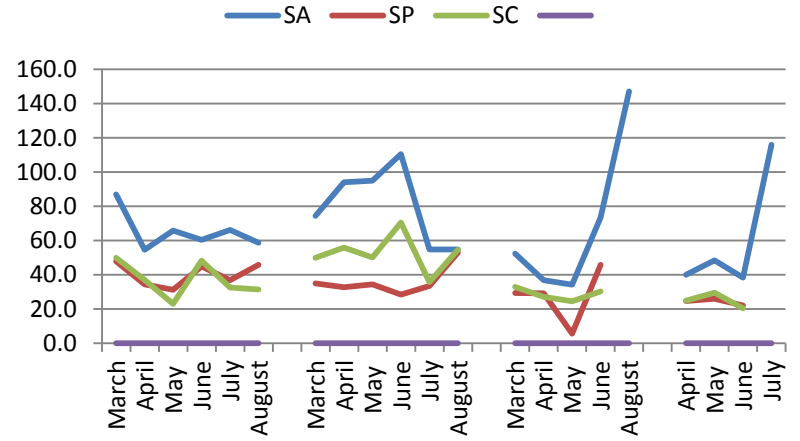
pH



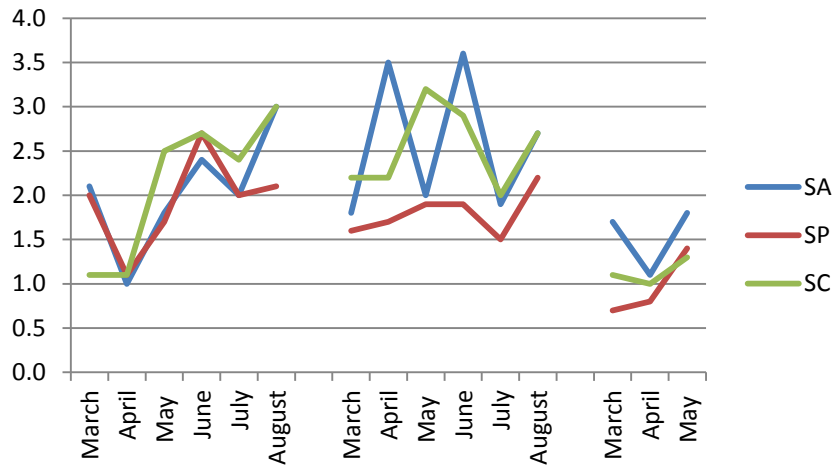
Dissolved Oxygen (mg/L)



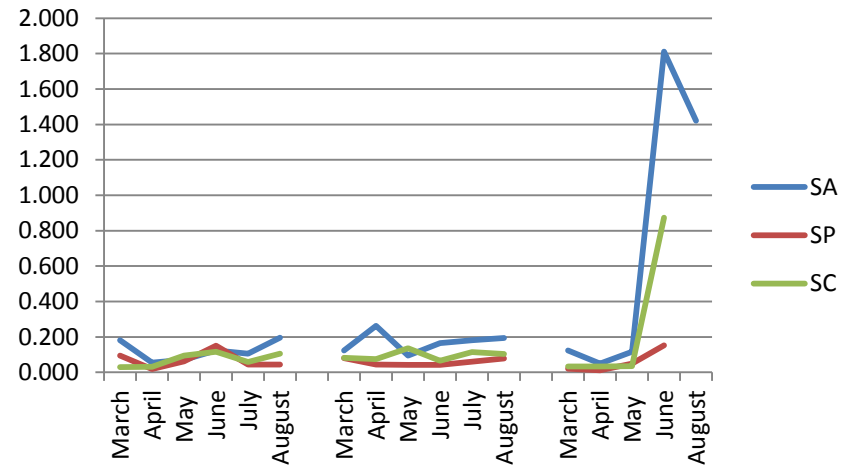
Conductivity



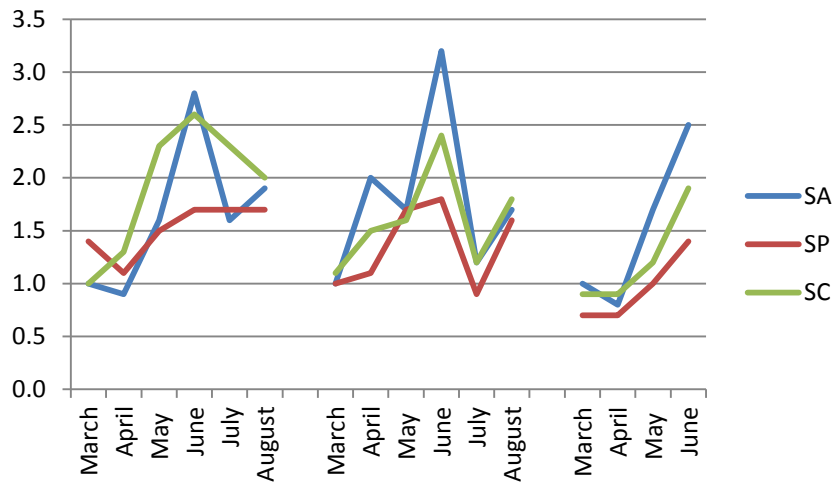
Total Nitrogen



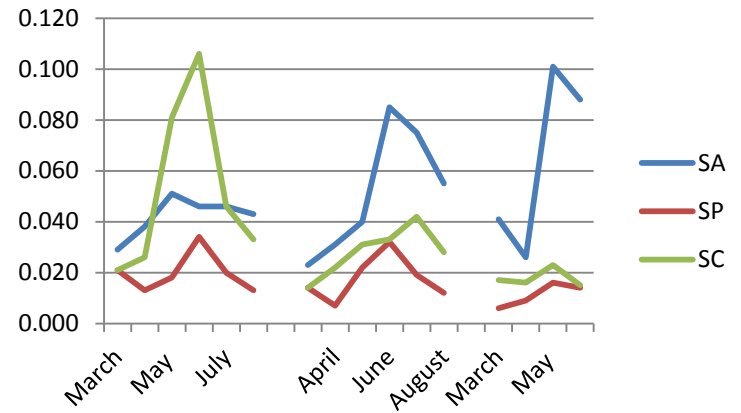
Total Phosphorous



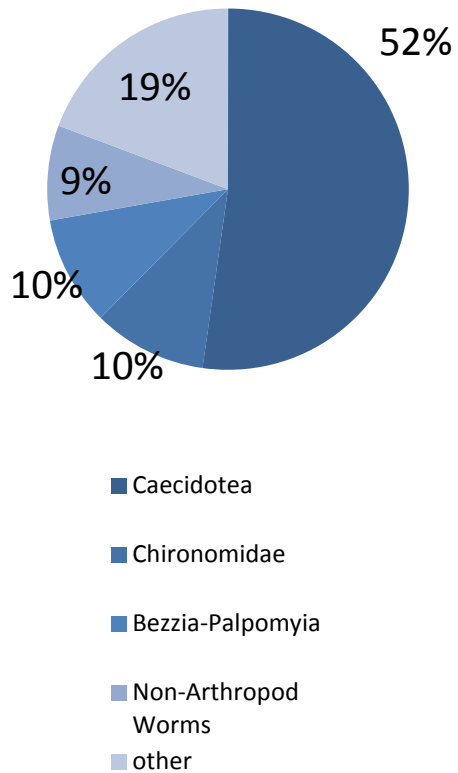
Total Dissolved Nitrogen



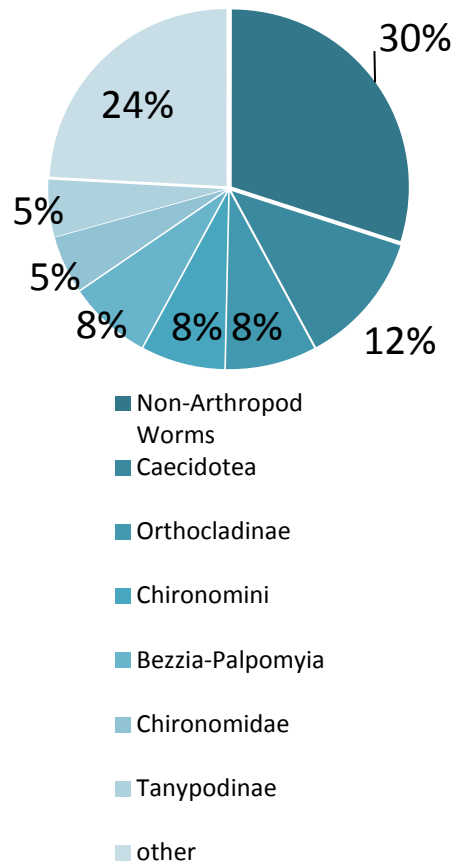
Total Dissolved Phosphorous



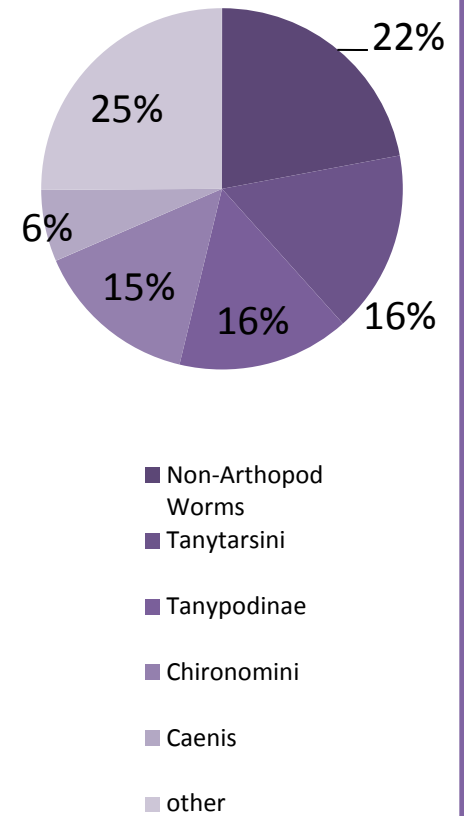
Cell 1 | *Sphagnum* Present



Cell 2 | *Sphagnum* Colonized



Cell 3 | *Sphagnum* Absent



The image features a decorative header and footer. The header at the top consists of a long blue bar on the left and a shorter purple bar on the right. The footer at the bottom consists of a purple bar on the left containing the text 'Results' and a long blue bar on the right.

Results

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Results

