

Preliminary report on diatom communities in the upper main stem of the Susquehanna River Summer 2014

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Abstract

The upper main stem of the Susquehanna River is formed by the confluence of the West and North Branches, each of which is chemically and physically distinctive. The upper main stem retains the signatures of the two branches due to weak lateral mixing, and we refer to them as the North Branch plume (NBP) and West Branch plume (WBP). Thus, characterization of the diatom communities required samples taken from sites that occur in the plumes of both branches. We sampled sites at a transect that straddles Byers Island near Shamokin Dam, PA and below the Adam T. Bower inflatable dam at Sunbury, PA. Samples were taken in the summer of 2014 and prepared for examination by light and electron microscopy. Within the plumes of the two branches, we focused on two particular habitats inhabited by diatom communities: sediment and stone. We eliminated epiphytes from this analysis because beds of submerged and emergent plants occurred only in WBP. Overall, we identified 101 different species in this study. Samples from WBP showed 50 and 62 species in the stone and sediment communities, respectively. Similar samples from NBP had 49 (stone), 36 (sediment). Of the diatom communities on stone surfaces, there were only 9 species of common (1-10% occurrence) and/or dominant (>10% occurrence) in common to both NBP and WBP. Similarly, sediment samples from both plumes had only 11 species in common. Habitats of the NBP were dominated by small centric species (e.g. *Stephanodiscus parvus*, *Cyclotella atomus*, *Stephanocyclus meneghiniana*, and *Discostella pseudostelligera*), all taxa that were absent from or rare in samples taken from the WBP.

Introduction

- Diatoms, a dominant group of algae and major component of the river biofilm communities, are used to evaluate water quality (Werner 1977).
- Diatoms are hypersensitive towards their environments (Pan et al. 1996), and, therefore are good biological indicators (Stevenson et al. 2008).
- The purpose of this study is to use diatom periphyton and phytoplankton (metaphyton) in the continuing assessment of water quality at the Byers Island Transect on the upper main stem of the Susquehanna River as well as to compare periphyton communities found in the environment as opposed to those found in periphytometers.

Site Description

The Byers Island Transect (Figure 1) straddles Byers Island 7km south of the confluence of the West and North branches of the Susquehanna River. Sites 1-4 are below the low head dams at the Sunbury Generation plant. Periphyton was sampled at sites 1-5 (each labeled with a star). Additionally, A 500m reach was established along the banks of site 1 and 2, which is denoted by green dots. We focused on Sites 1 and 2 in order to observe differences between the West Branch Plume (WBP, Site 1) and the North Branch Plume (NBP, Site 2).

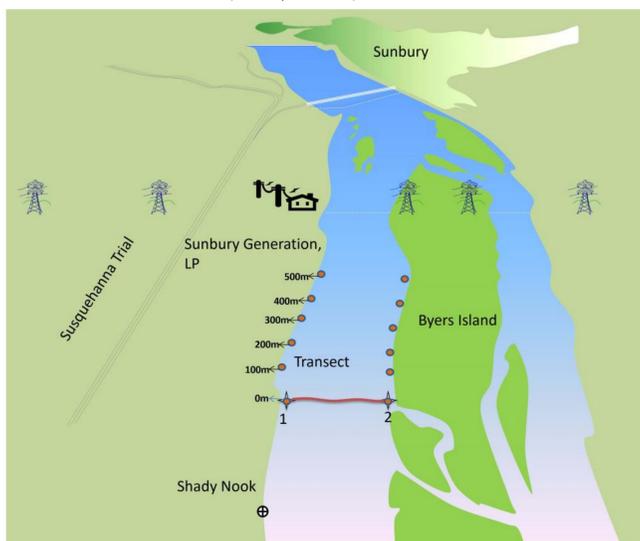


Figure 1: Map of the collection sites. Those locations marked with a red dot were actively sampled for diatom biofilms.

Methods

- Active field collections were made at the marked locations at 100M intervals above sites 1 and 2 (see Figure 1).
- Stones were collected and placed in containers.
- Sediment was collected using a turkey baster and placed in a 50ml Falcon tube.
- Samples were returned to the lab and cleaned using the following procedure:
 - Hypochlorite plus heating
 - Concentrated Potassium Permanganate
 - Concentrated Hydrochloric Acid
 - Concentrated (30%) Hydrogen Peroxide
- Diatom ID confirmed by JEOL JSM 6010LV SEM.
- Counts performed using the JEOL JSM 6010LV and NIKON Eclipse DIC light microscope (300 cell minimum) or until 25 fields had been reached at each site
- Pollution Tolerance Index (PTI) calculated according to Stephenson et al. (2008).
- Bray-Curtis Proportional Similarity was taken according to Bloom (1981).
- Water on the transect was monitored on a weekly basis for 8 weeks (June 5 - July 24) using a YSI 556 Multimeter (recorded temperature, conductivity, oxygen concentration and pH) and a Secchi Tube to measure turbidity.
- Water was collected for alkalinity and some was filtered in the laboratory and frozen in whirl-pacs for future water chemistry analysis.

Results

Table 1. All of the diatom species observed in samples taken from stones and sediment from specified locations in the WBP and NBP at the Byers Island Transect (see Figure 1). All centric diatoms in the taxa list are underlined. The cells are color-coded according to percent occurrence. The results are percentages compiled from pooled counts from all six locations at each site.

	SITE 1		SITE 2		SITE 1		SITE 2	
	STONE	SEDIMENT	STONE	SEDIMENT	STONE	SEDIMENT	STONE	SEDIMENT
<i>ACHNANTHIDIUM ATOMUS</i>	0.12	0.00	0.87	1.12	<u>0.00</u>	0.23	0.00	0.00
<i>ACHNANTHIDIUM DEFLEXUM</i>	10.97	5.48	2.50	8.07	0.32	0.00	0.00	0.00
<i>ACHNANTHIDIUM EXIGUUM</i>	0.00	0.46	0.00	0.00	0.00	0.00	0.20	0.00
<i>ACHNANTHIDIUM KRANZII</i>	0.04	0.00	1.01	0.00	0.88	0.00	0.00	0.00
<i>ACHNANTHIDIUM LATECEPHALUM</i>	0.00	0.23	0.00	0.00	0.06	0.00	0.00	1.12
<i>ACHNANTHIDIUM MINUTISSIMUM</i>	17.24	24.32	7.78	13.68	0.59	2.51	0.68	1.79
<i>ACHNANTHIDIUM RIVULARE</i>	3.81	0.57	1.29	0.00	0.00	0.23	0.00	0.00
<i>AMPHORA COPULATA</i>	0.00	0.00	0.14	0.00	0.00	0.46	0.00	0.00
<i>AMPHORA OVALIS</i>	0.12	0.00	0.00	0.00	0.00	0.68	0.00	0.00
<i>AMPHORA PEDICULUS</i>	0.54	1.71	0.14	0.45	0.23	1.83	0.95	0.90
<i>AMPHORA VENETA</i>	0.00	0.00	0.27	0.00	0.41	2.05	0.00	0.45
<i>ASTERIONELLA FORMOSA</i>	0.00	0.23	0.00	0.00	0.23	1.71	0.23	0.00
<i>BACILLARIA PAXILLIFERA</i>	0.00	0.23	0.00	0.00	0.00	0.23	0.00	0.00
<i>BRACHYHIRA MICROCEPHALA</i>	0.87	4.91	0.34	0.45	0.38	0.91	0.34	0.00
<i>CALONEIS BACILLUM</i>	0.12	0.46	0.00	0.45	0.00	0.68	0.00	0.00
<i>CAPARTOGRAMMA CRUCICULA</i>	0.12	0.00	0.00	0.00	0.32	0.68	0.00	0.00
<i>COCCONEIS PEDICULUS</i>	0.12	0.00	0.27	0.00	0.23	0.68	0.34	0.00
<i>COCCONEIS PLACENTULA</i>	15.84	8.22	42.63	8.97	0.00	0.00	0.14	0.00
<i>COSMONEIS PUSILLA</i>	0.00	0.00	0.00	0.45	0.00	0.23	0.00	0.00
<i>CYCLOSTEPHANOS DUBIUS</i>	0.00	0.00	0.00	0.90	0.47	0.68	0.00	0.00
<i>CYCLOTELLA ATOMUS</i>	0.00	0.00	8.66	9.87	0.00	0.00	0.14	0.00
<i>CYCLOTELLA BODANICA</i>	0.00	0.00	0.07	0.00	0.00	0.00	0.00	1.35
<i>CYMBELLA AFFINIS</i>	0.00	1.14	0.00	0.00	0.00	0.00	0.14	0.00
<i>CYMBELLA CISTULA</i>	0.00	0.00	0.07	0.00	0.35	0.46	0.00	0.00
<i>CYMBELLA TUMIDA</i>	0.00	0.00	0.14	0.00	0.12	0.23	0.00	0.45
<i>CYMBELLA TURGIDULA</i>	0.00	0.00	0.00	0.45	0.06	0.23	0.00	0.00
<i>DELICATA DELICATULA</i>	0.12	0.00	0.34	0.00	0.76	0.23	0.00	0.00
<i>DIATOMA MONILIFORMIS</i>	0.00	0.23	0.00	0.00	0.00	0.00	0.14	0.00
<i>DIATOMA VULGARIS</i>	0.12	1.94	0.00	0.27	0.23	9.70	0.34	0.00
<i>DISCOSTELLA PSEUDOSTELLIGERA</i>	0.00	0.00	0.27	12.33	0.00	0.23	0.00	0.00
<i>DISCOSTELLA STELLIGERA</i>	0.00	0.68	1.15	1.12	1.70	2.17	0.14	1.12
<i>DISCOSTELLA WOLTERECKII</i>	0.00	0.00	0.00	0.67	0.70	0.46	1.01	0.00
<i>ENCYONEMA CAESPITOSUM</i>	0.12	0.00	0.00	0.00	0.00	0.23	0.00	0.00
<i>ENCYONEMA MINUTUM</i>	0.00	1.14	0.14	1.35	0.32	2.63	0.00	0.00
<i>ENCYONEMA PROSTRATUM</i>	0.00	0.23	0.00	0.00	0.00	1.37	0.00	0.00
<i>ENCYONEMA SILESIACUM</i>	0.23	1.37	0.00	0.00	0.00	0.00	0.00	0.45
<i>ENCYONEMA UNDESCRIBED</i>	3.05	5.02	0.20	2.24	0.23	1.03	0.74	0.67
<i>EOLIMNA MINIMA</i>	0.23	0.00	0.00	3.59	0.12	0.00	0.74	0.90
<i>EUNOTIA MINOR</i>	0.00	0.23	0.14	0.00	5.98	0.46	9.54	4.48
<i>EUNOTIA TENELLA</i>	0.20	0.46	0.00	0.00	1.76	0.00	0.00	0.00
<i>FRAGILIARIA CAPUCINA</i>	0.00	1.71	0.34	0.00	0.00	0.23	0.00	0.00
<i>FRAGILIARIA VAUCHERIAE</i>	0.41	0.46	0.27	0.90	0.00	0.34	0.00	0.00
<i>FRUSTULIA ASIATICA</i>	0.00	0.23	0.14	0.00	0.00	0.46	0.68	9.64
<i>GOMPHONEIS CALCIFUGA</i>	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.45
<i>GOMPHONEIS CLEVEI</i>	27.74	0.34	12.72	6.50	0.00	0.00	0.00	1.12
<i>GOMPHONEIS MINUTA</i>	0.12	0.00	0.14	0.00	0.00	0.00	0.27	0.90
<i>GOMPHONEIS OLIVACEUM</i>	0.00	0.34	0.95	0.00	0.32	0.00	0.00	0.00
<i>GOMPHONEIA ANGUSTATUM</i>	0.35	0.68	0.41	0.00	0.00	0.00	0.14	0.00
<i>GOMPHONEIA PARVULUM</i>	0.35	1.26	0.63	0.45	0.00	0.31	0.00	0.00
<i>GYROSIGMA ACUMINATUM</i>	0.00	0.00	0.07	0.00	0.23	0.91	0.00	0.00
<i>HALAMPHORA VENETA</i>	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00
<i>HIPPODONTA CAPITATA</i>	0.00	0.23	0.00	0.00	0.00	0.23	0.00	0.00
<i>KARAYEVIA CLEVEI</i>	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>MASTOGLIOA SMITHII</i>	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
<i>MAYAMAEA ATOMUS</i>	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>MELOSIRA VARIANS</i>	0.06	0.00	0.00	0.00	0.00	0.00	0.00	1.12
<i>NAVICULA CAPITATORADIATA</i>	0.59	2.51	0.68	1.79	0.00	0.00	0.00	0.00
<i>NAVICULA CARI</i>	0.00	0.23	0.00	0.00	0.00	0.23	0.00	0.00
<i>NAVICULA CINCTA</i>	0.00	0.46	0.00	0.00	0.00	0.46	0.00	0.00
<i>NAVICULA CRYPTOCEPHALA</i>	0.00	0.68	0.00	0.00	0.00	0.68	0.00	0.00
<i>NAVICULA CRYPTOTENELLA</i>	0.23	1.83	0.95	0.90	0.23	1.83	0.95	0.90
<i>NAVICULA GREGARIA</i>	0.41	2.05	0.00	0.45	0.41	2.05	0.00	0.45
<i>NAVICULA LANCEOLATA</i>	0.23	1.71	0.23	0.00	0.23	1.71	0.23	0.00
<i>NAVICULA RADIOSA</i>	0.00	0.23	0.00	0.00	0.00	0.23	0.00	0.00
<i>NAVICULA REICHARDTIANA</i>	0.38	0.91	0.34	0.00	0.38	0.91	0.34	0.00
<i>NAVICULA SUBHYNCHOCEPHALA</i>	0.00	0.68	0.00	0.00	0.00	0.68	0.00	0.00
<i>NAVICULA TRIPUNCTATA</i>	0.23	0.68	0.34	0.00	0.23	0.68	0.34	0.00
<i>NAVICULA VIRIDULA</i>	0.00	0.00	0.14	0.00	0.00	0.00	0.14	0.00
<i>NITZSCHIA ACICULARIS</i>	0.00	0.23	0.00	0.00	0.00	0.23	0.00	0.00
<i>NITZSCHIA AMPHIBIA</i>	0.47	0.68	0.00	0.00	0.47	0.68	0.00	0.00
<i>NITZSCHIA DISSIPATA</i>	0.00	0.00	0.14	0.00	0.00	0.00	0.14	0.00
<i>NITZSCHIA FONTICOLA</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35
<i>NITZSCHIA FRUSTULUM</i>	0.00	0.00	0.14	0.00	0.00	0.00	0.14	0.00
<i>NITZSCHIA INCONSPICUA</i>	0.35	0.46	0.00	0.00	0.35	0.46	0.00	0.00
<i>NITZSCHIA PALEA</i>	0.12	0.23	0.00	0.45	0.12	0.23	0.00	0.45
<i>NITZSCHIA RECTA</i>	0.06	0.23	0.00	0.00	0.06	0.23	0.00	0.00
<i>PINNULARIA BOREALIS</i>	0.76	0.23	0.00	0.00	0.76	0.23	0.00	0.00
<i>PINNULARIA VIRIDIS</i>	0.00	0.00	0.14	0.00	0.00	0.00	0.14	0.00
<i>PLANOTHIDIUM DAUI</i>	0.23	9.70	0.34	0.00	0.23	9.70	0.34	0.00
<i>PLANOTHIDIUM DELICATULUM</i>	0.00	0.23	0.00	0.00	0.00	0.23	0.00	0.00
<i>PLANOTHIDIUM FREQUENTISSIMUM</i>	1.70	2.17	0.14	1.12	1.70	2.17	0.14	1.12
<i>PLANOTHIDIUM LANCEOLATUM</i>	0.70	0.46	1.01	0.00	0.70	0.46	1.01	0.00
<i>PLATESSA BAHSLII</i>	0.00	0.23	0.00	0.00	0.00	0.23	0.00	0.00
<i>PSAMMOTHIDIUM HELVETICUM</i>	0.32	2.63	0.00	0.00	0.32	2.63	0.00	0.00
<i>PSAMMOTHIDIUM SUBATOMOIDES</i>	0.00	1.37	0.00	0.00	0.00	1.37	0.00	0.00
<i>PUNCTICULATA PRAETERMISSA</i>	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.45
<i>REIMERIA SINUATA</i>	0.23	1.03	0.74	0.67	0.23	1.03	0.74	0.67
<i>REIMERIA UNISERIATA</i>	0.12	0.00	0.74	0.90	0.12	0.00	0.74	0.90
<i>RHOICOSPHEIA ABBREVIATA</i>	5.98	0.46	9.54	4.48	5.98	0.46	9.54	4.48
<i>ROSSITHIDIUM LINEARIS</i>	1.76	0.00	0.00	0.00	1.76	0.00	0.00	0.00
<i>STAURONEIS SMITHII</i>	0.00	0.23	0.00	0.00	0.00	0.23	0.00	0.00
<i>STAUROSIRELLA LEPTOSTAURO</i>	0.00	0.34	0.00	0.00	0.00	0.34	0.00	0.00
<i>STEPHANOCYCLUS MENEGHINIANA</i>	0.00	0.46	0.68	9.64	0.00	0.46	0.68	9.64
<i>STEPHANODISCUS HANTZSCHII</i>	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.45
<i>STEPHANODISCUS MINUTULUS</i>	0.00	0.00	0.00	1.12	0.00	0.00	0.00	1.12
<i>STEPHANODISCUS PARVUS</i>	0.00	0.00	0.27	0.90	0.00	0.00	0.27	0.90
<i>SURIRELLA ANGUSTA</i>	0.32	0.00	0.00	0.00	0.32	0.00	0.00	0.00
<i>THALASSIOSIRA LACUSTRIS</i>	0.00	0.00	0.14	0.00	0			