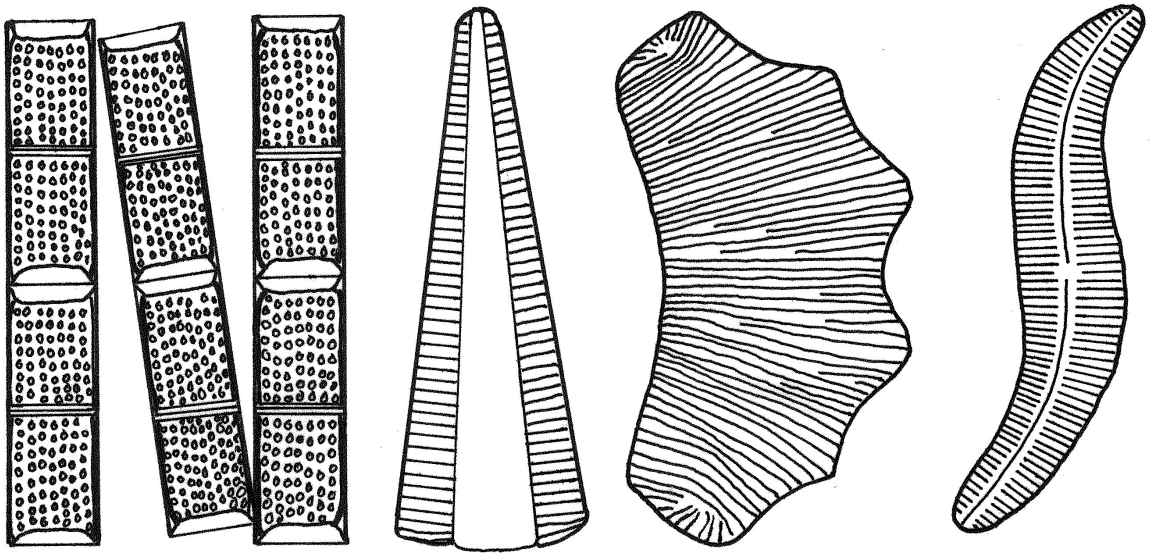
24th North American Diatom Symposium



Stone Laboratory, Gibraltar Island, OH
27 September - 1 October 2017

The North American Diatom Symposium: A Little History

The North American Diatom Symposium (NADS) is a biennial meeting normally held at field stations throughout the United States and Canada. The meeting was first held in 1970 at Cedar Creek in Minnesota. Since that date, the gathering has been hosted at field stations in Florida, Colorado, Manitoba, Kentucky, Alabama, Ohio, Minnesota, Iowa, Wisconsin, and Michigan. NADS usually attracts 80-100 diatomists from North America and around the world. The meeting provides a student friendly atmosphere, ample opportunities to network and socialize, the ever-popular scum run, local field collecting trips, and lively auction of diatom related valuables. NADS is an informal society, that is, there are no formal officers or structure.

J. Platt Bradbury and Rick Drum organized the first NADS meeting. It was held in October 1970 at Cedar Bog Lake in central Minnesota (now the University of Minnesota's Cedar Creek Ecosystem Science Reserve). The site is notable for being the location of study for R. L. Lindeman's classic paper "The trophic-dynamic aspect of ecology. Ecology 23:399-418". The meeting was attended by 23 diatomists. After several days of discussion with no formal papers the group sat in a circle and talked about diatom ecology. This resulted in a paper (Bradbury, J. P. 1973. Ecology of freshwater diatoms. Nova Hedwigia. 24:145-168.), that was essentially a verbatim record of that conversation.

This meeting provides the opportunity to catch up with colleagues and talk to some of the foremost diatom researchers in a beautiful, natural setting, offered by the field station atmosphere that has become a tradition at the symposium. This meeting provides the opportunity to catch up with colleagues and talk to some of the foremost diatom researchers in a beautiful, natural setting, offered by the field station atmosphere that has become a tradition at the symposium.

About Our 2017 Venue:
Ohio State's Stone Laboratory

Ohio State University's Stone Laboratory on Gibraltar Island in Lake Erie. This small island (6.55 acres, 0.026 km^2) is part of the Lake Erie Islands archipelago and located just offshore of the town of Put-in-Bay on South Bass Island (2.482 mi^2, 6.428 km^2).

The F. T. Stone Laboratory (known simply as Stone Lab) was dedicated on June 22, 1929, making it the oldest freshwater field station in the United States. It contains six classrooms, offices, laboratories, computing facilities, and a 100-seat auditorium. It hosts workshops for grade school students throughout the year, and full-credit college courses are offered to advanced high school students, undergraduates, and graduate students over the summer.

Historically, Gibraltar Island was an important lookout point for Commodore Oliver Hazard Perry during his successful Battle of Lake Erie against the British fleet in the War of 1812. Stone Laboratory has been a freshwater field station with research and teaching laboratories since 1895 and has been part of The Ohio State University since 1925. Stone Laboratory, the South Bass Island Lighthouse and the Aquatic Visitors Center at Put-in-Bay have offered field-based educational programs and research opportunities in biological science to thousands of participants, see webcam: https://ohioseagrant.osu.edu/research/live/cameras International symposium participants will present their work in diatom research including biodiversity, evolution, ecology, systematics, biological assessment, paleolimnology, and nanotechnology. In addition to the scientific program, the meeting will include traditional NADS activities (the Scum Run and auction).

The NADS Organizing Committee for 2017:
Ohio State's Stone Laboratory

Julie Wolin
Cleveland State University
Organizer for NADS 2017

Jeffrey Johansen
John Carroll University
Co-Organizer for NADS 2017

Rex Lowe
Bowling Green State University
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Mark Edlund
St Croix Watershed Research Sta.
Science Museum of Minnesota
NADS Auction Organizer

Brittany Dalton
Cleveland State University
Graduate Student Assistant

Emma Scott
Student Assistant

Kristin Stanford
OSU Stone Lab Events Manager

Sarah Hamsher
NADS Webmistress

The NADS Sponsors for 2017:
Ohio State's Stone Laboratory

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The NADS Program for 2017: Stone Laboratory, Ohio State University

Time	Wednesday	Thursday	Friday	Saturday	Sunday
730		**Breakfast**	**Breakfast**	**Breakfast**	**Cont Breakfast**
820		Info/ Welcome	**Breakfast**	**Breakfast**	**Cont Breakfast**
840		Welcome	Paleoecology		Departures
900		Stream Ecology	Paleoecology	Business	Departures
920		Stream Ecology	Paleoecology	Business	Departures
940		Stream Ecology	Paleoecology	Business	Departures
1000		**Deluxe Break**	**Deluxe Break**		
1020		Ecology	Great Lakes	Scum Run	
1040		Ecology	Great Lakes	Scum Run	
1100		Ecology	Great Lakes	Scum Run	
1120		Ecology	Great Lakes	Scum Run	
1140		Ecology		Scum Run	
1200	Registration	**Lunch**	**Lunch**	**Lunch**	
	Registration	**Lunch**	**Lunch**	**Lunch**	
1300	Registration	**Plenary**	**Plenary**	Field Trips	
	Registration	**EnvironChange**	**EnvironChange**	Field Trips	
1340	Registration	**Plenary**	**Plenary**	Field Trips	
1400	Registration	Reproduction	Bioassessment	Field Trips	
1420	Registration	Structure	Bioassessment	Field Trips	
1440	Registration	**Break**	**Break**	Field Trips	
1500	Registration	New Taxa	Bioassessment	Field Trips	
1520	Registration	New Taxa	Bioassessment	Transport to	
1540	Registration	DOTUS	Bioassessment	Put-in-Bay	
1600	Transport	Transport	Taxonomic Certification		
1630	Transport	POSTERS	Taxonomic Certification		
1640	Transport	POSTERS			
1700	**Dinner**	POSTERS	**Dinner**	Dinner	
1800		POSTERS		on your own	
1900	**Stone Lab Intro**	Banquet	**Auction**		
	Reception	Banquet	**Stone Lab**		
2230	**Transport**	**Transport**	**Transport**	**Transport**	

to Boardwalk	To Stone Lab	to Boardwalk	To Stone Lab	

TIME	28-Sep-17 AUTHOR	THURSDAY PRESENTRATION (SHORT TITLE)
730	*Breakfast*	*Breakfast*
820	Stone Lab Staff	WELCOME & INFORMATION
840	Lowe	HISTORY OF STONE LAB
900	Solomon et al	EXAMINING CHANGES IN STREAM ALGAL COMMUNITIES
920	Pillsbury & Clark	EFFECTS OF NUTRIENTS AND CURRENT ON *DIDYMOSPHENIA*
940	Genter	DIATOM DENSITIES EXPOSED TO HEAVY METALS
1000	*Break*	*Break*
1020	Benito et al.	METACOMMUNITY DYNAMICS IN TROPICAL SOUTH AMERICA
1040	Mazzei et al.	DRIVERS OF MAT-DWELLING *ENCYONEMA EVERGLADIANUM*
1100	Frankovich et al.	EPIZOIC AND APOCHLOROTIC TURSIOCOLA SPECIES
1120	Gaiser	CORE SPECIES REGULATING DIATOM NETWORK ASSEMBLY
1140	Wee & Bucolo	LABORATORY EXPERIMENTS IN DIATOM ECOPHYSIOLOGY
1200	*Lunch*	*Lunch*
1300	Potapova	PLENARY: CHRONICLES OF SALT MARSHES WRITTEN IN DIATOM LANGUAGE
1400	Massa et al.	SEXUAL REPRODUCTION *CYMBELLA AFFINIS, GOMPHONEIS*
1420	Card	VALVES: LOCULATE AEROLAE AND SANDWICH STRUCTURE
1440	*Break*	*Break*
1500	Lowe et al.	A NEW "CENTRIC" DIATOM FROM OAHU HAWAI'I
1520	Minerovic et al.	NEW TAXON CURATION AND MANAGEMENT IN THE ANSP
1540	Edlund et al.	STATUS OF THE DIATOMS OF THE UNITED STATES WEB
	Edlund & Lee	Discussion: DOTUS
1615		Transport to Aquatic Center
1630		*POSTERS*
1830		*POSTERS*
1900	*Banquet Dinner*	*Boardwalk*
2230		Water Taxi to Stone Lab

TIME	29-Sep-17 SPEAKER	FRIDAY PRESENTRATION (SHORT TITLE)
730	*Breakfast*	*Breakfast*
840	Burge et al.	PALEOLIMNOLOGY AND RESURRECTION ECOLOGY
900	Feitl et al.	DECADAL LACUSTRINE RECORDS, ECUADORAN LAKES
920	Chraïbi et al.	CONTROLS ON DIATOMS OF YELLOWSTONE
940	Warnock et al.	ÅNGERMANÄLVEN ESTUARY, NORTHERN BALTIC SEA
1000	*Break*	*Break*
1000	Woods et al.	DIATOM-DEPTH MODEL FOR WESTERN GREAT LAKES
1020	Sgro & Reavie	LAKE ERIE DIATOM INFERRED PHOSPHORUS
1040	Bramburger et al.	SIZE CHANGE IN GREAT LAKES PLANKTONIC DIATOMS
1100	Edlund et al.	PREDICTING CLIMATE SENSITIVITY OF BOREAL LAKES
1120		
1140		
1200	*Lunch*	*Lunch*
1300	Reavie	PLENARY: DIATOMS AS AN EARLY WARNING SYSTEM FOR IMPACTS FROM EUTROPHICATION, INVASIVE SPECIES AND CLIMATE CHANGE
1400	Sabir et al. (Ashworth)	DIATOM ECOLOGY ON CORAL REEFS OF THE RED SEA
1420	Tyree et al.	ALTERNATIVE DIATOM ENUMERATION METHODS
1440	*Break*	*Break*
1500	Lee et al.	HARMONIZING AND REVISING DIATOM TAXONOMY
1520	Charles et al.	QA ASSESMENT OF REPLICATE DIATOM COUNTS
1540	Stevenson	DIATOM INDICATOR MAGIC: LAW OF LARGE NUMBERS
1600	Stevenson et al	Discussion: TAXONOMIC CERTIFICATION
1700	*Dinner*	*Dinner*
1900	Auction/Mixer	Auction/Mixer
2230		Water Taxi from Stone Lab

TIME	30-Sep-17 SPEAKER	SATURDAY PRESENTRATION (SHORT TITLE)
730	*Breakfast*	*Breakfast*
830 900 1020	Edlund	NADS Business Meeting
		NADS Scum Run
1200	*Lunch*	*Lunch*
1300		Field Trips Lake Erie Science Cruise or Kayak the Bay
1500		Transport to Put-in-Bay Dinner on your own
2230	Water Taxi to Stone Lab	

METACOMMUNITY DYNAMICS OF LAKE DIATOMS IN TROPICAL SOUTH AMERICA

Xavier Benito[1], Sherilyn C. Fritz[1], Miriam Steinitz-Kannan[2], Maria I. Velez[3], Michael M. McGlue[4]
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Patterns that maintain and generate biodiversity of macro-organisms in the Neotropics are widely discussed in the scientific literature, yet the spatial ecology of microorganisms is largely unknown. The tropical Andes and adjacent Amazon lowlands span a wide gradient of climatic, topographic, and aquatic habitat conditions that present an opportunity to test biogeographic and metacommunity concepts for exploring drivers on diatom diversity and community assembly processes at different spatial scales. We assembled a database of 200 lakes with associated predictors that describe local (limnological) and regional (geo-climatic) environmental gradients to examine diatom metacommunity patterns at two different levels: taxon and functional (deconstructed species matrix by ecological guilds). We also derived spatial variables that simultaneously assessed the relative role of overland and topographic distances as proxies of dispersal limitation. We used complementary multivariate statistical techniques to analyze i) regionalization of lakes (Principal Component Analysis, cluster analysis and non-metric multidimensional scaling), and ii) diatom metacommunity structuring (variance partitioning). Lakes were grouped according to geo-climatic variability and landscape configuration. Six clusters were identified as functional metacommunity units for diatom communities arranged along a latitudinal gradient. Both diatom species composition and guilds differed sharply among lake clusters. Variance partitioning revealed that different latitudinal patterns emerged when analyzing diatom species and guilds separately. Latitudinal differences in environmental and spatial influences on species composition were not detected in the analysis of all taxa together, whereas spatial influences showed decreased importance with increasing latitude in guilds with lower dispersal abilities. Topographic heterogeneity played an important role in structuring diatom metacommunities, particularly in guilds with high dispersal abilities. However, diatom metacommunity structure was highly context-dependent in certain lake clusters of the Andean Altiplano, with no clear relationships among spatial extent, environmental heterogeneity, and dispersal ability. Our results indicate that a combination of environmental and landscape variables influence diatom metacommunity structure in lakes of tropical Andes and adjacent lowlands. In these physically dominated lake clusters, diatoms showed biogeographic patterns driven by spatial variables, whereas environmental factors were likely to be less important. We emphasize the value of both taxon and functional approaches for elucidating patterns of spatial ecology in aquatic microorganisms.

THE ONGOING SAGA OF SIZE CHANGE IN THE GREAT LAKES PLANKTONIC DIATOM COMMUNITY

Andrew J. Bramburger[1], Euan D. Reavie1, Gerald V. Sgro[2], Lisa R. Estepp[1], Victoria L. Shaw-Chraïbi[3], and Robert W. Pillsbury[4]

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2. John Carroll University, University Heights, OH, 44118 USA
3. Tarleton State University, Stephenville TX, 76401, USA
4. University of Wisconsin Oshkosh, Oshkosh, WI, 54901 USA

The planktonic diatoms of the Laurentian Great Lakes have exhibited a marked decrease in mean cell size over the past ~115 years. Both taxon-specific, demographic cell size changes and community level shifts towards dominance by smaller-celled taxa contributed to this overall pattern. The taxonomic composition of the Lakes has changed over this same period, and colonization and extinction events have doubtless contributed to this trend as well, but the relative influences of these phenomena are more difficult to quantify. Here, we examined the timing of diatom species' first and last appearances in the sedimentary record in the Great Lakes as a function of cell size. In all 5 lakes, the pattern of establishment or extirpation of differently-sized taxa through time can be represented as a negatively-sloped cubic curve. The largest taxa had their first appearances in Great Lakes sediments early after the first European colonization of the region. Across the basin, no "large" taxa were established after ~1940, and disappearances of these larger taxa from the sedimentary record have accelerated over the last quarter century. Appearances and disappearances of smaller-celled taxa, on the other hand, have occurred at relatively consistent rates throughout the period in question. Differences in the timing of establishments and extirpations of large vs. small taxa have contributed to overall cell size decreases in the lakes over the last century, and subtle changes in establishment and extirpation rates are reflective of the changing stressor regimes in the lakes through time.

PALEOLIMNOLOGY AND RESURRECTION ECOLOGY: THE FUTURE OF RECONSTRUCTING THE PAST

David Burge[1], Mark Edlund[1] and Dagmar Frisch[2]

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2 University of Birmingham, School of Biosciences, Birmingham B15 2TT, UK

Paleolimnologists have utilized diatom lake sediment records to understand historical lake and landscape development, timing and magnitude of environmental change at lake, watershed, regional and global scales, and as historical datasets to target watershed and lake management. Resurrection ecologists have begun to recognize lake sediments as sources of viable diatom propagules ("seed or egg banks") with which to explore questions of community ecology, ecological response, and evolutionary ecology. To date, *Daphnia* is the only model organism in these efforts, but many other aquatic biota, from viruses to macrophytes, and diatoms in particular, similarly produce viable propagules that are incorporated in the sediment record but have been underutilized in resurrection ecology. The common goals shared by these two disciplines have led to mutualistic and synergistic collaborations - a development that must be encouraged to expand. We give an overview of the achievements of paleolimnology and the reconstruction of environmental history of lakes, review the untapped diversity of aquatic organisms that produce dormant propagules, compare *Daphnia* as a model of resurrection ecology with other organisms amenable to resurrection studies, especially diatoms, and consider new research directions that represent the nexus of these two fields.

MICROMECHANICS OF DIATOM VALVES: LOCULATE AEROLAE AND SANDWICH STRUCTURE

Virginia M. Card

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Diatom valves have pores that vary widely in size, density, structure and arrangement, features that are used to classify and identify diatoms. Recent advances in applied chemistry have increased our knowledge of the composition and organization of molecules in the solid material of which the valves are composed, and developments in nanotechnology have enabled a closer look at how that material is arranged into the laminated porous structure of the diatom cell wall. This enables a new perspective on the relationship between ecological factors and the ultrastructural geometry of diatom valves. In this paper, the mechanical properties of diatom valves with loculate areolae are modeled as laminate sandwich panel structures with porous solid faces and honeycomb cores, composed of biosilica, a solid modelled as an organic/inorganic composite material. The ability of these models to explain diatom valve mechanical properties is confirmed by application to examples in *Coscinodiscophyceae*. Using this approach, hypotheses regarding the relationship between ecological factors and valve microstructure are developed and preliminarily tested. One such hypothesis is that the structure of valves are determined by their mechanical resistance to breakage by predators. An experimental prediction that follows from this hypothesis, through the use of this micromechanical modeling, is that centric species with larger diameter valves will have thicker core layers of higher relative density, and face layers of higher relative density, but not necessarily smaller or less abundant pores, compared to species with smaller diameter valves. This prediction is preliminarily supported by measurements of three or more species.

QUALITY ASSURANCE ASSESMENT OF REPLICATE DIATOM COUNTS: LESSONS FROM REVIEW OF 800 COMPARISONS

Donald Charles[1], Marco Cantonati[1,2] and Patrick Boylan[1]

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Comparing replicate counts of diatom slides made by two or more diatomists is a standard procedure for helping improve quality and consistency of identifications and quantifying taxonomic uncertainty. Two metrics widely used in making comparisons are Percent Similarity (PS) and Jaccard's index. Interpreting values of these metrics is challenging. Key questions are: What values represent acceptable agreement between analysts? How do these values vary with structure of assemblages (e.g., taxa richness) and initial efforts to resolve discrepancies (e.g., resolving synonym issues). These are important both in terms of evaluating consistency in counts generally, and because project sponsors regularly require that minimum criteria be met (e.g., PS of 60 – 90). To better understand what values might make reasonable criteria, we evaluated results of over 800 replicate counts of stream samples that are in the North American Diatom Ecological (NADED) database at the Academy of Natural Sciences. Comparisons were made by categories: counts done by the same analyst; counts by analysts using the same or different taxonomic systems, and counts before and after synonym issues were resolved. It was difficult to assign count pairs to categories where differences between analysts were due to use of different synonyms, lumping vs splitting, and differences in characteristics used to distinguish species and varieties (e.g., lengths, striae counts). PS's above 90% were generally restricted to counts by the same analyst and samples with low taxa richness. PS's below 60% were common and due to differences in taxonomic systems and efforts at resolution of synonyms; high taxa richness was frequently a contributing factor.

ASSESSING THE HIERARCHY OF ENVIRONMENTAL CONTROLS ON DIATOM COMMUNITIES OF YELLOWSTONE NATIONAL PARK

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Environmental conditions fundamentally determine ecological resilience, which we define as an ecosystem's ability to maintain structure and function during disturbance. We characterized lacustrine sediment cores from Yellowstone National Park for structure using fossil diatom assemblages and for function using algal and geochemical proxies of productivity. In one study, climate was the primary environmental control on community assemblage and productivity via its interaction with lake hydrology. A second study underlines that environmental conditions may mediate climate impacts in complex ways. *Lindavia bodanica* has displayed the same trend in size diminution observed in centric diatoms in many other Northern hemisphere lakes over the past century in correlation with increasing temperature. However, we found that earlier fossil diatom records from the same region showed no evidence of size diminution during the Holocene Insolation Maximum approximately 10,000 years ago. While the modern trend may be due in part to a changing climate and longer summer stratification, there may also be other factors at work; notable possibilities include increasing nitrogen, salinity, and alkalinity. Overall, climate exerts a primary environmental control on lake ecosystems, while catchment processes exert a secondary environmental control.

STATUS OF THE *DIATOMS OF THE UNITED STATES* WEB FLORA

Mark B. Edlund1, Sylvia S. Lee2, Marina Potapova3, Ian W. Bishop4 and Sarah A. Spaulding4

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The Diatoms of the United States web project (westerndiatoms.colorado.edu) has been available online since 2010. In that time, the project has grown from 3 contributors to over 80, and from 25 species pages to over 850.

The project was established to increase diatomists' access to accurate taxonomic information in order to reduce errors and uncertainty in documenting diatom biodiversity. That is, the project was established to increase taxonomic consistency and accuracy, primarily for survey and monitoring programs in North America. Names are reflected in the U.S. Geological Survey biological database, BioData.

Is the project on the right track? What are the next steps for online identification tools for diatoms? What is the potential for computer aided identification? The project has developed based on input from the scientific community. This NADS meeting is an opportunity for the community to provide input to direct the future of the resource.

Views expressed are the authors' and not views or policies of the U.S.EPA.

HISTORICAL DIATOM COMMUNITY AND PRODUCTIVITY SHIFTS HELP PREDICT THE SENSITIVITY OF BOREAL LAKES TO CLIMATE CHANGE

Mark B. Edlund, Joy Ramstack Hobbs, Norman Andresen, Adam Heathcote, Daniel R. Engstrom, Jasmine Saros, Kristin Strock, William O. Hobbs, David VanderMeulen

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4Environmental Science Dept, Dickinson College 112 Kaufman Hall Carlisle, PA 17013
5Environmental Assessment Program, Washington State Dept of Ecology, Olympia, WA 98504
6National Park Service, Great Lakes Inventory and Monitoring Network, 2800 Lake Shore Drive East, Ashland, WI 54806

The northern boreal lakes region covers 15% of the earth's land surface, contains >60% of the world's fresh surface waters, and holds over 3 million lakes. Multiple lines of evidence suggest that boreal-lake ecosystems are changing rapidly due to human-induced climate warming. Current research, however, has demonstrated variable ecological responses to climate change among lakes. We predict that the sensitivity of boreal lakes to climate change will vary primarily along two physical gradients with one reflecting direct, in-lake climate effects and the other reflecting indirect, watershed effects. To test this framework, we investigated 25 undeveloped boreal lakes using paleolimnological analysis and showed the lakes are changing rapidly, with significant shifts in diatom and other algal communities, unprecedented appearances of noxious cyanobacterial blooms, and increased carbon burial in lake sediments. Here we focus on the historical response of diatom communities to direct and indirect climate drivers to test our two-dimensional sensitivity framework. Historical diatom response in each lake was summarized by measures of community turnover, changes in diagnostic functional and taxonomic groups (e.g., tychoplankton, small "*Cyclotella"* species), and measures of algal production (biogenic silica). Each diatom response metric was estimated across time periods from the mid-1800s to present and projected on the sensitivity framework to determine whether physical characteristics of lakes and watersheds could serve as predictors of lake sensitivity to climate change.

DECADAL LACUSTRINE RECORDS OF CLIMATIC AND ENVIRONMENTAL CHANGE IN A SUBSET OF ECUADORAN LAKES

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2 Department of Biological Sciences, Northern Kentucky University, Highland Heights, Kentucky, 41099, USA

Ecologically sensitive regions, such as the tropics, have experienced a multitude of changes in the last few decades related to increased human activity and climatic shifts. These changes have the potential to alter lake systems impacting local biological communities and drinking water quality. Tropical Ecuadoran lakes were sampled by collaborator Dr. Miriam Steinitz-Kannan approximately 40 years ago; repeat samples of physical, chemical, and biological parameters from a selection of Ecuadoran lakes were taken in February and July 2017 to provide a comparison between modern conditions and those of 40 years ago. This offers a unique opportunity to observe short-term changes of both tropical high-mountain lakes and low-land Amazonian lakes in the context of climatic change and increased human activity. The following research focuses on three main questions: 1) To what degree have Ecuadoran lakes experienced change in the last 40 years? 2) Are alterations in the lake variables uniform, or are they spatially and temporally variable? 3) What is the underlying cause for these shifts; can a distinction between climate and human activity be achieved? The research presented here is part of a larger collaboration to assess limnological changes in tropical South America funded by National Geographic.

EPIZOIC AND APOCHLOROTIC *TURSIOCOLA* SPECIES (BACILLARIOPHYTA) FROM THE SKIN OF WEST INDIAN MANATEES (*TRICHECHUS MANATUS*)

Thomas A. Frankovich[1], Matt P. Ashworth[2], Michael J. Sullivan[3], Edward C. Theriot[2] and Nicole I. Stacy[4]

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[4]College of Veterinary Medicine, University of Florida, Gainesville, Florida 32641 USA

During a survey of diatoms growing on the skin of West Indian manatees (*Trichechus manatus*), unknown apochlorotic diatom species belonging to the genus *Tursiocola* Holmes, Nagasawa & Takano (1993) were observed. Many benthic diatom species living in organic rich sediments are facultative heterotrophs and can utilize variety of carbon substrates for growth during periods of low light energy. Presently, only seven diatom species that are exclusive to the genera *Nitzschia* Hassall (1845) and *Hantzschia* Grunow (1877) have been identified as lacking chloroplasts (i.e. apochlorotic) and hence are obligate heterotrophs. *Tursiocola* species are part of an endemic flora previously known as the "ceticolous taxa" because until recently, they had only been observed on the skin of whales and porpoises. Recent studies of epizoic diatoms on sea turtles, manatees, and one freshwater turtle increased the number of *Tursiocola* species and expanded the variety of host animals on which they occur. As part of an effort to characterize epizoic diatoms that live on marine vertebrates, four additional apochlorotic diatom species are described from manatees. Several photosynthetic diatoms were successfully cultured from the manatee skin samplings, but none of the *Tursiocola* species survived these culture attempts, even those supplied with heterotrophic media, suggesting a missing but unknown vital nutrient that is otherwise available on manatee skin. The present study describes the second evolutionary loss of photosynthesis within the Bacillariophyta, three new *Tursiocola* species, and the phylogenetic position of the genus. This is the first report of apochlorotic diatoms outside the family Bacillariaceae.

THE ROLE OF CORE SPECIES IN REGULATING DIATOM NETWORK ASSEMBLY

Evelyn Gaiser

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Benthic microbial mats on carbonate platforms contain distinctive cyanobacterial and algal species capable of thriving in low-nutrient, desiccation-prone and often high light environments. The diatom component of these mats has been well described in the karstic regions of the Caribbean, including the Everglades, and contains a consistent core species assemblage, some of which appear to contribute to the maintenance of the cohesive structure of mats. Core species may be defined by their apparent or measured roles, or by the degree to which they are positively or negatively associated with other species. We used network analytical approaches to determine the role of core species in potentially regulating the appearance of others along gradients of core species relative abundance. Core species are associated with tighter networks of fewer species that whose abundances are highly correlated with each other, compared to assemblages with fewer core species.

DIATOM DENSITIES IN FRESHWATER STREAMS EXPOSED TO HEAVY METALS AROUND THE ELIZABETH MINE, VERMONT, USA

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Freshwater microbenthic algae provide a multi-species dimension to the 'canary in the coal mine' concept of biological assessment. Diatoms are sensitive to high concentrations of heavy metals. A survey of diatom communities collected from fourteen sites distributed across six small to moderately-sized rivers near the Elizabeth Mine, Orange County, Vermont, revealed a range of individualistic responses by the nine abundant taxa to metal concentrations above and below the USEPA's probable effect concentrations (PEC). Metal concentrations above the PEC are expected to frequently cause adverse effects. Some taxa, like *Achnanthidium rivulare*, were relatively indifferent to high metal concentrations. *Eunotia implicata*, although not often abundant, had its high densities when many metals were above the PECs, but not when copper was above its PEC. At the other end of the spectrum, *Achnanthidium pyrenaicum* had its highest abundances when metal concentrations were low. Between these extremes was an association of four diatoms with high abundances when cadmium, copper, nickel, and zinc were near the PECs, but only when lead concentrations were low. Two taxa had more individualistic responses. *Achnanthidium minutissimum*, which was relatively indifferent to aluminum, copper, and iron, had low abundances when lead, nickel, zinc, and cadmium were above the PEC. *Cocconeis placentula*, which had its highest densities at moderate to high concentrations of cadmium, lead, nickel, and zinc, did so only when copper and iron concentrations were low. Changes in density, of course, could be due to a variety of direct and indirect effects of metal stress. These observations provide evidence that diatom communities provide a multi-species early indicator for assessing the extent of metal stress in freshwater stream environments.

HARMONIZING AND REVISING DIATOM TAXONOMY IN EXISTING BIOASSESSMENT DATASETS FOR USE AS INDICATORS

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As part of efforts to understand and monitor the condition of the nation's aquatic resources, diatom data have been collected from large-scale assessments, including the National Rivers and Streams Assessment (NRSA) of the U.S. Environmental Protection Agency. These data are valuable resources for assessing biological condition, but they have not been fully used because of inconsistencies in diatom taxonomy and identifications by different analysts. We harmonized, to the extent possible with the level of information and resources available, the taxonomy used by different analysts who have contributed diatom data to existing NRSA assessments in 2008-2009 and 2013-2014. Then, we tested the effectiveness of the harmonization effort and several methods of taxonomic adjustments (i.e., species-level, genus-level, and mixed taxonomy approaches) in decreasing the explanatory power of analysts while increasing that of environmental variables on the revised assemblage datasets. The objectives of this research were to produce diatom datasets that are harmonized and revised using the most current taxonomic information, as well as complete documentation of the revision process and effectiveness. Documentation of the revision process will provide transparency and replicable methods for incorporating new taxonomic data in future assessments. The replicable methods include R tools for harmonizing datasets. Tests of revision effectiveness will aid further investigation of the utility of diatoms as indicators in national, state, tribal and territorial bioassessment programs. Finally, lessons learned from this research will support the improvement of diatom methods for future NRSA and other assessments. Views expressed are the authors' and not views or policies of the U.S.EPA.

A NEW "CENTRIC" DIATOM FROM OAHU HAWAI'I.

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We describe a centric diatom collected from Kalawahine trail on Oahu, Hawai'i. Frustules have marginal striae with spines and siliceous extensions on some specimens. The center of the valve is unornamented and we have seen no fultoportulae or rimoportulae. The type location is a shaded depression in a cliff of sediment of volcanic origin. The population was living in a loose association with a filamentous cyanobacterium. We have collected this taxon elsewhere on Kaua'i and Oahu in similar habitats. Three genes were examined (rbcl, psbA and 18S). The closest taxa based on rbcl are brackish marine species and the closest taxa based on psbA include both freshwater and marine taxa.

SEXUAL REPRODUCTION IN *CYMBELLA AFFINIS* AND *GOMPHONEIS OLIVACEUM*

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Cymbella affinis and *Gomphoneis olivaceum* were observed undergoing sexual reproduction in West Lake Okoboji, Iowa, in May 2017. Both species were undergoing Geitler's Type Ia1 reproduction, where two gametangial cells are paired in a copulation jelly, each gametangium producing two gametes, one motile and one passive, and following gamete exchange and karyogamy, two paired auxospores expand in parallel each bounded by their perizonium to form two initial cells. The goal of this study was to assess the size relationship between paired gametangia, between pairs of initial cells, and between gametangia and initial cells in both species. The lengths of the two gametangial cells and the two initial cells were measured under 400x in randomly encountered living mating pairs. The results show a weak relationship between gametangial pairs in *Cymbella affinis* whereas there was a stronger relationship between gametangial pairs in *Gomphoneis olivaceum*. Within both species, the two initial cells produced after mating were of similar length, and the combined size of the initial cells was also significantly related to the combined size of gametangial cells. Both species appeared to utilize a strategy of synchronous sexuality under good growth conditions for their reproductive ecology, as sexuality was no longer occurring in the population when sampled two weeks later. Future work remains to fully understand sexual reproduction in diatoms, including the biological and environmental conditions that trigger sexuality, and how variation in gametangial and initial cell lengths may affect species ecology.

Views expressed are the authors' and not views or policies of the U.S.EPA.

DRIVERS AND SPATIAL CONSISTENCY OF SPECIALIZATION IN A DOMINANT, MAT-DWELLING DIATOM, *ENCYONEMA EVERGLADIANUM,* FROM THREE FRESHWATER WETLANDS IN THE CARIBBEAN BASIN

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We used populations of an abundant diatom in calcareous microbial mats, *Encyonema evergladianum*, from 3 karstic wetlands in the Caribbean Basin to test whether the relative abundance of this species is more strongly driven by macrohabitat features (landscape-scale gradients of conductivity and P availability) or mat microhabitat characteristics (biomass and mineral content), and whether specialization is maintained in populations from geographically separated but environmentally similar wetlands. We found that, across Caribbean wetlands, the abundance of *E. evergladianum* was most strongly tied to microbial-mat biomass, suggesting that this species is specialized for, and probably contributes to, the unique conditions of these mats. However, the magnitude and importance of micro- and macroscale drivers on *E. evergladianum* abundance differed among wetlands, which implies that this diatom has differentiated ecotypically across its range. We found no morphological correlates to potential ecotypes, making it difficult to distinguish between ecotypes without molecular studies. We also searched for an engineering role of *E. evergladianum* in mat structure by examining freeze-fractured mat fragments under scanning electron microscopy, but found no morphological evidence for functional contributions to mat cohesion. *Encyonema evergladianum* is a consistently strong indicator of oligotrophic, freshwater conditions that promote calcareous microbial mats in coastal karstic wetlands of the Caribbean. However, abundance-based approaches to habitat assessment need to be calibrated in the context of individual wetlands, particularly in these subtropical wetlands that are exposed to abrupt ecosystem-scale changes in response to climate and anthropogenic changes in salinity and nutrient delivery.

UPDATES TO NEW TAXON CURATION AND MANAGEMENT IN THE ANSP DIATOM HERBARIUM

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The Diatom Herbarium at the Academy of Natural Sciences of Drexel University (ANSP) is home to over 5000 nomenclatural types as well as the Diatom New Taxon File (DNTF), a card catalog of diatom names and literature citations maintained in its original form through 2012. The first phase of the DNTF digitization project has been completed; all cards are now digitally and publicly available on our website, http://symbiont.ansp.org/dntf/. In an ongoing effort to maintain records of ANSP type specimens associated with these names, we also present an updated inventory of our types collection, which now includes records of unmounted original material. This update sparked a lively internal discussion on type designations, especially the meaning of the term "isotype" as it applies to admixture diatom samples. We attempt to clarify ambiguous type designations by distinguishing between cited and uncited (iso)types, and propose to reclassify slides previously designated as "isotypes" that were made from original material, but neither made nor seen by the original author. We hope that these distinctions aid in our understanding of intended species descriptions and promote careful consideration of type designations for name-bearing taxa.

THE EFFECTS OF NUTRIENTS AND CURRENT ON THE GROWTH AND STALK PRODUCTION OF *DIDYMOSPHENIA GEMINATA*

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The St. Mary's River (Sault Ste Marie, Michigan, USA), like many other oligotrophic systems, has recently experienced nuisance blooms of the diatom *Didymosphenia geminata*. The occurrences of these blooms is not well understood. We placed nutrient diffusing substrata (treatments = control, N, P, and N+P), already inoculated with *D. geminata,* within the river in both high and low current areas. After two weeks, the nutrient diffusing substrata were retrieved and both *D. geminata* stalk and cell densities were assessed. The health of *D. geminata* cells were estimated by the robustness of their chloroplasts. In high current: stalk production was significantly reduced by P additions along but not P +N additions, and while overall cell density was not significantly different between treatments we found significantly more asexually reproducing and healthier cells in the P+N treatments. No significant differences were found among treatments from the low current site. Our data supports the idea that stalk production (the major component of nuisance growth) is triggered by low P conditions while mesotrophic conditions likely increase cell densities.

CHRONICLES OF SALT MARSHES WRITTEN IN DIATOM LANGUAGE

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The sharp distinction between freshwater and marine diatom floras has been successfully used to reconstruct the history of sea-level and coastline changes since 19th century. Classifications of diatom species into salinity categories are still a favorite tool for interpreting diatom data in sediment cores from coastal locations, including intertidal marshes. Coastal wetlands and salt marshes are not, however, just zones where two separate floras come into contact, but unique and heterogeneous ecosystems supporting specialized biological communities. Disentangling environmental drivers of diatom community structure in these habitats is akin to decoding a forgotten language that was used for writing a historic account of environmental change in coastal regions. Our goal in studying diatom assemblages from New York and New Jersey salt marshes is to advance their use as indicators of past and present conditions. Using several sets of modern diatom data collected for various research projects, we identified species' preferences for habitat, substrate type, sediment texture, salinity, and nutrient content. In order to understand the origins of diatom populations found in marsh sediments, we also examined diatoms inhabiting adjacent water bodies and intertidal sand- and mudflats. These data, together with other biological and geochemical proxies were used to reconstruct environmental history of the coast, assess human impacts, and estimate resilience of salt marshes to storms, hurricanes and sea level rise. Our investigation of seven cores collected from salt marshes in New Jersey revealed dramatic changes in the composition of diatom assemblages over the last ~ 200-250 years, and especially in a few last decades, following a relative stable period of approximately 1800 years. We attribute these changes mostly to cultural eutrophication, as the most evident shift in diatom assemblages is towards the dominance of species associated with high nitrogen content of sediments, such as *Halamphora* spp., *Fallacia pygmaea*, *Planothidium* cf. *frequentissimum*, *Navicula johnsonii*, *N*. cf. *willisiae* and others. In some locations, metal pollution appears to be related to changes in diatom assemblages. The most conspicuous alterations of marsh ecosystems in the late Holocene were apparently caused by storm events as evidenced by an increase of planktonic and tychoplanktonic diatoms in marsh sediments and disappearance of diatoms typically associated with vegetated marshes. Careful ecological species profiling in conjunction with multidisciplinary approach to sediment core analysis can shed great light on the history of costal ecosystems.

DIATOMS AS AN EARLY WARNING SYSTEM FOR IMPACTS FROM EUTROPHICATION, INVASIVE SPECIES AND CLIMATE CHANGE

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Multiple stressors require management options in the Laurentian Great Lakes and diatom-based paleolimnology provides tools to track changing conditions and predict future impairments. We can provide early data reflecting aquatic impacts before they are realized in higher trophic levels, thereby predicting future conditions. Here are two examples of how paleolimnology is being used to inform management decisions for the Great Lakes. (1) The RAP for the St. Louis River requires removal of beneficial use impairments associated with nutrients. Sediment cores were analyzed for physical, chemical and biological remains and long-term changes in diatoms provided evidence that some areas have improved since nutrient abatement. However, nearshore areas show increasing nutrients and algal abundance, likely due to stressors that are not fully understood (climate change, sediment nutrients). Recommendations for delisting and future studies are forthcoming. (2) A diatom-based paleolimnological study has revealed the first biological effects of climate change on the base of the food webs in all five Great Lakes: an increasing relative abundance of *Cyclotella sensu lato*. Atmospheric warming is the strongest correlate with these changes, and recommendations are made regarding the eventual impacts on food webs throughout the Great Lakes system.

EXPLORING DIATOM ECOLOGY ON THE CORAL REEFS OF THE SAUDI ARABIAN RED SEA COASTLINE IN THE DEVELOPMENT OF A DIATOM-BASED, COST-EFFECTIVE BIOMONITORING TOOL

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Due to their diversity and quick response to changing environmental conditions, diatoms have been successfully utilized to monitor aquatic environments and provide early warning of possible harmful or undesired water quality affects, or as monitoring tools to help provide objective goals for efforts to mitigate water quality issues in a cost-effective fashion. One environment where diatoms have not been used in this fashion, however, are vulnerable coral reef habitats, such as those found along the Saudi Arabian Red Sea coastline. This has largely been due to a general lack of knowledge of tropical benthic diatom taxonomy and ecology. We have created an international collaboration to overcome these obstacles, building a database of benthic marine diatoms and their habitats, in one of the first studies of marine benthic diatom tolerance and distribution in relationship to coastal pollution in a tropical region. In February 2015 and May 2016, we collected benthic diatoms by SCUBA diving from a diversity of coral reef-associated substrates from five locations with different levels of human impact along the Saudi Arabian Red Sea coastline. Results from the 2015 sampling show a change in the species diversity of the diatom assemblage between sites under different degrees of human impact. We also present findings which suggest diatom species diversity can also change as a function of collection depth.

HISTORIC PHOSPHORUS LEVELS IN LAKE ERIE MEASURED BY DIATOM INFERRED PHOSPHORUS

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Phosphorus (P) levels in Lake Erie have become a matter of government concern since the passage of the Clean Water Act in 1972. There has been even greater focus on P in the lake since 2014 when 500,000 residents of Toledo, Ohio lost water for two days when their treatment facility was overwhelmed by microcystin toxins. How much P in the lake water is acceptable is debatable. How much P was historically in the lake water is unknown before monitoring began in the 1970s. Here we examine historic levels of P in Lake Erie based on diatom inferred P from samples collected from a core collected in the central basin of Lake Erie in 2011. We also assess if the goal of microcystis abatement might be met given current P target levels for the lake. The information presented is extracted from a broader paleolimnological study of Lake Erie.

EXAMINING POTENTIAL CHANGES IN STREAM ALGAL COMMUNITIES IN THE SOUTHERN APPALACHIANS, PRE- AND POST-HEMLOCK DIE-OFF

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Eastern hemlock (*Tsuga canadensis*) function as an important foundation species throughout eastern North America. However, widespread death of hemlock over the last decade has occurred in the southern Appalachians as a result of the spread of an invasive hemipteran, hemlock woolly adelgid (*Adelges tsugae*). Hemlock was once abundant along streams and its death has likely caused significant changes to stream processes. Little is known about how the loss of hemlock affects stream algae. We hypothesize that diatom communities may be affected by enhanced light levels and decreasing pH following hemlock die-offs. In 2005-2006, prior to hemlock die-off, we collected baseline data on algal biomass (chlorophyll-*a* and ash free dry mass) in eight stream reaches throughout the Coweeta Hydrologic Lab/Forest in western North Carolina. We also analyzed diatom communities in those streams, identifying 89 species including several taxa endemic to the southern Appalachians (*Meridion alansmithii*, *Eunotia billii*, *Nupela lapidosa*). Densely shaded streams were characterized by low algal biomass dominated by adnate diatoms (*Eunotia* spp. and *Achnanthidium deflexum*). In 2017-2019, post hemlock die-off, we are re-sampling the eight study reaches to evaluate how diatom communities have changed. We hypothesize increased algal biomass, loss of endemic taxa, and an increase in upright-growing diatoms (*Gomphonema* spp. and *Synedra* spp.) (associated with higher light levels).

DIATOM INDICATOR MAGIC: THE LAW OF LARGE NUMBERS PROVIDES GOOD METRIC PERFORMANCE DESPITE CURRENT LEVELS OF TAXONOMIC INCONSISTENCY

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Consistent identification of diatoms among taxonomists is certainly a source of error in ecological assessments, but the magnitude of that error is not well understood. Diatom metric performance in US national assessments has been high when compared to other organism groups. But concerns remain about taxonomic uncertainty. The likely explanation for good metric distinction between high and low quality sites is the law of large numbers, which holds frequencies of events with the same likelihood of occurrence even out, given enough trials or instances. For example, the more times you flip a coin, the closer you get to 50% heads and 50% tails. Therefore, if we assume misidentifications of species cause random, unbiased error in metrics and we have enough observations of different species in samples, a few accurate identifications with corresponding ecological indicator values provides the true value for metrics. I used duplicate counts of the same samples (used for quality control (QC)) from the 2008-2009 USEPA's National Rivers and Streams Assessment (NRSA) to evaluate this hypothesis. I found differences in metric values between QC counts decrease with increasing numbers of species observed in a samples. Differences in metric values between QC counts decrease with increasing similarity between QC samples. Results from these analyses are consistent with predictions of the law of large numbers. Additional analyses showed metric deviance responded relatively little to QC changes compared to other factors.

DEVELOPING ALTERNATIVE DIATOM ENUMERATION METHODS TO BUILD BETTER PREDICTIVE BIOASSESSMENT MODELS

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Diatoms are routinely sampled in biological assessments of water quality, but the method traditionally used to characterize diatom communities does not adequately capture species richness for use in most assessment applications. The traditional enumeration method of 300-600 cell fixed counts was designed to characterize the relative abundance only of dominant taxa, making it inappropriate for common bioassessment applications such as observed/expected (O/E) models, which rely on species richness. We analyzed the nature of diatom communities in reference sites of varying diversity using a measure of counting efficiency, which revealed 600-cell fixed counts did not consistently characterize high diversity sites compared to low diversity sites. To address this problem, we compared the fixed count method to a stratified method, which captures both abundance and richness, and a timed presence method, which captures richness for O/E models. The stratified and timed presence methods captured greater species richness compared to fixed counts. We then built O/E models using genus and species-level data for data collected with both the fixed and timed presence methods. The timed presence method produced more sensitive and precise models than the fixed method at both the genus- and species-level. A timed presence method could thus improve measurements of stream health while expediting analyses and saving money.

HOLOCENE ENVIRONMENTAL HISTORY OF THE ÅNGERMANÄLVEN ESTUARY, NORTHERN BALTIC SEA

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The Baltic Sea has experienced a complex geological history, with notable swings in salinity driven by changes to its connection with the Atlantic and glacioisostatic rebound. Sediments obtained during International Ocean Drilling Program Expedition 347 allow studying the effects of these changes on the ecology of the Baltic in high resolution through the Holocene in areas where continuous records had not always been available. Sites M0061 and M0062, drilled in the Ångermanälven Estuary (northern Baltic Sea), contain records of Holocene-aged sediments and microfossils. Here we present detailed records of palaeoecological and palaeoenvironmental changes to the Ångermanälven Estuary inferred from diatom, palynomorph and organic-geochemical data. Based on diatom assemblages, the record is divided into four zones that comprise the Ancylus Lake, Littorina Sea, Post-Littorina Sea and Recent Baltic Sea stages.
The Ancylus Lake phase is initially characterized as oligotrophic, with the majority of primary productivity in the upper water column. This transitions to a eutrophic state which continues into the Initial Littorina Sea stage. The Initial Littorina Sea stage contains the most marine phase recorded here, as well as low surface water temperatures. These conditions end before the Littorina Sea stage, which is marked by a return to oligotrophic conditions and warmer waters of the Holocene Thermal Maximum. Glacioisostatic rebound leads to a shallowing of the water column, allowing for increased benthic primary productivity and stratification of the water column. The Medieval Climate Anomaly is also identified within Post-Littorina Sea sediments. Modern Baltic sediments and evidence of human-induced eutrophication are seen. Human influence to the Baltic Sea begins *c.* 1700 cal. a BP and becomes more intense *c.* 215 cal. a BP.

APPLIED LABORATORY EXPERIMENTS IN DIATOM ECOPHYSIOLOGY: WHICH IS MORE IMPORTANT, THE QUESTION OR THE ANSWER?

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In a recent study, (Wee et al. 2016, J Appl Phycol 28:3317-29) clonal *Skeletonema costatum* cultures were used to investigate phytoplankton responses to human-induced, petrochemical contamination. The laboratory-based experiments were designed to emulate a single watershed, the Lake Pontchartrain Basin (LPB). Population growth and relative abundances of both cellular fatty acids and RuBisCO RNA transcript copy numbers were evaluated in cultures exposed to light slop oil. Of the oil contaminants measured within the culture medium C_6-C_{12} hydrocarbons and arsenic coincided with initial growth inhibition and altered cellular physiologies, respectively. From this, relationships among population growth, food reserves, and photosynthetic potentials were deemed useful determinants for assessing phytoplankton response. During the course of the investigation a number of procedural factors were identified that ran counter to those often used in microalgal, laboratory culture experiments including: experimental design reflects a perturbed, naturally-occurring system; sealed vs unsealed culture vessels, batch vs chemostat cultures, axenic vs clonal cultures, optical turbidity vs chlorophyll fluorescence as a measure of population growth, enrichment vs defined culture media, experimental control of a complex mixture such as crude oil. The decision concerning which option to use often corresponded with the nature of the scientific question being addressed; were the results being interpreted relative to: (1) the response of a population of cells to an environmental perturbation or (2) the response of the cellular components and biochemical processes to the perturbation in the experimental system? Further, the authors hypothesize that a defined growth medium that emulates the abiotic signature of the LPB would strengthen the experimental approach described here where an enrichment culture medium (f/2) was used. To assess whether this is a viable option for future studies we present cellular growth rates of *S. costatum* populations in f/2 media to a recently constructed, defined diatom culture medium based on the ionic proportions of Lake Pontchartrain Basin waters.

LAKE SENSITIVITY TO LATE HOLOCENE CLIMATE DRIVERS: A DIATOM-DEPTH MODEL FOR THE WESTERN GREAT LAKES REGION

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Pollen-based studies from the western Great Lakes region show that lakes provide excellent records of Holocene climate effects on landscapes. Less is known about the effects of climate on lakes in this region. The existing lake and landscape records show overall regional synchrony to major climate periods (Holocene Thermal Maximum), but less synchrony or regional and lake-landscape cohesiveness in response to shorter climate anomalies. In particular we lack records of lake response across parts of this region to Late Holocene climate periods such as the Little Ice Age. One such region, the northwestern Wisconsin Sand Plain, is positioned at the ecotone of the Great Plains and the eastern deciduous forest, and may be highly responsive to climate change. Here we examine a sediment core from a lake positioned high in the landscape and use diatoms to reconstruct historical lake depth for the last 4000 years.

A transect of sediment cores was collected in 2010 from Cheney Lake, Douglas Co., WI. Cheney Lake is a relatively small (<10 ha), seepage lake with a deep basin (~6 m) and simple bathymetry, surrounded by jack pine forest and no buildings or roads. To reconstruct historical changes in lake depth, a depth-diatom model was constructed based on diatom species-depth relationships from a set of 18 modern surface sediment samples (0-1 cm interval) collected in 2012 from Cheney Lake at depths of 0.5 to 5 m. A transfer function was developed using weighted-averaging (WA) regression techniques along with canonical correlation (CCA) and redundancy analysis (RDA) to test model error and variance explained.

A 92 cm long core recovered from 53 cm water depth was imaged and analyzed for loss-on-ignition, pollen, and diatoms at 1 cm resolution. The core preserved several sand lenses indicative of historically shallower lake conditions. A minimum of 300 valves per sample was counted to obtain a sub-century history of the diatom species assemblage in Cheney Lake. Historical diatom-inferred lake depth was estimated by applying weighted-averaging calibration (WA) techniques using each species depth optimum. Validity of model results was assessed with the modern analogue technique (MAT).

Model output suggests that Cheney Lake may have been almost 6 m deeper beginning around 4000 cal BP, nearly twice as deep as the modern lake. Deep lake conditions, which are reflected in the diatom species assemblages, persisted for several thousand years. The reconstruction also suggests a gradual shallowing of water depth starting around 1500 cal BP, reaching minimal depths around 1100 cal BP. Lake levels rebound around 900 cal BP and remain ~4 m above modern lake level until around 250 cal BP. An abrupt shift in the moisture regime is evident around the time of European contact, when lake levels fell to current low levels, never to return to pre-contact lake levels.

MORPHOLOGICAL VARIATION OF *CYCLOTELLA (PANTOCSEKIELLA) COMENSIS* IN THE LAURENTIAN GREAT LAKES

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An important indicator of climate change and low nutrients in surface waters, *Cyclotella comensis* Grunow in Van Heurck is ubiquitous in the Laurentian Great Lakes. *C. comensis* forms a diverse complex with high morphological plasticity. In a large dataset including fossil and modern collections from the Great Lakes we have distinguished two distinct morphotypes of *C. comensis*: *Cyclotella comensis* var. 1 and *Cyclotella comensis* var. "rough center with process" (RCWP). To further examine differences in morphologies, specimens were analyzed with light microscopy and scanning electron microscopy. All have radial, uniform, and aveolate striae, a central fultoportula, a rimoportula opposite of the central fultoportula, and marginal fultoportulae. *C. comensis* var. 1 is in the smaller size range of *C. comensis* (4-7 µm vs. 4-13 µm) and has a pore field on one side of its tangentially undulated center. *C. comensis* var. RCWP (also reported as *Cyclotella* cf. *delicatula*) has a distinct central fultoportula and colliculate center and lacks the pore field and tangential undulation of *C. comensis* and *C. comensis* var. 1. Its diameter is generally 5-17 µm, larger than *C. comensis*. Samples also contained transitional specimens possessing traits from multiple morphotypes; therefore, it is likely there is some integration between the morphotypes and little genetic variation. However, because of morphological variation and apparent differences in ecological preference, distinction may be important within the species.

A PRELIMINARY INVESTIGATION INTO DIATOM ASSEMBLAGE RESPONSE TO HYDROTHERMAL EXPLOSION EVENTS, YELLOWSTONE LAKE, WYOMING

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Yellowstone Lake in Yellowstone National Park is the largest high-elevation lake in North America, at an elevation of 2,357 meters and with an area of 344 square kilometers. Yellowstone Lake is strongly influenced by hydrothermal systems, with over 650 vent structures on the lake floor. Hydrothermal explosion events are a catastrophic response to forcing where subsurface fluids flash to steam, and several events have been documented during the Holocene from shoreline deposits. The objective of this study is to assess the effect of localized hydrothermal explosions on the diatom community in Yellowstone Lake. An outcrop on the northern shore of Yellowstone Lake was subsampled for diatom analysis above and below the Turbid Lake hydrothermal explosion breccia, dated from ~10 ka BP. Twenty-six sediment samples were analyzed, and eight diatom species had >5% abundance in the sequence. The diatom assemblage is dominated by *Aulacoseira subarctica* throughout most of the record, with moderate percentages of benthic species. The diatom assemblage showed little response to the hydrothermal event, which occurred during an interval of low lake levels. Counts of *Aulacoseria subarctica* initial valves may aid in deciphering conditions before and after the explosion event, and the shoreline record will be complemented by multi-proxy analyses of a continuous sediment core from within the lake.

DIATOM DATA IN THE NEOTOMA PALEOECOLOGY DATABASE

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The Neotoma Paleoecology Database (www.neotomadb.org) is a community-curated data resource that supports global change research by enabling broad-scale studies of taxon and community diversity, distributions, and dynamics during large environmental changes of the past. In addition to diatoms, it includes data on pollen, ostracods, insects, plant macrofossils, vertebrates, geochronology and other sediment characteristics. By consolidating many kinds of paleoecological data into a common repository, Neotoma lowers costs of paleodata management, makes paleoecological data openly available, and offers paleoecologists a high-quality, curated data resource. Currently, over 1,000 of the 16,000+ datasets in Neotoma are diatom related; they include > 330 diatom stratigraphies and 600 surface samples. These data are in addition to those in the Diatom Paleolimnology Data Cooperative (diatom.ansp.org/dpdc/)(about 5,000 diatom counts), which are being transferred to Neotoma. The Explorer application on the Neotoma website provides a way to search for data by investigator, site name, taxon name, geographic area, and other data factors. For stratigraphic diatom datasets, diagrams can be viewed showing taxon abundance vs depth or chronology (when present). Data uploads are handled via the Tilia software program; its automated systems check data conformity and completeness, and match taxon names with those in the master list. Downloading datasets into Tilia from Neotoma allows users to work with the data using the many tools offered by the Tilia software. Most diatom datasets are currently entered by stewards at the Academy of Natural Sciences of Drexel University (ANS), but others can upload as well. Data include diatom counts from core stratigraphies and calibration datasets, chronologies, inferred environmental values, and related metadata. We anticipate that diatom community investigators will continue to have their datasets uploaded and that data will be used for large-scale synthesis studies. For data contributors, Neotoma offers a public data archive with high visibility and quality standards. For data users, Neotoma provides a well-structured, open-access, and easy-to-use resource with multiple avenues for accessing, analyzing, and refining paleoecological data. Neotoma is used as an educational resource as well; a lesson plan using diatom data is being produced at ANSto allow students to investigate earth systems changes, develop an understanding of past biotic responses to climate change, and apply knowledge gained to current rates of environmental change.

EFFECTS OF ACID AND METALS ON BENTHIC ALGAE IN STREAMS OF DIFFERENT TROPHY USING CHEMICAL DIFFUSING SUBSTRATA

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Acid and dissolved metals associated with mine drainage can greatly decrease the abundance and diversity of benthic algal communities however, it is difficult to isolate effects *in situ*. We examined the efficacy of using chemical diffusing substrata (CDS) to determine how acid and metals interact to affect benthic algae in streams with different trophy. CDS containing Mn (24 mg/L), Fe (24 mg/L), Al (6.4 mg/L), acid (1.0N H_2SO_4), Mn+acid, Fe+acid, and Al+acid were deployed in a flow-through system to determine flux from the liquid media. Concentrations of metals and/or H^+ in CDS treatment solutions significantly decreased linearly over time. Flux values for metals ranged from 0.5 to 7.4 µg/cm^2/day, and H^+ flux for acid solutions was 212.6 µg/cm^2/day. Corresponding water column concentrations that would produce the same flux as CDS metal treatments were estimated to be near the lower end of the range where detrimental effects on algae occur. Acid treatments were estimated to be the equivalent of a stream pH of 2.5. Five replicates of each CDS treatment, and a water control, were placed into a eutrophic (ES) and an oligotrophic (OS) stream. In OS, periphyton on CDS treatments with acid solutions had significantly lower cell densities and significantly more acid-tolerant taxa. Acid treatments did not significantly affect cell densities, and were not related to species composition in ES, as higher alkalinity and nutrients likely increased neutralization processes within the biofilm. Lower chlorophyll and higher phaeophytin concentrations of communities on acid treatments in ES indicated sublethal effects. Metal treatments had little to no effect on abundance or species composition of algae in either stream. It is difficult to use CDS to examine impacts of relatively nontoxic metals because the media concentrations required to generate fluxes in the toxic range are near the limits of solubility.

STALKED *RHOPALODIA* FROM LAKE TANGANYIKA

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Among freshwater lakes, Lake Tanganyika in the African Rift Valley is surpassed only by Lake Baikal in depth and total volume. Benthic primary productivity rates in the > 50m deep photic zone are extremely high despite the very low biomass of attached algae. The most abundant diatom taxa in the epilithic assemblages belong to Eurhopalodiae group within the genus *Rhopalodia* Müll., such as
R. hirudiniformis Müll. and *R. gracilis* Müll. Müller (1905) noted that *R. hirudiniformis* and *R. vermicularis* Müll. formed stalks similar to those of *Gomphonema* Ehrenb. when he described the species. Although literature sources occasionally mention stalks, sources lack accompanying structural and ecological details. From epilithic samples collected from 12 rocky sites from the northeast shore of Lake Tanganyika around Kigoma, Tanzania, we use LM and SEM examination to document external and internal morphological and ultrastructural features of *Rhoplalodia*, especially with respect to the apex associated with the stalk. We describe stalk morphology, attachment point, branching, and observations on epiphytes. SEM images showed no structures associated with stalk production. The presence of stalks in the Eurhopalodiae group of the *Rhopalodia*, in contrast with the lack of stalk production in the Epithemioideae group, suggest the need for further phylogenetic and molecular work between the two groups.

RELATING FRAGILARIOPSIS KERGUELENSIS FRAGMENTS TO ORIGINAL VALVE DIMENSIONS

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Morphological variability in marine diatoms recovered from sediment cores has become a valuable proxy for changes to temperature, sea-ice and nutrient conditions in the past. Of particular utility in the Southern Ocean is Fragilariopsis kerguelensis. Typically, a full valve is required for morphological measurements. However, especially during glacial periods, the majority of Fragilariopsis kerguelensis valves found sediment cores are fragmented reducing the usable sample size. As F. kerguelensis is the dominant species of diatom in the Southern Ocean and extensively used as a proxy record, including fragments as usable specimens would be helpful to many studies. As such, it is important to be able to reliably relate the geometry of fragments to the valves original length normalized width, which is related to various oceanographic conditions. This study compares various valve measurements to the width:length ratio in an attempt to identify a viable proxy from fragmentary valves.

THE TYPE SPECIMEN OF FRESHWATER BIRAPHID GENERA AND WHERE TO FIND THEM

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Each genus of diatoms has an assigned type specimen. Ideally, a type specimen is identified on a microscope slide through giving coordinates or by circling with a microscope tool. However, according to the International Code of Nomenclature for algae, fungi, and plants, an entire slide or even an illustration may be used to designate the type, and this is typical for the genera that were described before ICN was established. Lists of diatom genera with their type specimens exist. However, the locations of the illustration or of the designated slide is incomplete. The goal of this project is to record the locations of the type specimens of the freshwater biraphid genera, with a focus on the Nitzschoid and Surirelloid groups. The type localities, physical specimens, and publications with illustrations were provided when available. This information will provide a quick reference resource for those researchers who are revising a genera or describing a new one.

MORPHOLOGICAL DIVERSITY OF EUNOTIA AND GOMPHONEMA TAXA FROM UPPER THREE RUNS CREEK IN SOUTHEASTERN UNITED STATES

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Diatom diversity in the southeastern United States remains largely unknown. To better understand diatom assemblages and communities, Ruth Patrick and The Academy of Natural Sciences of Philadelphia conducted diatometer surveys along the Savannah River from the early 1950s to 2000s. Anthropogenic alterations of the hydrology of the Savannah River started as early as the 1940s by the Army Corps of Engineers and continue today. Therefore, these studies may not capture the extent of the diatom biodiversity that would be found in southeastern habitats under less hydrologic alterations. Upper Three Runs Creek, which is a tributary of the Savannah River, is known as a southeastern biodiversity hotspot. Because this site is designated by the Savannah River Site to receive as minimal anthropogenic impacts as possible, it also serves as a control site in many scientific studies. In 2010, a study was conducted by Georgia College to investigate the dominant taxa found at Upper Three Runs Creek. This study found dominant taxa such as: *Gomphonema parvulum* (Kützing) Kützing *sensu lato*, *Gomphonema parvulum* (Kützing) Kützing *sensu stricto*, *Eunotia carolina* Patrick, *Luticola goeppertiana* (Bleisch) D.G. Mann, *Achnanthidium minutissimum* (Kützing) Czarnecki, and *Tabellaria flocculosa* (Roth) Kützing. High morphological diversity specifically among genera Eunotia and Gomphonema was also found. Using archives from this 2010 study, we began the process of investigating and describing the morphological differences among Eunotia and Gomphonema taxa found at Upper Three Runs Creek.

SUCCESSION OF DIATOM NONOBLIGATE ECTOSYMBIONTS ON CLADOPHORA FROM WEST OKOBOJI LAKE, IOWA

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Epiphytic diatoms have an implied fitness advantage accessing light and nutrients when colonizing macrophytes or other algae. In the research, conducted on West Okoboji Lake, coverage of the epiphytic diatom community on Cladophora was assessed and related to water column nutrients. Epiphyte biofilms of living diatom cells were compared two weeks apart. Nutrient relationship was inferred based on coverage by adnate diatoms versus chain forming and stalked diatoms. More adnate diatoms were expected in low nutrient water column conditions, where taking nutrient from the macrophyte would have been advantageous. A minimum of ten undisturbed Cladophora filaments were observed and placement and physiological state of the diatom frustules were documented and compared. Population descriptions of the dominant diatoms found: *Cocconeis pediculus* Ehrenberg, *C. placentula* Ehrenberg, *Diatoma vulgaris* Bory, and *Rhoicosphenia abbreviata* (Agardh) Lange-Bertalot were compared with literature valves and periphyton communities from the area. Surface area limitation on older Cladophora stimulated longer stalks on Gomphonemoid and Cymbeloid diatoms, the number of adnate diatoms was reduced significantly. High biomass of the substrate and epiphytes suggest high nutrient condition in the system.

DIATOM MIGRATION PATTERNS BETWEEN EPIBENTHOS AND PLANKTON IN A FIFTH ORDER HARDWATER STREAM (IOWA USA): USING LIFESTYLE TO TRACK 40 YEARS OF CHANGING N:P AND HYDROLOGY

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Plankton diatoms in all waters move between the water column and surfaces in response to seasonal changes. Numerous structural and physiological adaptations permit suspension or attachment as the dominant lifestyle for each diatom taxon.

The headwaters of the Cedar River lie in recent glacial till; the floodplain was mostly prairie two centuries ago. The waters have probably always been nutrient rich and also well buffered by the carbonate-rich bedrock frequently exposed in the riverbed.

This 40-year retrospective study of the Cedar River in Waverly, Iowa, compares relative abundances of epibenthic surface diatoms with quantitatively sampled plankton diatoms. Samples from 1990 to 2016 were analyzed to sort river diatom taxa into four lifestyle preferences: edaphic, epibenthon, tychoplankton, or euplankton. Tychoplankton are diatoms that become plankton when epibenthon slough off or erode during increased discharge. Obviously, all river diatoms end up in either location depending on the circumstances. The fourth category (edaphic) includes soil and wetland diatoms that wash into rivers during major run-off events. This lifestyle classification is used to assess effects of a continued reversal of the Redfield ratio (N:P) that began in the 1980s and to evaluate a simultaneous increased discharge trend as climate has changed.

Lifestyle preferences of the 100 most abundant diatom taxa were 14 plankton, 43 tychoplankton, 41 epibenthon, 2 edaphon. Most centrics (12) were plankton. Thirty-two taxa showed at least a 10-fold increase in abundance after 1990 but only three a similar decrease. The greatest change in diatom population size was that of *Diatoma moniliformis*, which was not observed prior to 1990 but has since become 23rd in total abundance. No diatom taxa have disappeared.

The proportions of diatom lifestyles in the plankton vary predictably with flood intensity. Increased summer flood discharge reduces water temperatures to favor diatoms over planktonic greens, dinoflagellates, and cyanobacteria. Increased summer discharge appears to counteract any effect of the changed N:P.

Diatoms mounted on glass slides provide a usable archive for re-examining environmental changes, including floods. Matching diatom distribution and abundance to relevant water quality physical and chemical data archives is critical.

DIATOMS FROM DROUGHT EXPOSED HABITATS IN ICELAND

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With the current climate alterations, photosynthetic communities require further examination and understanding. Diverse diatoms from Iceland have been reported in the literature and descriptions of new to science taxa continues. This research focuses on taxa with potential strategies to survive terrestrial environments like: wet walls with lichen and moss cover. The ecology of taxa that are able to take advantage of the microhabitats available in aerophilous locations is largely unknown. During the summer of 2013 and 2015, subaerial algal assemblages were collected from rock outcrops or large boulders on the landscape from southwestern Iceland, primarily in the Hengill watershed, but also Sporhellan, Þingvellir National Park, and along Landmannaleið in the southern part of the Highlands. Light and scanning electron micrographs of internal and external morphology and ultrastructure of wet-wall diatoms is presented. Algal assemblages were dominated by co-occurring Diadesmis and Humidophila taxa. *Diadesmis gallica* W. Smith and *Humidophila perpusilla* (Grunow) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot, Koplaová had the highest relative abundance. Numerous specimens of the genera Orthoseira, Diadesmis, Epithemia, and Eunotia were evaluated taxonomically. Desiccation adaptations are discussed.

DIATOM COMMUNITIES OF TRAVERTINE-PRECIPITATING SPRINGS ON A GRADIENT OF ANTHROPOGENIC DISTURBANCE IN THE SANDIA MOUNTAINS, NEW MEXICO

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Carbonate-rich waters of travertine-precipitating springs facilitate unique physiochemical environments that support distinct diatom species assemblages adapted to the environmental stress of constant carbonate precipitation. Spring systems are further limited by the impacts of historical and ongoing anthropogenic disturbance which includes recreational activity and hydrologic modification of springs using spring boxes and wells. This study focused on impacts of water chemistry and anthropogenic disturbance on diatom assemblages found in travertine-precipitating springs. Data were collected in the fall and spring at eight spring sites, including six known to precipitate travertine, in the Sandia Mountains of central New Mexico. Water chemistry, benthic diatoms, sediment composition, percent organic matter, and categorical disturbance variables were analyzed. Hydrochemical analysis showed seven springs are dominated by Ca-HCO_3 and one was mixed Ca-Mg-Cl type. Common diatom taxa include indicators of high conductivity (e.g., *Diploneis oblongella*, *Pinnularia* spp.), flowing water (e.g., *Meridion circulare*), and sediment substrates (e.g., *Surirella* spp., *Planothidium* spp.). Diatom assemblage analysis, disturbance characterization, and other biological assessments can be used to prioritize restoration of springs with unique habitats, such as travertine-precipitating springs.

MARRYING GIS AND DIATOM ANALYSES: RECONSTRUCTING THE HISTORY OF WATER QUALITY OF THE WABASH RIVER

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The Wabash River is a large meandering stream that stretches for over 471 miles from Ohio through Indiana, where it ultimately joins the Ohio River. The majority of Wabash River tributaries drain agricultural landscapes. Ramifications of this agricultural drainage are such that the Wabash River Valley comprises some of the highest nutrient yields in the US, which contribute to excessive algal bloom nutrient exports into the Gulf of Mexico. This study uses diatom assemblages and GIS techniques to analyze the water quality of the Wabash River both currently and historically. Each spring the Wabash River floods into nearby lakes. Using GIS techniques, such as Image Classification, and Landsat Imagery provides evidence of which lakes are affected by its floodwaters and need to be cored for further analysis using an HTH corer. Coring affected lakes provides a historic diatom record. Additionally, collecting weekly live samples from the Wabash River provides high-resolution data for water quality analysis. Each modern and historic sample will be analyzed for up to 300 diatom valves using a Leica DM2500 research-grade microscope at 100x magnification. Identifying the diatoms to species level allows for a deeper understanding of the water quality through nutrient load preferences from specific species. These trends ultimately give a macroscopic picture of the Wabash River's impact on hypoxia in the Gulf of Mexico.

SELECTIVE GRAZING OF SEDIMENT DIATOMS BY CHIRONOMID LARVAE IN WEST LAKE OKOBOJI, IOWA

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Diatoms are a key food source for macroinvertebrates. Consumption of diatoms alters their community structure, function, and resource availability to grazers. The objective of this study was to assess the grazing selectivity of chironomid larvae for sediment diatoms. A dredge sample was collected from 9.1 m depth in Miller's Bay in West Lake Okoboji, Iowa. A sample of the top 1 cm of sediment was removed as a representation of chironomid food source, and chironomid larvae (n = 13) were removed from the bulk sediment by screening. Diatoms were processed from the intestinal tracts, assigned operational taxonomic unit numbers, and enumerated. Of the 10 most abundant taxa in the sediment, 5 of those taxa were found in the chironomid gut contents, mainly consisting of centrics and araphids. In particular, both *Stephanodiscus minutulus* and *Fragilaria vaucheriae* collectively composed almost half of the diatom assemblages in the guts. There were 15+ diatom taxa found in the intestines that were not found in the sediment (relative abundance <10%). Future work includes investigating the relationship between grazers' body size and size of diatoms consumed and seasonality of macroinvertebrate diets.

DIRECT OBSERVATION OF AEOLIAN TRANSPORT OF DIATOMS IN THE MCMURDO DRY VALLEYS, ANTARCTICA: IMPLICATIONS FOR MICROBIAL BIOGEOGRAPHY AND LANDSCAPE CONNECTIVITY

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In the McMurdo Dry Valleys (MDVs), Antarctica desert, aeolian processes are major drivers of sediment transport and biogeochemical processes. Aeolian dispersal of microorganisms may also contribute to microbial community assembly processes in aquatic habitats in the MDVs (lakes, ephemeral streams, and glacier cryoconite). Diatoms are abundant in MDV stream and lake benthic microbial mats and are also common in glacier and lake ice cryoconite, with some taxonomic similarity between stream and glacier cryoconite communities. The objective of this study was to characterize the similarity of aeolian diatom community composition and species richness to those of local and regional aquatic communities. Wind-blown sediments from 4 sites along a near coastal-to-inland gradient through Taylor Valley were collected by passive samplers 55 cm above the sediment surface during one austral winter. Aeolian sediments were examined using compound light microscopy for preliminary characterization of diatom community composition and presence of cytoplasm. Aeolian communities were compared to stream, lake, and cryoconite communities across Taylor Valley from over 10 years of sampling by the McMurdo Dry Valleys Long-Term Ecological Research program. Overall, aeolian communities were dominated by taxa common in local aquatic habitats. Diatom valves of all shapes and sizes known in the MDVs were observed in the aeolian material, and only 2-5% of individuals per site had clearly visible cytoplasmic material. Diatom community species richness and composition in aeolian material were found to vary spatially along the valley gradient. Whole community similarity between aeolian and local samples was low and insignificant. These results, while preliminary, suggest predominantly local transport of organisms by near-surface wind, potential species-specificity for survival ability in the wind, and strong environmental filtering of taxa after dispersal. Local sourcing of diatoms is consistent with previous isotope sediment analysis that indicated a primarily local origin of the wind-blown sediments. In this study, we directly observed the aeolian transport of diatoms representative of stream microbial mats, thereby establishing an important link between previously observed taxonomic similarity between MDV stream and glacial cryoconite diatom communities.

Our results suggest wind-mediated dispersal of microorganisms is an important driver of biological connectivity over the MDV landscape.

DIATOMS EPIPHYTIC ON *SPHAGNUM* MOSS IN MIDWESTERN QUAKING BOGS: USE AS PALEOLIMNOLOGICAL INDICATORS

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Sphagnum moss creates a moist microhabitat capable of hosting diatoms due to specialized cells that hold water. These epiphytic diatoms can also be recovered from *Sphagnum* samples preserved in herbaria, providing a record of environmental conditions at the time of collection. To determine their potential as paleoindicators, we compared epiphytic diatoms from herbarium *Sphagnum* samples to diatoms growing on *Sphagnum* in quaking bogs today. We also compared the epiphytic assemblages to diatoms in nearby bog sediments. From a 100-km radius spanning parts of Wisconsin, Illinois, and Indiana, we collected live *Sphagnum* samples from Beulah Bog, Volo Bog, and Pinhook Bog. The herbarium samples, collected from the same region over the past one hundred years, were obtained from the Field Museum of Natural History. Diatoms were plentiful on both the live and herbarium *Sphagnum* samples, and were dominated by *Eunotia nymanniana*, *Eunotia paludosa*, and *Pinnularia hilseana*. *E. nymanniana* was not observed in surface bog sediments, suggesting an adaptation to living on the subaerial habitat of *Sphagnum*. The species may thus be a useful paleolimnological indicator of when quaking bogs with floating *Sphagnum* mats developed. Because herbarium samples are labeled with the date of collection, our results also show the potential of using epiphytic diatoms in high resolution paleolimnological studies to infer recent anthropogenic impact.

STREAM DIATOM RESPONSES TO CONDUCTIVITY ARE AFFECTED BY MAJOR ION COMPOSITION

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Similar conductivities with different dominant ions might have dissimilar ecological effects. Our study examined if specific conductivities comprised of different ions associated with resource extraction affected stream periphyton assemblages. Sixteen artificial streams were dosed with two ion recipes intended to mimic sources and ranges of conductivity observed from field surveys. One recipe mimicked deep well brine (DWB) with chloride salts dominating and was dosed at five concentrations. The other reflected surface coal mine (SCM) leachate with bicarbonate and sulfate salts dominating and was dosed at four concentrations. Periphyton communities became more dissimilar to control treatments with increasing bicarbonate and sulfate than with increasing chloride concentrations. In SCM treatments, mean ash-free dry mass and chlorophyll a significantly increased ($R^2 > 0.74$) with greater concentrations, whereas they had mostly similar values across DWB treatments. After 28 days of dosing, greater concentrations of ions were associated with increasingly dissimilar diatom assemblages when compared to those in controls for both SCM ($R^2 > 0.60$) and DWB doses ($R^2 > 0.52$). Mean similarity declined to ~20% in the highest SCM dose and remained above 85% in the highest DWB dose. In SCM treatments, Synedra, Nitzschia, Melosira, and Navicula abundances contributed to reduced similarity to control assemblages by increasing with greater concentrations. Results indicate that periphyton communities respond differently to multiple dominant ions comprising similar conductivities, and further understanding these effects are important to informing future practices and management efforts.

DIATOMS FROM THE HIGHEST LAKES AND STREAMS IN THE WORLD, HIMALAYAN RANGE, NEPAL

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A set of more than 60 water and algae samples were collected between two expeditions in 2016 and 2017 from streams and lakes leading from the Mount Everest base camp to Sagarmatha National Park (SNP), Nepal. Among other diatoms, these samples include a recently proposed new *Lindavia* species described from Gokyo Cho, a lake near Mount Everest in the Himalayan Mountain Range. Here we present a more complete assessment of the diatoms observed in samples from these expeditions and explore the potential for human activity as vectors for the distribution in this unique high-elevation ecosystem.

THE MICROSCOPIC WORLD OF DIATOMS: A STREAM BIOMONITORING CASE STUDY FOR HIGH SCHOOL SCIENCE CLASSROOMS

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For high school students interested in environmental science, diatoms offer excellent insight into watershed health and human impacts on the environment. These microscopic algae have high species diversity, intricate geometry, and, at 20–500 micrometers, a relatively large size, making them easily visible with a compound light microscope and scanning electron microscope (SEM). Studying diatoms as biological indicators immerses students in a compelling exploration of aquatic ecosystems. In this published work, we presented a novel and challenging set of activities that fosters a greater understanding of scientific phenomena aligned with the Next Generation Science Standards (NGSS). This investigation represented a two-year collaboration between a high school science teacher and a diatom researcher, who mentored projects developed by 10th-grade chemistry students in Portland, Oregon. Students designed an experiment to study water quality using diatoms as a biomonitoring tool. Working in groups, students collected benthic diatom samples and surveyed water quality parameters from local streams. Students analyzed diatoms to the genus level utilizing web resources paired with more non-traditional identification techniques including mnemonics and visual associations. With their diatom and water quality results in hand, students applied biotic indices to evaluate the quality of the streams in the context of their research questions. To facilitate success in the classroom, we provided differentiation strategies, including group sizes, timing, and guiding questions for each activity. We also discussed how to extend this lesson plan to include using a SEM in the classroom. This set of activities is aligned with NGSS HL-LS2 Ecosystems: Interactions, Energy, and Dynamics, as well as HS-ESS3 Earth and Human Activity.

A RECONSTRUCTION OF PAST SEA ICE EXTENT AND PRIMARY PRODUCTIVITY AT IODP SITE U1339 (UMNAK PLATEAU, BERING SEA), BASED ON DIATOM AND STABLE ISOTOPE PROXY RECORDS

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The recent rapid decline in Arctic sea ice extent has prompted concerns about the fate of sea ice in the future, and the stability of sea ice-dependent ecosystems. By studying the natural variability of sea ice cover and primary productivity during past warm intervals, we can better understand the long-term response of sea ice to a warming climate. Proxy records from the Umnak Plateau (IODP Site U1339) in the Bering Sea afford the chance to examine changes in sea ice and primary productivity during a long-lived interglacial known as Marine Isotope Stage (MIS) 11 (424-374 ka), which is considered a good analogue for future change.

This work uses diatom assemblage counts and stable isotopic analyses to describe variability in sea ice extent and primary productivity at the Umnak Plateau during MIS 11. The presence of sea ice-associated diatoms throughout the core suggests that sea ice was consistently present in the Umnak Plateau region during MIS 11. Sea ice and open water diatom species co-exist in the sediments, indicating that the sea ice cover was most likely seasonal. A new sea ice proxy, based on a General Additive Model fitted with five diatom species, was used to reconstruct past sea ice concentrations.

Laminated sediments at the boundary between MIS 12 and 11 point toward intervals of enhanced seasonal productivity during deglaciation. High productivity during deglaciation is characterized by an increase in organic and inorganic carbon, and also by a significant increase in *Chaetoceros* resting spores, a diatom associated with high productivity. An increase in sedimentary $\delta^{15}N$ values during laminated intervals suggests that deglaciation may also have been characterized by more complete surface nitrate utilization. In addition, the onset of MIS 11 is marked by an increase in the relative abundance of the diatom *Neodenticula seminae*, which suggests a greater influence of warm Alaskan Stream water at the site. It is surprising to note that the relative percent abundance of sea ice diatoms shows a steady increase following deglaciation, reaching a maximum during the peak interglacial warmth of Late MIS 11.

ALGAL COMMUNITY DYNAMICS IN THE SAVANNAH RIVER ESTUARY UNDER ANTHROPOGENIC STRESS

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Estuaries are naturally diverse systems with mixed freshwater and marine water in addition to being exposed to constant tide shifts. Anthropogenic alternations that are occurring on the Savannah River are expected to change the hydrology of the ecosystem and effect algal community structure and composition. The Savannah Harbor Expansion Project, which involves the widening and deepening of the river by 1.5 m to accommodate for larger vessels. It is anticipated that this project will affect tidal height, influx of salt water, and overall turbidity, which will disturb algal populations. Baseline data from the Savannah River mudflats were obtained in 2011. Algal community indices were assessed along with live to dead diatom ratios. Living diatoms were classified as freshwater, marine, or brackish in addition to planktonic, epipelic, and benthic. In 2011, deposition of marine planktonic species and high amount of dead diatom frustules were documented. In 2016, we repeated sampling at the original location followed the same standard protocols as those conducted in 2011. In the analyses of the whole algal community there was a reduction of 59% of live diatoms. Live diatoms were replaced by filamentous cyanobacteria genera such as Phormidium and green coccoid algae, classified as freshwater. There was a decrease in abundance of chain forming marine plankton species potentially due to higher sedimentation rates. Species richness within cleaned diatom communities decreased by 15.3%, but *Cymatosira belgica* Grunow remained the dominant species with the average of 40% relative abundance. Marine epipelic diatoms, like *Tryblionella granulata* (Grunow) Mann and *Rhaphoneis amphiceros* (Ehrenberg) Ehrenberg declined significantly. More than 10% of algal species are potentially new to science. Due to the negative affect of dredging and more sediment deposition, diatom communities show significant change due to increase in turbidity, lower light availability, higher temperature, and higher anthropogenic waste.

THE DIATOM RECORD OF ENVIRONMENTAL CHANGE ACROSS THE PLIOCENE-PLEISTOCENE TRANSITION AT LAKE EL'GYGYTGYN, NORTHEAST RUSSIA

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The unique ~3.6 My sedimentary record from Lake El'gygytgyn, northeast Russia provides an opportunity to explore environmental conditions in the Arctic during the high-CO_2 Pliocene and the transition into the Pleistocene. Diatoms are found throughout the length of the Lake El'gygytgyn core record, and diatom and biogenic silica concentrations vary widely. From 2.613-2.575 Ma, high-resolution analysis of diatom concentration in sediment and images obtained by scanning electron microscopy were used to determine the nature of the fluctuations in the diatom population during the Pliocene-Pleistocene climate transition. A low concentration of both planktonic and benthic diatoms occurs during the inferred cold event at 2.6 Ma. Distinct morphology and ultrastructure characteristics in the dominant planktonic *Pliocaenicus* (*Lindavia*) spp. before and after this event provide further support for a threshold in ice conditions severely impacting diatom production in the lake.

DIATOM RESPONSE TO PALEOCLIMATE DRIVEN DUNE ACTIVITY ALONG THE LAKE MICHIGAN SHORELINE

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Coastal dunes along Lake Michigan are not stable over time and changes are most likely tied to climate change (lake level, wind, and storm frequency and intensity). Timing of dune migration can be determined by optically stimulated luminescence dating (OSL) of minerals or radiocarbon dating of buried organic material, but these methods are limiting due to the inherent processes of dune migration. Previous work on Gilligan Lake near Holland, MI shows the presence of periodic sand layers in lake sediments related to lake level change in Lake Michigan. Multi-proxy data from Gilligan Lake sediments were used to determine climate-related dune migration activity. Diatom microfossils were analyzed from a specific sediment region of interest. The diatoms indicate a diverse community in Gilligan Lake during this period. Taxa are consistent with flora common in lakes associated with wetland habitats and contain many acidophilic species common to lower pH environments. Two major signals are evident from the diatom data in this section of the core, a decline in open lake condition, and a decrease in acidophilic taxa associated with wetlands.

USING DOTUS (DIATOMS OF THE UNITED STATES) TO ENHANCE STUDENT ENGAGEMENT AT UNDERGRADUATE AND GRADUATE LEVELS

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Diatoms of the United States (DOTUS) is an on-line taxonomic and ecological resource for a variety of users from scientists to students to the public. The information provided on DOTUS pages contributes to our knowledge of diatoms including species distribution, ecology, and variation among populations. Since 2011, students and researchers in *Ecology and Systematics of Diatoms* at the Iowa Lakeside Lab have contributed over 50 species pages to DOTUS for their final project to solidify their understanding of nomenclature, typology, intraspecific morphological variability, and autecology through peer-reviewed e-publication.

The 2017 class at Iowa Lakeside Lab examined the size range and morphology of ten taxa collected from five states, and compared some species to historical populations archived in the Reimer Herbarium. The taxa examined were *Nitzschia sigmoidea, Epithemia alpestris*, *Luticola goeppertiana*, and *L. hlubikovae* from Iowa; *Placoneis amphibola* and *Placoneis paraelginensis* from Minnesota; *Neidium sacoense* from Pennsylvania and Wisconsin; and *L. ignorata* and *L. frenguellii* co-occurring with an undescribed *Luticola* species from Oklahoma. Preparation of these DOTUS pages led to several findings: 1) the basionym was incorrectly cited for *Luticola goeppertiana* (Bleisch) Mann 1990, which led to validating the name in Rarick et al. (2017, *Notulae Algarum* 29), 2) two populations of *Placoneis paraelginensis* had wide variation in morphology, challenging our concept of this species, 3) *Placoneis amphibola* was found

to be sympatric with another undetermined large *Placoneis*, and 4) one novel *Luticola* species was found on turtles. Using DOTUS as a pedagogical tool engages students in the practices of science and dissemination of knowledge. Contributing to DOTUS species pages can lead to new observations that challenge and advance our understanding of diatom classification and ecology.
Views expressed are the authors' and not views or policies of the U.S.EPA.

EVALUATION OF DIATOM MIGRATION THROUGH SAND AT LOW TIDE ON ST. SIMONS ISLAND, GA

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Barrier islands incorporate various types of ecosystems including: open beaches, tidal streams, tidal ponds, mixed estuaries, and tidal marshes. The ecology of these habitats is largely unknown for the Georgia coast. Diatoms are a common algal group in sediment and beach samples. Diatom functional groups are based on the ability to move or attach to substrates. Diatoms move to the sand surface during low tide to access light. The goals of this study were first to document species composition of algae on exposed to desiccation sand at low tide. Second, to classify all diatoms based on their ability to move or attach. Third, to estimate species specific distance of movement along the known gradient. The distance travelled was measured by taking known heights (0.5 cm, 1 cm, and 2 cm) of sand samples at the same time of the day during low tide using Petri dishes. Collections were repeated, resulting in 27 samples collected from May and June 2016. Algal communities were dominated by live diatoms (99%). Within the diatom community, biraphid diatoms such as representatives of the genera *Nitzschia* and *Navicula* had 50% and 25% relative abundance respectively. Chain forming marine planktonic diatoms like *Cymatosira belgica* Grunow (20%) were probably deposited on the surface as the ocean retreated. Species richness was significantly different between distances to reach the surface, but biodiversity remained high in all samples. There was a higher percentage of biraphid diatoms at 2 cm compared to 0.5 cm. Biraphid nitzschioid diatoms presented a higher probability for survival deeper in the sediment.

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Benito et al.	xbenitogranell2@unl.edu	METACOMMUNITY DYNAMICS OF LAKE DIATOMS IN TROPICAL SOUTH AMERICA
Bramburger et al.	abrambur@d.umn.edu	THE ONGOING SAGA OF SIZE CHANGE IN THE GREAT LAKES PLANKTONIC DIATOM COMMUNITY
Burge et al.	dburge@smm.org	PALEOLIMNOLOGY AND RESURRECTION ECOLOGY: THE FUTURE OF RECONSTRUCTING THE PAST
Card, V	virginia.card@metrostate.edu	MICROMECHANICS OF DIATOM VALVES: LOCULATE AEROLAE AND SANDWICH STRUCTURE
Charles et al.	Charles@ansp.org	QUALITY ASSURANCE ASSESMENT OF REPLICATE DIATOM COUNTS: LESSONS FROM REVIEW OF 800 COMPARISONS
Chraïbi etal.	chraibi@tarleton.edu	ASSESSING THE HIERARCHY OF ENVIRONMENTAL CONTROLS ON DIATOM COMMUNITIES OF YELLOWSTONE NATIONAL PARK
Edlund et al	medlund@smm.org	STATUS OF THE *DIATOMS OF THE UNITED STATES* WEB FLORA
Edlund, M et al	medlund@smm.org	HISTORICAL DIATOM COMMUNITY AND PRODUCTIVITY SHIFTS HELP PREDICT THE SENSITIVITY OF BOREAL LAKES TO CLIMATE CHANGE
Feitl et al.	mfeitl@huskers.unl.edu	DECADAL LACUSTRINE RECORDS OF CLIMATIC AND ENVIRONMENTAL CHANGE IN A SUBSET OF ECUADORAN LAKES
Frankovich et al.	frankovich@virginia.edu	EPIZOIC AND APOCHLOROTIC TURSIOCOLA SPECIES (BACILLARIOPHYTA) FROM THE SKIN OF WEST INDIAN MANATEES (TRICHECHUS MANATUS)
Gaiser, E	gaisere@fiu.edu	THE ROLE OF CORE SPECIES IN REGULATING DIATOM NETWORK ASSEMBLY
Genter, B	robert.genter@jsc.edu	DIATOM DENSITIES IN FRESHWATER STREAMS EXPOSED TO HEAVY METALS AROUND THE ELIZABETH MINE, VERMONT, USA
Lee et al.	sylvlee39@gmail.com	HARMONIZING AND REVISING DIATOM TAXONOMY IN EXISTING BIOASSESSMENT DATASETS FOR USE AS INDICATORS
Lowe, R et al.	lowe@bgsu.edu	A NEW "CENTRIC" DIATOM FROM OAHU HAWAI'I
Massa et al.	e3massa@gmail.com	SEXUAL REPRODUCTION IN *CYMBELLA AFFINIS* AND *GOMPHONEIS OLIVACEUM*
Mazzei, V & Gaiser, E	vmazz001@fiu.edu	DRIVERS AND SPATIAL CONSISTENCY OF SPECIALIZATION IN A DOMINANT, MAT-DWELLING DIATOM, *ENCYONEMA EVERGLADIANUM,* FROM THREE FRESHWATER WETLANDS IN THE CARIBBEAN BASIN
Minerovic et al.	adm354@drexel.edu	UPDATES TO NEW TAXON CURATION AND MANAGEMENT IN THE ANSP DIATOM HERBARIUM
Pillsbury, B	pillsbur@uwosh.edu	THE EFFECTS OF NUTRIENTS AND CURRENT ON THE GROWTH AND STALK PRODUCTION OF *DIDYMOSPHENIA GEMINATA*
Potapova, M	mp895@drexel.edu	CHRONICLES OF SALT MARSHES WRITTEN IN DIATOM LANGUAGE
Reavie et al.	ereavie@d.umn.edu	DIATOMS AS AN EARLY WARNING SYSTEM FOR IMPACTS FROM EUTROPHICATION, INVASIVE SPECIES AND CLIMATE CHANGE
Sabir et al. (Ashworth)	mashworth@utexas.edu	EXPLORING DIATOM ECOLOGY ON THE CORAL REEFS OF THE SAUDI ARABIAN RED SEA COASTLINE IN THE DEVELOPMENT OF A DIATOM-BASED, COST-EFFECTIVE BIOMONITORING TOOL
Sgro, G & Reavie, E	jsgro@jcu.edu	HISTORIC PHOSPHORUS LEVELS IN LAKE ERIE MEASURED BY DIATOM INFERRED PHOSPHORUS

Authors	Email	Oral Presentation Title
Solomon et al	kjsolomon89@gmail.com	EXAMINING POTENTIAL CHANGES IN STREAM ALGAL COMMUNITIES IN THE SOUTHERN APPALACHIANS, PRE- AND POST-HEMLOCK DIE-OFF
Stevenson, RJ	rjstev@msu.edu	DIATOM INDICATOR MAGIC: THE LAW OF LARGE NUMBERS PROVIDES GOOD METRIC PERFORMANCE DESPITE CURRENT LEVELS OF TAXONOMIC INCONSISTENCY
Tyree et al.	meredith.tyree@colorado.edu	DEVELOPING ALTERNATIVE DIATOM ENUMERATION METHODS TO BUILD BETTER PREDICTIVE BIOASSESSMENT MODELS
Warnock et al.	jwarnock@iup.edu	HOLOCENE ENVIRONMENTAL HISTORY OF THE ÅNGERMANÄLVEN ESTUARY, NORTHERN BALTIC SEA
Wee J & Bucolo, P	wee@loyno.edu	APPLIED LABORATORY EXPERIMENTS IN DIATOM ECOPHYSIOLOGY: WHICH IS MORE IMPORTANT, THE QUESTION OR THE ANSWER?
Woods et al.	phyliswoods@gmail.com	LAKE SENSITIVITY TO LATE HOLOCENE CLIMATE DRIVERS : A DIATOM-DEPTH MODEL FOR THE WESTERN GREAT LAKES REGION

Authors	Email	Poster Presentation Title
Alexsen et al.	alexs005@d.umn.edu	MORPHOLOGICAL VARIATION OF CYCLOTELLA (PANTOCSEKIELLA) COMENSIS IN THE LAURENTIAN GREAT LAKES
Brown, S & Fritz, S	sabrina.brown@huskers.unl.edu	A PRELIMINARY INVESTIGATION INTO DIATOM ASSEMBLAGE RESPONSE TO HYDROTHERMAL EXPLOSION EVENTS, YELLOWSTONE LAKE, WYOMING
Carey etal (Charles)	Charles@ansp.org	DIATOM DATA IN THE NEOTOMA PALEOECOLOGY DATABASE
DeNicola, D	dean.denicola@sru.edu	EFFECTS OF ACID AND METALS ON BENTHIC ALGAE IN STREAMS OF DIFFERENT TROPHY USING CHEMICAL DIFFUSING SUBSTRATA
Ferguson et al.	b.ferguson@iup.edu	RELATING FRAGILARIOPSIS KERGUELENSIS FRAGMENTS TO ORIGINAL VALVE DIMENSIONS
Furey et al.	pcfurey@hotmail.com	STALKED *RHOPOLODIA* FROM LAKE TANGANYIKA
Jaskowiak, M	mjaskowiak@bradley.edu	THE TYPE SPECIMEN OF FRESHWATER BIRAPHID GENERA AND WHERE TO FIND THEM
Johnson et al.	kjohn02@gmail.com	MORPHOLOGICAL DIVERSITY OF EUNOTIA AND GOMPHONEMA TAXA FROM UPPER THREE RUNS CREEK IN SOUTHEASTERN UNITED STATES
Lor, B & Manoylov, K	blia.lor@bobcats.gcsu.edu	SUCCESSION OF DIATOM NONOBLIGATE ECTOSYMBIONTS ON CLADOPHORA FROM WEST OKOBOJI LAKE, IOWA
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Manoylov K & Furey P	kalina.manoylov@gcsu.edu	DIATOMS FROM DROUGHT EXPOSED HABITATS IN ICELAND
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Slate, J et al.	J-Slate@neiu.edu	DIATOMS EPIPHYTIC ON *SPHAGNUM* MOSS IN MIDWESTERN QUAKING BOGS: USE AS PALEOLIMNOLOGICAL INDICATOR
Smucker, N	smucker.nathan@epa.gov	STREAM DIATOM RESPONSES TO CONDUCTIVITY ARE AFFECTED BY MAJOR ION COMPOSITION
Stone, J et al.	jeffery.stone@indstate.edu	DIATOMS FROM THE HIGHEST LAKES AND STREAMS IN THE WORLD, HIMALAYAN RANGE, NEPAL
Sultany, M & Bixby, B	bbixby@unm.edu	THE MICROSCOPIC WORLD OF DIATOMS: A STREAM BIOMONITORING CASE STUDY FOR HIGH SCHOOL SCIENCE CLASSROOMS
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Wolin, J	j.wolin@csuohio.edu	DIATOM RESPONSE TO PALEOCLIMATE DRIVEN DUNE ACTIVITY ALONG THE LAKE MICHIGAN SHORELINE
Wu et al.	shelly.wu@tcu.edu	USING DOTUS (DIATOMS OF THE UNITED STATES) TO ENHANCE STUDENT ENGAGEMENT AT UNDERGRADUATE AND GRADUATE LEVELS
Zohn, M & Manoylov, K	merry.zohn@bobcats.gcsu.edu	EVALUATION OF DIATOM MIGRATION THROUGH SAND AT LOW TIDE ON ST. SIMONS ISLAND, GA