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Diatoms of Acadia National Park, Maine, USA,

with a detailed account on taxonomy and morphology of several remarkable species

Ph.D. Thesis

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Annotation

This thesis was focused on studying diatoms (Bacillariophyceae) from Acadia National Park, Maine, USA. First, the park is introduced and the preliminary study of freshwater algae, including diatoms, is presented. Extraordinary species richness of algae was discovered, especially in the group of diatoms, which is documented by a complete list of 674 diatom taxa in 92 genera encountered in the freshwater and brackish habitats within the park. Of those a considerable number of species unfortunately remained unidentified, as they did not conform to any described taxon in the available scientific literature. Therefore, several of those unnamed taxa were studied in close detail using light and scanning electron microscopes, exhaustive literature and herbaria search, and yielded description of three new species from genus *Eunotia*, and rediscovery of two rare and almost forgotten *Surirella* species.

Declaration [in Czech]

Prohlašuji, že svoji disertační práci jsem vypracovala samostatně pouze s použitím pramenů a literatury uvedených v seznamu citované literatury.

Prohlašuji, že v souladu s § 47b zákona č. 111/1998 Sb. v platném znění souhlasím se zveřejněním své disertační práce, a to v úpravě vzniklé vypuštěním vyznačených částí archivovaných Přírodovědeckou fakultou elektronickou cestou ve veřejně přístupné části databáze STAG provozované Jihočeskou univerzitou v Českých Budějovicích na jejích internetových stránkách, a to se zachováním mého autorského práva k odevzdanému textu této kvalifikační práce. Souhlasím dále s tím, aby toutéž elektronickou cestou byly v souladu s uvedeným ustanovením zákona č. 111/1998 Sb. zveřejněny posudky školitele a oponentů práce i záznam o průběhu a výsledku obhajoby kvalifikační práce. Rovněž souhlasím s porovnáním textu mé kvalifikační práce s databází kvalifikačních prací Theses.cz provozovanou Národním registrem vysokoškolských kvalifikačních prací a systémem na odhalování plagiátů.

České Budějovice, 3. května 2014

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Jana Veselá

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I dedicate this thesis to the memory of an extraordinary man, my grandfather Jan Procházka.

List of papers and author's contribution

The thesis is based on the following papers (listed chronologically):

I. Vaccarino, M.A., **Veselá, J**. & Johansen, J.R. (2011) The algal flora of Acadia National Park, Maine, U.S.A. Northeastern Naturalist 18: 457–474. (IF_5 = 0.619)

Jana Veselá planned and organized the sample collection efforts, collected samples in the field with the help of co-authors, wrote the introduction, field-site description and material and methods parts of the manuscript, prepared one of the tables and the map of sampled sites.

II. **Veselá, J.** & Johansen, J.R. (submitted) Three new *Eunotia* (Bacillariophyta) species from Acadia National Park, Maine, USA. Phytotaxa.

Jana Veselá conducted most of the research including LM and SEM microscopical analyses, majority of morphometric analyses and literature research; prepared figure plates and the table, wrote or participated on writing of all parts of the manuscript.

III. **Veselá, J.**, Johansen, J.R. & Potapova, M. (2013) *Surirella terryi and S. cruciata*: two rare diatoms from North America. Diatom Research 28: 503–516. (IF_5= 0.994)

Jana Veselá conducted the research including LM and SEM microscopical analyses, morphometric analyses, literature and herbarium research; made all figure plates and the table, wrote a vast majority of the manuscript, and edited comments of the co-authors and reviewers.

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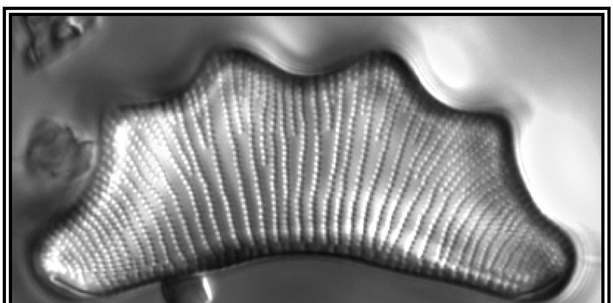

General Introduction

General introduction

What are diatoms and why should we bother to study them?

Diatoms (Bacillariophyta) represent a major group of microscopic algae found worldwide in nearly all aquatic and many subaerial habitats. These single-celled eukaryotic algae are mainly characterized by siliceous (opaline) cell walls composed of two valves, together forming a unit called the frustule. Unfortunately, for species level identifications the protoplast is far from sufficiently informative. However, the robust and mostly highly ornamented siliceous frustules of diatoms are exceedingly complex, and therefore suitable for distinguishing among the species—with the valve shape, size and ornamentation being taxonomically important. One of the other unique characteristics of diatoms is certainly their reproductive strategy. The vegetative stage highly dominates over the sexual stage during their life cycle. In general, most diatom species repeatedly undergo cell division, during which the population mean size gradually diminishes as the daughter valves are predominantly formed smaller than the parent valves. When the population reaches the critical (small) size, a single sexual reproductive event occurs, during which the cell size is restored to its maximum (Round et al. 1990). Overall the diatom life cycles can last from months to a couple of decades (depending on the species), with the sexual stage lasting only a couple of weeks (Mann 1988, Kaczmarska et al. 2013). Despite their microscopic sizes (from less than 10 µm to up to ca. 500 µm) diatoms are fairly abundant in the phytoplankton and phytobenthos of the marine and fresh waters of all latitudes, and play an important role as primary producers in these ecosystems. Werner (1977) has estimated that diatoms might be responsible for ca. 20–25% of the Earth's primary production, which places them even ahead of the productivity of the world's tropical rainforests (Field et al. 1998). Also, they are globally significant in biogeochemical cycles of carbon and silica. Throughout the time of their existence, since the early Mesozoic (Medlin et al. 1997), diatoms radiated into an enormous number of species. There is no accurate estimate of the number of diatom species (Stoermer & Smol 2001), although it is certainly the most species-rich group of algae. According to Mann & Droop (1996) approximately 200 diatom genera and over 200,000 extant (i.e., still living) species are expected to exist worldwide (with well over 25 000 species already described to date, Alverson 2008). Nevertheless, this estimate likely will be raised by the application of modern species concepts (Stoermer & Smol 2001). Aside from their ubiquity, abundance and extraordinary morphological diversification, diatoms are interesting in their sensitivity to specific ecological conditions, which all together make them almost ideal biological indicators (e.g., Dixit et al. 1992). This advantageous quality of diatoms, enhanced by the great preservation of siliceous frustules in sediments, has been widely applied by many countries in water quality monitoring, paleolimnological reconstructions or in understanding of regional and global climate changes. Besides ecological uses, diatoms have also been helpful in forensic research, archeology and have started to be utilized by humans in a number of industrial applications, such as nanotechnologies (for more see Stoermer & Smol 2001).

Why is taxonomy important?

Basically, the answer is simple: without an excellent knowledge of "what is out there", we are not able to benefit from the valuable diatom qualities, which are directly tied up to the nature of individual species. In other words, accurate taxonomy is essential as a base for ecological studies and industrial uses. Mentioning exclusively the ecological applications, diatoms have been used in paleolimnological reconstructions (e.g., Fritz et al. 1991, Campeau et al. 1999), in characterization of global climate changes (principally in Canadian Arctic, e.g., Pienitz et al. 1995, Douglas et al. 2004, Smol et al. 2005), and are routinely used by national and regional agencies in environmental monitoring and water quality assessments in Europe (with contribution of European Union directives; e.g., Kelly et al. 1998, Gevrey et al. 2004), as well as in North America (e.g., Hill et al. 2003, Ponader et al. 2007, Potapova & Charles 2007). Popular transfer functions in paleoecological studies (e.g., Fritz et al. 1991, Juggins 1992, Fallu et al. 2000, Roseacute et al. 2000) and diatom indices in limnoecological studies (e.g., Hofmann 1994, Kelly & Whitton 1995, Gómez & Licursi 2001, Coste et al. 2009), in which possibly the closest relationship between diatom frequency, abundance and ecological preferences is shown, have been created for many individual water bodies or entire regions. However, the scientists conducting those studies are fully aware of the fact that all their results are entirely dependent upon their ability to correctly recognize encountered species and upon their understanding of the ecology of individual taxa (e.g., Birks 1994, Kociolek & Stoermer 2001). Since a huge number of diatom species exists, it has been difficult for ecologists to embrace the extensive knowledge of the vast, and not always easily obtainable, existing literature. Therefore, a considerable effort has been started, mostly thanks to the "Frankfurt school" (Mann 1999), since the 1990's to make comprehensive diatom floras which would help ecologists with their accurate diatom identifications. Apart from countless articles published every year in peer-reviewed scientific journals, a number of massive publications have been completed for Europe, such as the series *Süßwasserflora von Mitteleuropa* (Krammer & Lange-Bertalot 1986, 1988, 1991a, b), the series *Diatoms of Europe* focusing on individual genera (Krammer 2000, Lange-Bertalot 2001, Krammer 2002, 2003, Levkov 2009, Lange-Bertalot et al. 2011, Levkov et al. 2013), or a publication on European freshwater benthic diatoms (Hofmann et al. 2011). Besides that, quite a few thorough regional floras from throughout the world have been created (series *Iconographia Diatomologica*, 25 volumes, and *Bibliotheca Diatomologica*, 60 volumes up to now), in which hundreds of new species have been encountered and described. Despite these impressive numbers of large diatom publications, North American research has lagged noticeably behind (more about North American diatom research later).

How to approach taxonomy of diatoms?

There are various approaches to studying diatoms and arriving at the taxonomy of this particularly species-rich group of algae. The choice of the specific approach directly influences the methods which must be employed, and the type of outcomes which can be expected. Each of the approaches has advantages and disadvantages, therefore it is necessary to be aware of them and to decide beforehand which of them, or which combination of them, need to be employed to fulfill our requirements.

Since the early times of investigation of diatoms, more than 200 years ago, diatoms have been recognized exclusively based on the morphology of their frustules viewed by a light microscope. It was due in part to the fact, that the protoplast is morphologically poor, like in many taxonomical groups of microalgae. Thanks to the elaborately ornamented siliceous cell walls of diatoms, though, scientists have been able to distinguish, even in the days of primitive microscopes, among numbers of species and varieties. The diagnostic characters were, and still are, the valve shape, morphometrics (valve length and width, striae count, etc.) and the ornamentation. This approach has been a prevailing practice until recent times, although it slowly became obvious that the diversity of diatoms was significantly underestimated and that the phenetic species concept, i.e., a traditional approach using morphological observation to place similar populations into the same species, is neither adequate nor sufficient to either recognize biodiversity or arrive at a systematically correct taxonomy (Kooistra et al. 2003).

Many more diagnostic features have been discovered with the dawn of electron microscopy (since 1930's, Hasle & Fryxell 1970). In fact, usage of the scanning electron microscope (SEM) literally revolutionized diatom systematics, because new taxonomically important ultrastructural features have been revealed, e.g., a variety of morphologically distinct fultoportulae and rimoportulae (special pores in centric, araphid and eunotioid diatoms), variously occluded areolae and many others. These findings have radically changed the generic classifications of diatoms, because many (possible) synapomorphies and autapomorphies have been revealed. As a result large genera have been finally split into numerous, smaller (in terms of number of species) genera. This was, for example, the case of *Navicula*, one of the most species-rich genera in diatoms, which has been split since that time into more than 15 smaller and morphologically well defined genera (Round et al. 1990, Lange-Bertalot 2001). Similarly this happened also with *Achnanthes*, *Cymbella*, *Fragilaria* and others. The way of ranking organisms changed, and consequently the new systematic classification of diatoms attempted to reflect phylogenetic relationships of diatoms and to delimitate possibly monophyletic genera, even though it all was still based on phenotypic characters (summarized by Round et al. 1990).

A completely different approach was applied to diatoms when the emphasis on the biological species concept became influential in diatom taxonomy (not until the 1970's, Mann 1999). This concept underscores the importance of reproductive isolation among individual species. Thus, the ability to interbreed with the members of the same group, but no other ones (although chosen based on their morphology), has been tested by laboratory breeding experiments (e.g., work on *Sellaphora pupula*, Mann 1984). This approach, although applied only in very few cases, revealed even more variability than the previous detailed morphological observations. Taxa with recognizable morphological differences that were considered slight in the past were found to be reproductively isolated, and as a result a number species were proposed.

Later, with the involvement of geometric morphometric and multivariate statistical methods several semi-cryptic (i.e., previously unrecognized or recognized at infraspecific levels) taxa were described as species based on morphometric delimitation. Geometric morphometrics seemed to represent an advantageous tool, especially in unraveling complex sets of continuous morphometric characters and in detection of the species morphometric limits (e.g., Theriot & Stoermer 1984, Theriot & Ladewski 1986, Theriot et al. 1988, Beszteri et al. 2005, Fránková et al. 2009). However, this approach has several fundamental disadvantages: it is quite labor-intensive and substantially time-consuming, it is applicable to rare or uncultured species only with difficulties, and it is based solely on phenotypic characters. As a result, this approach did not gain many followers and, aside from specific cases, was basically replaced by molecular methods.

Not surprisingly, with the arrival of using molecular data it was found that the genetic variability within some of the morphologically defined species also exceeds their morphological variability (e.g., Medlin et al. 1991). Apart from that and as mentioned earlier, the way of classification of organisms has extremely changed throughout the years, as phylogenetic species concepts have come into favor. Therefore, not only differences among the species are searched for, but also their evolutionary relationships. In these cases genetic data can be especially useful. Besides their ability to detect phylogeny of individual taxa, molecular data also seem to be the only practical means of exploring cryptic and semi-cryptic diversity (Amato et al. 2007, Mann 2010). However, there are several flaws to this approach. First, most of the diatom species are not easily cultivable which makes them rather difficult to sequence (this has been changing). Secondly, the use of molecular data in ecological studies is frequently impractical. Finally and most importantly, the molecular methods used in diatoms are still in a state of infancy. There is evidence that widely used molecular markers (e.g., SSU rDNA) give confusing results, due to various factors, such as high intragenomic polymorphism (in one case grater than 7%, Alverson & Kolnick 2005). Moreover, in some cases different markers support different interpretations of species boundaries – meaning that a phylogeny based on a specific genetic marker significantly differs from a phylogeny obtained using a different genetic marker (Kooistra et al. 2008). This is quite disturbing given the current trust of scientists in molecular based phylogenies. Therefore, traditional approaches are still applicable and desirable, despite the rising movement of emphasizing the use of molecular data as a primary tool for delimitating species.

Because various species of diatoms were soon recognized to reflect specific environmental conditions, ecological data were generally collected together with diatom samples from the early days of their study. However, the importance of the species ecology and particularly biogeography was not recognized until very recently. It was due to a persistent and widely held view that microbes were entirely cosmopolitan (Baas Becking 1934). Basically, the idea was: if there is a suitable habitat present anywhere in the world, there will be a certain composition of diatom species displayed (Vanormelingen et al. 2008). This view has not yet been totally left behind (e.g., Finlay 2002, Casteleyn et al. 2010), as we are still not sure about the biology and geography of many species. However, modern studies have revealed that diatom community structure and diversity are influenced by geographical factors and that the endemism observed in isolated areas is real (Potapova & Charles 2002, Vanormelingen et al. 2008). Thus, the current state of knowledge declares that the geographic distribution of diatoms ranges from global to narrow endemic. Nonetheless, the statement "a cosmopolitan diatom does not exist" by David G. Mann (1999) may be in fact confirmed in the future.

From all the information given above, it is obvious that the choice of a species concept, and therefore the approach used, is critical to taxonomic studies. In fact, there are numerous species concepts employed by scientists for recognition of new or already existing species (Mann 1999, Johansen & Casamatta 2005, Alverson 2008, Mann 2010). However, only some of them are suitable for diatoms and are acceptable in modern systematics (Mishler & Theriot 2000). The most appealing concept among systematists is, with no doubt, the phylogenetic species concept. However, it can hardly be applied to diatoms due to our very poor phylogenetic knowledge of them. If a species concept for studying diatoms has to be chosen at this point, it would be probably the Ecotypic Species Concept (Johansen & Casamatta 2005). Given the combination of rare sexual reproduction of diatoms, difficulty of obtaining molecular based phylogeny, and relatively easily observable morphological traits and ecological preferences, it seems to be the most suitable working species concept at the moment. The basic assumption of this concept is that ecotypes are defined by ecological niches. This concept seems to fit diatoms because they do experience fast changes in ecological conditions, which act as a selective force. Moreover, it is known that small morphological nuances of valve characters do have ecological meaning. Finally, molecular data alone do not provide sufficient information for species recognition, and give inconsistent results. Thus, phylogenetic species concept itself cannot be applied presently.

Finally, there has been a call for "pluralism" pronounced by David G. Mann already 30 years ago (Mann 1982, 1990). This idea emphasizes the need of implementing data besides morphology obtained from various approaches, such as ecological, biological, biochemical and molecular data, in order to recognize all biodiversity (Mann 2010). This manner, although called a "polyphasic approach", is already successfully used in studying taxonomy of cyanobacteria (among others: Comte et al. 2007). Accordingly, there is indeed a growing practice of diatomists to obtain types of data additional and separate to morphological data when describing new species. On the other hand, it is unfortunately still possible, even among experienced diatomists, for example to describe a species based only on several LM pictures without any SEM observations (e.g., *Eunotia pienitzii* Lange-Bertalot in Lange-Bertalot et al. 2011). In my personal opinion using the pluralistic approach is a good idea, since we still do not have a reliable tool for delimitating diatom species, and because our knowledge of the diatom biology is substantially poor. Until we resolve these problems, which can last for decades, we should include as many data as possible in description of encountered (new or existing) diatoms. At the minimum, for each newly described diatom species these requirements should be fulfilled: documentation of sufficient LM observations (micrographs and measurements), ultrastructure observations using SEM or even TEM (micrographs and measurements), some evidence on observation of life cycle (LM size diminution series is a way), any available ecology (ideally water pH, conductivity and concentration of nutrients) and biogeographical data (ideally GPS coordinates, and a description of the site) should be collected. Type specimens should be chosen, marked on the permanent slide and the slide should be deposited in an accessible herbarium (Mann 2010). After then and if possible, it would be useful to include as well molecular and other taxonomically relevant data.

In this study, the Ecotypic Species Concept is used for recognition of individual diatom species. For the description of new species and re-evaluation of several rare species, the pluralistic approach is applied.

How much is known about North American diatoms?

As stated above, our understanding of the North American diatom flora is way behind the state of knowledge of European diatoms. There has been several larger works conducted on diatoms from the United States in the distant past. For example, Boyer (1916) studied the Delaware River in around Philadelphia (with a weak tidal influence in that area, author’s comment), encountered over 500 diatom taxa and 15 of them described as new. Hohn & Hellerman (1963) studied North American rivers and found approximately 450 taxa, including over 100 new species and varieties which they described. However, the first, and up to recently, the last effort of completing the comprehensive study of diatoms from North America was made by Patrick & Reimer (1966, 1975). In their, unfortunately unfinished, study of diatoms from the United States (exclusive of Alaska and Hawaii) they documented approximately 6,000 species and varieties. This might appear as a sufficiently large number, although looking more closely with the modern taxonomic attitude, for example, at genus *Eunotia*, only 62 species and varieties were reported for the entire United States. This number is rather low, compared to 54 *Eunotia* species observed only within the boundaries of Great Smoky Mountains National Park (Furey et al. 2011) with 14 new *Eunotia* species described, or even 77 *Eunotia* taxa encountered during study of Acadia National Park (Veselá 2010, see further).

Since it became obvious and accepted by the community of diatomists that most diatom species are not cosmopolitan (Mann 1999) and identification of North American diatoms with European taxonomic keys is inappropriate, a considerable effort to describe the diversity of freshwater diatoms in North America has been started. This effort has resulted in the description of many new species of diatoms (e.g., Gaiser & Johansen 2000, Brant 2003, Manoylov et al. 2003, Morales 2003, Bixby 2005, Bahls 2012, 2013, Stepanek & Kociolek 2013), in publishing of several large regional diatom floras (e.g., Siver et al. 2005, Antoniades et al. 2008, Zimmermann et al. 2010, Siver & Hamilton 2011), and establishment of an updateable online diatom identification guide "The Diatoms of the United States" (Spaulding et al. 2010). In addition, the identities of several rarely reported and forgotten taxa described in the past from North America have been recently clarified (e.g., Kociolek et al. 2011, Graeff & Kociolek 2013, Potapova 2013, Veselá & Potapova 2014).

It seems that scientists realized this substantial lack of knowledge concerning diatoms from the developed countries of North America and are trying to catch up with Europe. One of the interesting areas within North America, which we found that was basically not studied for freshwater algae, was a small national park on the Atlantic coast of New England, i.e., Acadia National Park. By studying diatoms of this park, we hoped to contribute by a small piece to the common effort of North American diatomists.

Acadia National Park – site description

Acadia National Park is a small, although very popular, national park situated on the Atlantic coast of Maine, in the most northeastern part of the United States. Its area of ca. 190 km^2 (Killion & Foulds 2007) is fragmented with all parts located between 44.00–44.43° N, and 68.04–68.66° W. The main parts include Mount Desert Island (MDI, almost half of the island area), tip of Schoodic Peninsula (SchP), and pieces of land on Isle au Haut (IAH), a smaller and more distant island southwest of the MDI. The park is located at the transition of the temperate and boreal zones, experiencing strongly oceanic climate, moderate temperatures and high precipitation throughout the year (1370 mm of rain per year, Kahl et al. 2007). The altitude rises from the sea-level up to the 467 m-high Cadillac Mountain. The bedrock of the area is composed of coarse-grained pink granite. Soils, when developed, are shallow and acidic. The region was strongly affected by the glaciation period (ca. 18,000 years ago, Karr 2005), when north-south oriented mountain ridges and plentiful lakes in the valleys were created. As a result, the park is very heterogeneous possessing a large variety of freshwater habitats (i.e., four large lakes, countless small lakes, vast wetlands and numerous first-order streams), giving rise to a diverse fauna and flora. The small park area hosts over 1100 vascular plants, over 200 bird species and 90 other vertebrates (excluding the surrounding marine wildlife), together with several endangered species (Killion & Foulds 2007). The region was sparsely inhabited up until the middle of the 19^{th} century, and then inhabited by wealthy vacationers. The national park was established in 1919, and this act prevented further anthropogenic development (more details about the park in Veselá 2010, Vaccarino et al. 2011 – **Paper I**).

What has been known about diatoms of this park?

The finding that freshwater and brackish algae have hardly been studied in Acadia National Park has been quite surprising, especially given the diversity and extent of freshwater habitats, the age and enormous popularity of the park, and the location not far away from numerous renowned universities.

Overall, very few studies have been conducted on freshwater and brackish algae within the whole State of Maine. Focusing on the diatoms only, the first reference from that area comes from West (1891). Although he studied freshwater algae of Maine, his work was, unfortunately, mostly focused on desmids. Therefore a very short list of 15 diatom genera is presented in his work. Since then few and far from exhaustive studies have been published on this topic (for more see Vaccarino et al. 2011 – **Paper I**). In fact, diatoms have not been really studied in Maine until recently, when several ecological studies were conducted. Wang et al. (2006) developed and tested diatom indicators in the Casco Bay watershed in southern Maine, although they did not report any taxonomical information. As a part of a more extensive study in the northeastern United States, Davis & Anderson (1985) reported 455 diatom taxa from New England samples (6 sites from Vermont and New Hampshire, 25 sites in Maine – with none of them near or within Acadia National Park, author's comment). However, in their publication a list of only 152 frequently observed diatoms was included. All of the diatom genera and several of species reported there were also detected within Acadia National Park (**Appendix I**). Similarly, Charles et al. (2006) gave a list of common diatoms with 90 taxa frequently encountered in samples from the Northeast (which included Maine, Maryland, New Jersey and Pennsylvania). Of these, only 23 diatom species were also observed within Acadia National Park (compared with **Appendix I**). Based on multivariate analysis, the authors identified four major groups of diatom assemblages (i.e., Gulf Coast, Northeast, Southeast and West of Appalachians). Interestingly, one of the samples from Northeast, Kennebec River in central Maine, did not fall with its composition of diatoms within any of the four determined groups. The authors suggested it was due to the noticeable geographical isolation from other sampled sites. This fact, indeed, might have contributed to the dissimilarity from other samples in the analysis. On the other hand, this result also could have been caused by the presence of a truly distinctive diatom flora, as our preliminary research indicated (Vaccarino et al. 2011 – **Paper I**, Veselá 2010). Finally, several authors examined the quality of water directly within Acadia National Park in recent years (e.g, Kahl et al. 2007, Nelson et al. 2007), although only Bank et al. (2007) referred to freshwater phytoplankton and zooplankton. Unfortunately, Bank et al. (2007) studied solely the concentration of mercury in the phytoplankton and did not provide any names of algal species or genera.

All in all, diatoms within the State of Maine have been very poorly studied up to date. Moreover, diatom flora of Acadia National Park basically has not been studied at all. Therefore, a preliminary study on freshwater algal genera was conducted by us in 2008 (Vaccarino et al. 2011 – **Paper I**). Subsequently, diatoms have been studied in closer detail during a Master's thesis conducted by Veselá (2010). This work yielded observation of 87 diatom genera from freshwater and brackish habitats in the park with more than 500 encountered, although not specified, species. In fact, the M.S. thesis was mainly focused on the most species-rich diatom genus encountered in the park, genus *Eunotia*. In total, 77 species and varieties of *Eunotia* have been documented in the study, including 33 unidentified taxa (i.e., 17 completely unknown, marked as "sp.", and 16 not reliably identified, marked as "cf."). Since the time of completing that study on Eunotiophycidae four years ago, the genus *Eunotia* has received considerable attention, with nearly 100 species new to science described within the genus (e.g., Furey et al. 2011, Lange-Bertalot et al. 2011, Siver & Hamilton 2011). This fact is in accordance with the findings by Veselá (2010), as obviously many species of *Eunotia* have been recognized by others, although not named until recently.

Those results from the M.S. thesis, along with the previous ones from Vaccarino et al. (2011 – **Paper I**), have all indicated an interesting fact, which was the extraordinary richness of algae, and especially diatoms, present within the small and, as far as pH and conductivity of freshwater habitats, homogeneous park area (for more information see Veselá 2010 and Vaccarino et al. 2011 – **Paper I**).

AIMS OF THE STUDY

The general objective of this study was to examine diatoms of freshwater and brackish habitats within Acadia National Park, by means of light and (in some cases also) scanning electron microscopy, and by conducting an exhaustive scientific literature search. A complete list of diatom species occurring in the park was aimed to be provided (**Appendix I, II**), with a special attention to the taxonomic precision and thoroughness. This included no "force-fitting" of names on encountered diatom taxa, if a confident identification could not have been done using available literature. Part of that task was focused on re-evaluation of documented *Eunotia* species and varieties during the Master's thesis (Veselá 2010), meaning to correct the list of taxa in consideration of the voluminous literature on *Eunotia* recently published (**Appendix Ib**). Overall, it was expected, while pursuing the above mentioned tasks, to experience a necessity of studying some diatom species from the park exhaustively (using a pluralistic approach), as observation of a number of rare and new diatom taxa was anticipated.

The first paper (**Paper I**) introduces Acadia National Park, brings information on the collection of samples including measurements of several water characteristics, and presents the first comprehensive list of freshwater algal genera observed in this park. It also discusses works on freshwater algae including diatoms which have been conducted in Maine and Acadia National Park.

The second paper (**Paper II**) focuses on the description of three *Eunotia* species new to science which have been found in the park, i.e., *E. novaeangliae* nom. prov., *E. panda* nom. prov., and *E. spatulata* nom. prov. The morphological variability of each taxon was documented using light microscopy and the morphometric characters were obtained. Ultrastructural details were studied using SEM and the micrographs of external and internal valve views are presented. A thorough literature search was conducted. Environmental characteristics of the samples, where the taxa occurred, are also given. Types and isotypes were designated and the corresponding permanent slides were sent to selected herbaria. In addition each species was compared to other similar diatom taxa and, if a record of the species was discovered in the published literature, the distribution of that taxon was discussed.

The last paper (**Paper III**) presents two rare *Surirella* species, which have nearly been forgotten and have now been rediscovered by us. These species, *S. terryi* W.A. Terry and *S. cruciata* A.W.F. Schmidt, both described more than 100 years ago from North America, were reported only several times up to now and illustrated solely by drawings. For the first time we show the light and SEM micrographs of these species, and give the valve morphometrics based on more than 200 specimens (of each). Because several herbaria have been thoroughly searched, geographical distributions of those species are also presented, along with a thorough discussion on similar species. At last, type specimens, the lectotype of *S. terryi*, the neotype and epitype of *S. cruciata*, were designated by us, since no types were previously selected.

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Appendix Ia. List of high-level taxonomic groups of diatoms observed in Acadia National Park, Maine, USA. System of taxa follows Round et al. (1990). Number of observed species within each genus is in parentheses.

Division: **BACILLARIOPHYTA**

- Class: **COSCINODISCOPHYCEAE** ("centric diatoms")
  - Subclass: **THALASSIOSIROPHYCIDAE**
    - Order: **Thalassiosirales**
      - *Cyclotella* (4), *Discostella* (1), *Puncticulata* (1), *Thalassiosira* (7)
  - Subclass: **COSCINODISCOPHYCIDAE**
    - Order: **Melosirales**
      - *Hyalodiscus* (1), *Melosira* (1)
    - Order: **Paraliales**
      - *Paralia* (1)
    - Order: **Aulacoseirales**
      - *Aulacoseira* (8)
    - Order: **Coscinodiscales**
      - *Actinocyclus* (1), *Actinoptychus* (1), *Coscinodiscus* (2)
  - Subclass: **BIDDULPHIOPHYCIDAE**
    - Order: **Triceratiales**
      - *Plagiogramma* (1)
  - Subclass: **RHIZOSOLENIOPHYCIDAE**
    - Order: **Rhizosoleniales**
      - *Urosolenia* (2)
  - Subclass: **CHAETOCEROTOPHYCIDAE**
    - Order: **Chaetocerales**
      - *Chaetoceros* (1)
- Class: **FRAGILARIOPHYCEAE** ("araphid diatoms")
  - Subclass: **FRAGILARIOPHYCIDAE**
    - Order: **Fragilariales**
      - *Asterionella* (1), *Ctenophora* (3), *Diatoma* (2), *Fragilaria* (17), *Fragilariforma* (6), *Meridion* (1), *Opephora* (3), *Pseudostaurosira* (5), *Stauroforma* (2), *Staurosira* (3), *Staurosirella* (6), *Synedra* (3), *Tabularia* (4), *Ulnaria* (2)

Appendix Ia. (continued)

Order: **Tabellariales**
Tabellaria (10)
Order: **Licmophorales**
Licmophora (2), cf. *Licmophora* (1)
Class: **BACILLARIOPHYCEAE** ("raphid diatoms")
Subclass: **EUNOTIOPHYCIDAE**
Order: **Eunotiales**
Actinella (1), *Eunotia* (84), *Peronia* (2), *Semiorbis* (1)
Subclass: **BACILLARIOPHYCIDAE**
Order: **Mastogloiales**
Mastogloia (2)
Order: **Cymbellales**
Brebissonia (1), *Cymbella* (3), *Cymbopleura* (5), *Encyonema* (13), *Encyonopsis* (7), *Gomphonema* (19), *Placoneis* (2)
Order: **Achnanthales**
Achnanthes (15), *Achnanthidium* (7), *Cocconeis* (16), *Eucocconeis* (6), *Planothidium* (8), *Psammothidium* (12), *Rossithidium* (2)
Order: **Naviculales**
Berkeleya (2), *Brachysira* (17), *Caloneis* (10), *Capartogramma* (1), *Cavinula* (4), *Chamaepinnularia* (17), *Cosmioneis* (2), *Craticula* (4), *Decussata* (1), *Diadesmis* (8), *Diploneis* (5), cf. *Entomoneis* (1), *Fallacia* (6), *Frustulia* (17), *Gyrosigma* (2), *Haslea* (1),*Hippodonta* (1), *Kobayasiella* (4), *Luticola* (2), *Mayamaea* (1), *Microcostatus* (2), *Navicula* (45), *Neidium* (22), *Oestrupia* (1), *Parlibellus* (1), *Petroneis* (1), *Pinnuavis* (1), *Pinnularia* (63), *Plagiotropis* (4), *Pleurosigma* (3), *Sellaphora* (8), *Stauroneis* (21)

Appendix Ia. (continued)

Order: **Thalassiophysales**
Amphora (15), *Halamphora* (2)
Order: **Bacillariales**
Denticula (1), *Hantzschia* (3), *Nitzschia* (39), *Tryblionella* (4)
Order: **Rhopalodiales**
Rhopalodia (3)
Order: **Surirellales**
Entomoneis (2), *Stenopterobia* (5), *Surirella* (12)

Appendix Ib. List of diatom species observed in Acadia National Park, Maine, USA. * indicates taxa observed only in brackish sites; ° indicates *Eunotia* species which have been described since 2010, or will be described soon.

Division: **BACILLARIOPHYTA**

Class: **COSCINODISCOPHYCEAE**
Subclass: **THALASSIOSIROPHYCIDAE**

Order: **Thalassiosirales**
Cyclotella atomus Hustedt
Cyclotella menighiniana Kützing
Cyclotella tripartita Håkannson
Cyclotella sp. 1
Discostella stelligera (Cleve et Grunow) Houk et Klee
Puncticulata bodanica (Grunow) Håkansson
Thalassiosira baltica (Grunow) Ostenfeld *
Thalassiosira cf. *hyperborea* var. *septentrionalis* (Grunow) Hasle *
Thalassiosira nordenskjoeldii Cleve *
Thalassiosira sp. 1 *
Thalassiosira sp. 2 *
Thalassiosira sp. 4
Thalassiosira sp. 5 *

Subclass: **COSCINODISCOPHYCIDAE**

Order: **Melosirales**
Hyalodiscus scoticus (Kützing) Grunow *
Melosira nummuloides (Dillwyn) Agardh *

Order: **Paraliales**
Paralia sp. 1 *

Order: **Aulacoseirales**
Aulacoseira ambigua (Grunow) Simonsen
Aulacoseira crassipunctata Krammer
Aulacoseira islandica (Otto Müller) Simonsen
Aulacoseira cf. *islandica* (Otto Müller) Simonsen
Aulacoseira perglabra var. *florinae* (Camburn) Haworth

Appendix Ib. (continued)

Aulacoseira tenella (Nygaard) Simonsen
Aulacoseira sp. 1
Aulacoseira sp. 2

Order: **Coscinodiscales**
Actinocyclus sp. 1 *
Actinoptychus senarius (Ehrenberg) Ehrenberg *
Coscinodiscus cf. *rothii* var. *subsalsa* (Juhlin-Dannfelt) Hustedt *
Coscinodiscus sp. 1 *

Subclass: **BIDDULPHIOPHYCIDAE**

Order: **Triceratiales**
Plagiogramma staurophorum (Gregory) Heiberg *

Subclass: **RHIZOSOLENIOPHYCIDAE**
Order: **Rhizosoleniales**
Urosolenia cf. *eriensis* H.L. Smith
Urosolenia longiseta Zacharias

Subclass: **CHAETOCEROTOPHYCIDAE**

Order: **Chaetocerales**
Chaetoceros sp. 1 *

Class: **FRAGILARIOPHYCEAE**
Subclass: **FRAGILARIOPHYCIDAE**

Order: **Fragilariales**
Asterionella formosa Hassall
Ctenophora pulchella (Kützing) Williams et Round
Ctenophora cf. *pulchella* var. *lacerata* (Hustedt) Bukhtiyarova
Ctenophora sp. 1 *
Diatoma mesodon (Ehrenberg) Kützing
Diatoma tenue Agardh
Fragilaria capucina cf. var. *distans* Mayer
Fragilaria capucina var. *vaucheriae* (Kützing) Lange-Bertalot
Fragilaria capucina var. 1 Desmazieres
Fragilaria capucina var. 2 Desmazieres *

Appendix Ib. (continued)

Fragilaria capucina var. 3 Desmazieres
Fragilaria cf. *delicatissima* Proschkina-Lavrenko
Fragilaria cf. *elliptica* Schumann
Fragilaria exigua (W. Smith) Lemmermann
Fragilaria investiens (Smith) Cleve-Euler *
Fragilaria cf. *nanana* Lange-Bertalot
Fragilaria neoproducta Lange-Bertalot *
Fragilaria tenera (W. Smith) Lange-Bertalot
Fragilaria sp. 1 *
Fragilaria sp. 2
Fragilaria sp. 3 *
Fragilaria sp. 4
Fragilaria sp. 5
Fragilariforma constricta var. 1 (Ehrenberg) Williams et Round
Fragilariforma constricta var. 2 (Ehrenberg) Williams et Round
Fragilariforma virescens (Ralfs) Williams et Round
Fragilariforma virescens var. *capitata* (Østrup) Czarnecki
Fragilariforma sp. 1
Fragilariforma sp. 2
Meridion circulare (Greville) Agardh
Opephora sp. 1 *
Opephora sp. 2 *
Opephora sp. 3 *
Pseudostaurosira brevistriata var. 1 (Grunow) Williams et Round
Pseudostaurosira brevistriata var. 2 (Grunow) Williams et Round
Pseudostaurosira cf. *microstriata* (Marciniak) Flower
Pseudostaurosira trainorii Morales
Pseudostaurosira sp. 1 *
Stauroforma exiguiformis (Lange-Bertalot) Flower, Jones et Round
Stauroforma sp. 1
Staurosira ambigua Morales, Edlund et Spaulding
Staurosira construens Ehrenberg
Staurosira venter (Ehrenberg) Cleve et Möller
Staurosirella dubia (Grunow) Morales et Manoylov
Staurosirella lapponica (Grunow) Morales et Manoylov
Staurosirella pinnata (Ehrenberg) Williams et Round
Staurosirella cf. *pinnata* (Grunow) Williams et Round *
Staurosirella sp. 1

Appendix Ib. (continued)

Staurosirella sp. 2
Synedra barbatula Kützing *
Synedra sp. 1
Synedra sp. 2
Tabularia cf. *affinis* (Kützing) Snoeijs *
Tabularia cf. *laevis* Kützing *
Tabularia cf. *tabulata* (Agardh) Snoeijs *
Tabularia sp. 1 *
Ulnaria acus (Kützing) Aboal
Ulnaria ulna (Nitzsch) Compère

Order: **Tabellariales**
Tabellaria fenestrata (Lyngbye) Kützing
Tabellaria cf. *fenestrata* var. *asterionelloides* Grunow
Tabellaria flocculosa (Roth) Kützing
Tabellaria flocculosa strain III sensu Koppen (1975)
Tabellaria flocculosa strain IV sensu Koppen (1975)
Tabellaria flocculosa var. *linearis* Koppen
Tabellaria flocculosa cf. var. *linearis* Koppen
Tabellaria quadriseptata Knudson
Tabellaria cf. *quadriseptata* Knudson
Tabellaria ventricosa Kützing

Order: **Licmophorales**
Licmophora sp. 1 *
Licmophora sp. 2 *
cf. *Licmophora* sp. 3 *

Class: **BACILLARIOPHYCEAE**
Subclass: **EUNOTIOPHYCIDAE**

Order: **Eunotiales**
Actinella punctata Lewis
Eunotia acicularis Metzeltin et Lange-Bertalot °
Eunotia arculus Lange-Bertalot et Nörpel
Eunotia cf. *arculus* Lange-Bertalot et Nörpel
Eunotia bidens Ehrenberg
Eunotia bidentula W. Smith

Appendix Ib. (continued)

Eunotia cf. *bigibba* Kützing
Eunotia bilunaris (Ehrenberg) Schaarschmidt
Eunotia bilunaris var. *linearis* (Okuno) Lange-Bertalot et Nörpel
Eunotia boomsma Furey, Lowe et Johansen °
Eunotia boreoalpina Lange-Bertalot et Nörpel-Schempp
Eunotia cf. *boreotenuis* Nörpel-Schempp et Lange-Bertalot
Eunotia botellus Moser, Lange-Bertalot et Metzeltin
Eunotia botuliformis Wild, Nörpel et Lange-Bertalot
Eunotia chelonia Nörpel-Schempp, Lange-Bertalot et Metzeltin
Eunotia circumborealis Lange-Bertalot et Nörpel
Eunotia curtagrunowii Nörpel-Schempp et Lange-Bertalot
Eunotia diadema Ehrenberg
Eunotia elegans Østrup
Eunotia exigua (Brébisson) Rabenhorst
Eunotia cf. *exigua* (Brébisson) Rabenhorst
Eunotia faba Ehrenberg
Eunotia fallax Cleve
Eunotia cf. *flexuosa* (Kützing) Kützing
Eunotia cf. *flexuosa* var. *eurycephala* Grunow
Eunotia fureyae Lange-Bertalot °
Eunotia genuflexa Nörpel-Schempp
Eunotia glacialis Meister
Eunotia gratella f. *β* Berg
Eunotia hexaglyphis Ehrenberg
Eunotia implicata Nörpel, Alles et Lange-Bertalot
Eunotia incisa Gregory
Eunotia cf. *incisa* Gregory
Eunotia intermedia (Krasske) Nörpel-Schempp et Lange-Bertalot
Eunotia juettnerae Lange-Bertalot °
Eunotia cf. *kruegeri* Lange-Bertalot
Eunotia kulikovskiyi Lange-Bertalot °
Eunotia lapponica Grunow
Eunotia latitaenia Kobayasi, Ando et Nagumo
Eunotia lewisii Siver et Hamilton °
Eunotia cf. *meisteroides* Lange-Bertalot
Eunotia metamonodon Lange-Bertalot °
Eunotia cf. *metamonodon* Lange-Bertalot
Eunotia microcephala Krasske

Appendix Ib. (continued)

Eunotia monodon Ehrenberg
Eunotia cf. *monodon* Ehrenberg
Eunotia cf. *monodontiforma* Lange-Bertalot et Nörpel-Schempp
Eunotia mucophila (Lange-Bertalot et Nörpel-Schempp) Lange-Bertalot
Eunotia neocompacta var. *vixicompacta* Lange-Bertalot °
Eunotia nipponica Skvortzow
Eunotia novaeangliae nom. prov. (Veselá & Johansen, submitted) °
Eunotia nymanniana Grunow
Eunotia paludosa Grunow
Eunotia cf. *paludosa* Grunow
Eunotia panda nom. prov. (Veselá & Johansen, submitted) °
Eunotia paratridentula Lange-Bertalot et Kulikovskiy
Eunotia pectinalis (Dillwyn) Rabenhorst
Eunotia pienitzii Lange-Bertalot °
Eunotia praerupta Ehrenberg
Eunotia rhomboidea Hustedt
Eunotia rhynchocephala Hustedt
Eunotia richbuttensis Furey, Lowe et Johansen °
Eunotia romanowii Siver °
Eunotia cf. *rushforthii* Furey, Lowe et Johansen
Eunotia satelles (Nörpel-Schempp et Lange-Bertalot) Nörpel-Schempp et Lange-Bertalot
Eunotia serra Ehrenberg
Eunotia spatulata nom. prov. (Veselá & Johansen, submitted) °
Eunotia subarcuatoides Alles, Nörpel-Schempp et Lange-Bertalot
Eunotia subherkiniensis Lange-Bertalot °
Eunotia superbidens Lange-Bertalot °
Eunotia cf. *sylvahercynia* Nörpel, Van Sull et Lange-Bertalot
Eunotia tautoniensis Hustedt
Eunotia cf. *tenella* (Grunow) Hustedt
Eunotia tetraodon Ehrenberg
Eunotia trinacria Krasske
Eunotia ursamaioris Lange-Bertalot et Nörpel-Schempp
Eunotia valida Hustedt
Eunotia cf. *varioundulata* Nörpel-Schempp et Lange-Bertalot
Eunotia sp. 1
Eunotia sp. 2
Eunotia sp. 3

Appendix Ib. (continued)

Eunotia sp. 4
Eunotia sp. 5
Eunotia sp. 6
Eunotia sp. 7
Peronia heribaudi Brun et M. Peragallo
Peronia sp. 1.
Semiorbis rotundus G. Reid et Williams

Subclass: **BACILLARIOPHYCIDAE**

Order: **Mastogloiales**
Mastogloia elliptica (C. Agardh) Grunow *
Mastogloia pumila (Cleve et Möller) Cleve *

Order: **Cymbellales**
Brebissonia lanceolata (Agardh) Mahoney et Reimer *
Cymbella aspera (Ehrenberg) Cleve
Cymbella cf. *borealis* Cleve
Cymbella subarctica Cleve-Euler
Cymbopleura incertiformis Krammer
Cymbopleura naviculiformis (Auerswald ex Heiberg) Krammer
Cymbopleura spuria (Cleve) Krammer
Cymbopleura subcuspidata (Krammer) Krammer
Cymbopleura subrostrata (Cleve) Krammer
Encyonema elginense (Krammer) Mann
Encyonema elginense morph. 4 (Krammer) Mann
Encyonema cf. *gaeumannii* (Meister) Krammer
Encyonema hebridicum var. 1 (Gregory) Grunow
Encyonema hebridicum var. 2 (Gregory) Grunow
Encyonema kalbei Krammer
Encyonema lunatum (W. Smith) Van Heurck
Encyonema neogracile Krammer
Encyonema schimanskii Krammer
Encyonema silesiacum (Bleisch) Mann
Encyonema cf. *silesiacum* var. *lata* Krammer
Encyonema sp. 1
Encyonema sp. 2
Encyonopsis cesatii (Rabenhorst) Krammer

Appendix Ib. (continued)

Encyonopsis cf. *cesatiiformis* Krammer
Encyonopsis cf. *grunowii* Krammer
Encyonopsis neoamphioxys Krammer
Encyonopsis subminuta Krammer et Reichardt
Encyonopsis sp. 1
Encyonopsis sp. 2
Gomphonema angustatum (Kützing) Rabenhorst
Gomphonema cf. *aquaemineralis* Kramer et Lange-Bertalot
Gomphonema coronatum Ehrenberg
Gomphonema cf. *globiferum* Ehrenberg
Gomphonema gracile Ehrenberg
Gomphonema gracile var. *lanceolatum* (Kützing) Cleve
Gomphonema hebridense Gregory
Gomphonema cf. *micropus* Kützing
Gomphonema parvulum (Kützing) Kützing
Gomphonema cf. *parvulum* (Kützing) Kützing
Gomphonema cf. *parvulum* var. *exilissimum* Grunow
Gomphonema truncatum Ehrenberg
Gomphonema cf. *utae* Lange-Bertalot et Reichardt
Gomphonema variostriatum Camburn et Charles
Gomphonema sp. 1
Gomphonema sp. 2
Gomphonema sp. 3
Gomphonema sp. 4
Gomphonema sp. 5
Placoneis cf. *lata* (M. Peragallo) R. Lowe
Placoneis sp. 1 *

Order: **Achnanthales**
Achnanthes cf. *alpestris* (Brun) Lange-Bertalot & Metzeltin
Achnanthes altaica (Poretzky) Cleve-Euler
Achnanthes brevipes var. *brevipes* Agardh *
Achnanthes cf. *groenlandica* (Cleve) Grunow *
Achnanthes cf. *kuelbsii* Lange-Bertalot
Achnanthes subsalsa Petersen
Achnanthes cf. *thermalis* (Rabenhorst) Schönfeldt
Achnanthes sp. 1 *
Achnanthes sp. 2 *

Appendix Ib. (continued)

Achnanthes sp. 3 *
Achnanthes sp. 4 *
Achnanthes sp. 5
Achnanthes sp. 6
cf. *Achnanthes* sp. 7
cf. *Achnanthes* sp. 8 *
Achnanthidium minutissimum var. *gracillimum* (Meister) Bukhtiyarova
Achnanthidium minutissimum cf. var. *scoticum* (Carter) H. Cremer
Achnanthidium minutissimum var. 1 (Kützing) Czarnecki
Achnanthidium cf. *subsalsum* (J.B. Petersen) M. Aboal
Achnanthidium sp. 1
Achnanthidium sp. 2
Achnanthidium sp. 3
Cocconeis californica Grunow
Cocconeis costata var. *hexagona* Grunow *
Cocconeis placentula var. *placentula* Ehrenberg
Cocconeis scutellum Ehrenberg *
Cocconeis speciosa Gregory *
Cocconeis stauroneiformis (W. Smith et Rabenhorst) Okuno*
Cocconeis sp. 1 *
Cocconeis sp. 2 *
Cocconeis sp. 3 *
Cocconeis sp. 4 *
Cocconeis sp. 5 *
Cocconeis sp. 6 *
Cocconeis sp. 7 *
Cocconeis sp. 8
Cocconeis sp. 9 *
Cocconeis sp. 10 *
Eucocconeis alpestris (Brun) Lange-Bertalot
Eucocconeis depressa (Cleve) Lange-Bertalot
Eucocconeis flexella (Kützing) Cleve
Eucocconeis cf. *flexella* (Kützing) Cleve
Eucocconeis laevis (Østrup) Lange-Bertalot
Eucocconeis leptostriata Lange-Bertalot
Planothidium delicatulum (Kützing) Round et Bukhtiyarova *
Planothidium cf. *delicatulum* (Kützing) Round et Bukhtiyarova *
Planothidium frequentissimum (Lange-Bertalot) Round et Bukhtiyarova

Appendix Ib. (continued)

Planothidium sp. 1 *
Planothidium sp. 2
Planothidium sp. 3 *
Planothidium sp. 4
Planothidium sp. 5 *
Psammothidium daoense (Lange-Bertalot) Lange-Bertalot
Psammothidium cf. *didymum* (Hustedt) Bukhtiyarova et Round
Psammothidium cf. *grischunum* (Wuthrich) Bukhtiyarova et Round
Psammothidium cf. *helveticum* (Hustedt) Bukhtiyarova et Round
Psammothidium cf. *marginulatum* (Grunow) Bukhtiyarova et Round
Psammothidium cf. *scoticum* (Flower et Jones) Bukhtiyarova et Round
Psammothidium subatomoides (Hustedt) Bukhtiyarova et Round
Psammothidium sp. 1
Psammothidium sp. 3
Psammothidium sp. 5
Psammothidium sp. 6
Psammothidium sp. 4
Rossithidium linearis (W. Smith) Round et Bukhtiyarova
Rossithidium pusillum (Grunow) Round et Bukhtiyarova

Order: **Naviculales**
Berkeleya cf. *obtusa* (Greville) Grunow *
Berkeleya rutilans (Roth) Grunow *
Brachysira brebissonii var. 1 R. Ross
Brachysira brebissonii var. 2 R. Ross
Brachysira brebissonii var. 3 R. Ross
Brachysira folis (Ehrenberg) R. Ross
Brachysira microcephala var. 1 (Grunow) Compère
Brachysira microcephala var. 2 (Grunow) Compère
Brachysira cf. *neoacuta* Lange-Bertalot
Brachysira cf. *neoexilis* Lange-Bertalot
Brachysira cf. *procera* Lange-Bertalot et G. Moser
Brachysira cf. *seipii* var. 1 Lange-Bertalot et G. Moser
Brachysira cf. *seipii* var. 2 Lange-Bertalot et G. Moser
Brachysira serians var. 1 (Brébisson) Round et Mann
Brachysira serians var. 2 (Brébisson) Round et Mann
Brachysira serians var. 3 (Brébisson) Round et Mann
Brachysira styriaca (Grunow) R. Ross

Appendix Ib. (continued)

Brachysira sp. 1
Brachysira sp. 2
Caloneis aerophila Bock
Caloneis amphisbaena (Bory) Cleve
Caloneis cf. *amphisbaena* (Bory) Cleve *
Caloneis bacillum (Grunow) Cleve
Caloneis cf. *bacillum* (Grunow) Cleve
Caloneis crassa (Gregory) R. Ross *
Caloneis lauta Carter
Caloneis silicula (Ehrenberg) Cleve
Caloneis cf. *undulata* (Gregory) Krammer
Caloneis westii (W. Smith) Hendey *
Capartogramma sp. 1
Cavinula cocconeiformis (Greville) Mann et Stickle
Cavinula cf. *jaernefeltii* (Hustedt) Mann et Stickle
Cavinula pseudoscutiformis (Hustedt) Mann et Stickle
Cavinula sp. 1
Chamaepinnularia begeri (Krasske) Lange-Bertalot
Chamaepinnularia mediocris (Krasske) Lange-Bertalot
Chamaepinnularia cf. *mediocris* (Krasske) Lange-Bertalot
Chamaepinnularia cf. *vyvermanii* Lange-Bertalot
Chamaepinnularia sp. 1
Chamaepinnularia sp. 2
Chamaepinnularia sp. 3
Chamaepinnularia sp. 4
Chamaepinnularia sp. 5
Chamaepinnularia sp. 6
Chamaepinnularia sp. 7
Chamaepinnularia sp. 8
Chamaepinnularia sp. 9
Chamaepinnularia sp. 10
Chamaepinnularia sp. 11
Chamaepinnularia sp. 12
Chamaepinnularia sp. 13
Cosmioneis pusilla (W. Smith) Mann et Stickle
Cosmioneis cf. *pusilla* (W. Smith) Mann et Stickle
Craticula acidoclinata Lange-Bertalot et Metzeltin
Craticula sp. 1

Appendix Ib. (continued)

Craticula sp. 2 *
Craticula sp. 3
Decussata placenta (Ehrenberg) Lange-Bertalot
Diadesmis arcuata (Heiden) Lange-Bertalot
Diadesmis arcuatoides Lange-Bertalot
Diadesmis biceps Arnott
Diadesmis brekkaensis (Petersen) Mann
Diadesmis cf. *contenta* (Van Heurck) Mann
Diadesmis fukushimae Lange-Bertalot, M. Werum et A. Broszinski
Diadesmis paracontenta var. *paracontenta* Lange-Bertalot et Werum
Diadesmis cf. *paracontenta* subsp. *magisconcava* Lange-Bertalot
Diploneis interrupta (Kützing) Cleve *
Diploneis sp. 1 *
Diploneis sp. 2
Diploneis sp. 3 *
Diploneis sp. 4
cf. *Entomoneis* sp. 1 *
Fallacia maceria (Schimanski) Lange-Bertalot
Fallacia naumannii (Hustedt) Mann
Fallacia pygmaea (Kützing) Stickle et Mann *
Fallacia vitrea (Østrup) Mann
Fallacia sp. 1 *
Fallacia sp. 2 *
Frustulia cf. *amphipleuroides* (Grunow) Cleve-Euler
Frustulia bahlsii Edlund et Brant
Frustulia crassinervia (Brébisson) Lange-Bertalot et Krammer
Frustulia cf. *crassinervia* (Brébisson) Lange-Bertalot et Krammer
Frustulia creuzburgensis (Krasske) Hustedt
Frustulia cf. *erifuga* Lange-Bertalot et Krammer
Frustulia krammeri Lange-Bertalot et Metzeltin
Frustulia cf. *krammeri* Lange-Bertalot et Metzeltin
Frustulia pseudomagaliesmontana Camburn et Charles
Frustulia saxonica var. 1 Rabenhorst
Frustulia saxonica var. 2 Rabenhorst
Frustulia cf. *saxonica* Rabenhorst
Frustulia undosa Metzeltin et Lange-Bertalot
Frustulia vulgaris (Thwaites) De Toni
Frustulia sp. 1

Appendix Ib. (continued)

Frustulia sp. 2
Frustulia sp. 3
Gyrosigma cf. *balticum* (Ehrenberg) Rabenhorst *
Gyrosigma sp. 1
Haslea spicula (Hickie) Bukhtiyarova *
Hippodonta capitata (Ehrenberg) Lange-Bertalot, Metzeltin et Witkowski
Kobayasiella madumensis (E.G. Jørgensen) Lange-Bertalot
Kobayasiella parasubtilissima (H. Kobayasi et T. Nagumo) Lange-Bertalot
Kobayasiella subtilissima (Cleve) Lange-Bertalot
Kobayasiella sp. 1
Luticola goeppertiana (Bleisch) Mann
Luticola mutica (Kützing) Mann
Mayamaea sp. 1
Microcostatus krasskei (Hustedt) Johansen et J.C. Sray
Microcostatus sp. 1
Navicula cf. *absoluta* Hustedt
Navicula angusta Grunow
Navicula cf. *barberi* Hendey
Navicula cf. *bipustulata* Mann *
Navicula cryptocephala Kützing
Navicula digitatoradiata (Gregory) Ralfs
Navicula cf. *directa* var. *javanica* Cleve *
Navicula exilis Grunow
Navicula gregaria Donkin
Navicula heimansioides Lange-Bertalot
Navicula kefvingensis Ehrenberg *
Navicula leptostriata Jørgensen
Navicula cf. *pagophila* Grunow *
Navicula peregrinopsis Lange-Bertalot et Witkowski *
Navicula rhynchocephala Kützing
Navicula salinarum Grunow
Navicula saxophila W. Bock
Navicula cf. *transitans* Cleve *
Navicula variostriata Krasske
Navicula cf. *variostriata* Krasske
Navicula sp. 1

Appendix Ib. (continued)

Navicula sp. 2
Navicula sp. 3
Navicula sp. 4
Navicula sp. 5 *
Navicula sp. 6 *
Navicula sp. 7 *
Navicula sp. 8
Navicula sp. 9 *
Navicula sp. 10
Navicula sp. 11
Navicula sp. 12
Navicula sp. 13
Navicula sp. 14 *
Navicula sp. 15
Navicula sp. 16
Navicula sp. 17
Navicula sp. 18
Navicula sp. 19
Navicula sp. 20
Navicula sp. 21 *
Navicula sp. 22 *
Navicula sp. 23
Navicula sp. 24 *
Navicula sp. 25
Neidium cf. *affine* var. *bonsaensis* Foged
Neidium cf. *affine* var. *constricta* Frenguelli
Neidium affine var. *longiceps* (Gregory) Cleve
Neidium cf. *affine* var. *longiceps* (Gregory) Cleve
Neidium cf. *alpinum* Hustedt
Neidium amphigomphus (Ehrenberg) Pfitzer
Neidium apiculatum Reimer
Neidium bisulcatum (Lagerstedt) Cleve
Neidium cf. *bisulcatum* (Lagerstedt) Cleve
Neidium bisulcatum var. *subundulatum* (Grunow) Reimer
Neidium cf. *boyeri* Reimer
Neidium hitchcockii (Ehrenberg) Cleve
Neidium iridis (Ehrenberg) Cleve
Neidium cf. *iridis* (Ehrenberg) Cleve

Appendix Ib. (continued)

Neidium cf. *productum* (W. Smith) Cleve
Neidium sp. 1
Neidium sp. 2
Neidium sp. 3
Neidium sp. 4
Neidium sp. 5
Neidium sp. 6
Neidium sp. 7
Oestrupia sp. 1 *
Parlibellus sp. 1 *
Petroneis marina (Ralfs) Mann *
Pinnuavis sp. 1
Pinnularia aestuarii Cleve *
Pinnularia angusta Cleve-Euler
Pinnularia appendiculata var. *amaniana* Krammer
Pinnularia cf. *biceps* Gregory
Pinnularia borealis Ehrenberg
Pinnularia cruxacea Krammer
Pinnularia divergentissima var. *subrostrata* Cleve
Pinnularia gibbiformis Krammer
Pinnularia cf. *gibbiformis* Krammer
Pinnularia globiceps Gregory
Pinnularia ignobilis (Krasske) Cleve-Euler
Pinnularia lata (Brébisson) W. Smith
Pinnularia latevittata Cleve
Pinnularia cf. *lenticula* Cleve-Euler
Pinnularia macilenta (Ehrenberg) Ehrenberg
Pinnularia cf. *mesolepta* (Ehrenberg) W. Smith
Pinnularia cf. *microstauron* (Ehrenberg) Cleve
Pinnularia neomajor Krammer
Pinnularia cf. *neomajor* var. 1 Krammer
Pinnularia cf. *parallela* Brun
Pinnularia podzorskii Krammer
Pinnularia polyonca (Brébisson) W. Smith
Pinnularia subcapitata var. 1 Gregory
Pinnularia subcapitata var. 2 Gregory
Pinnularia subcapitata var. 3 Gregory
Pinnularia cf. *subrostrata* (Cleve) Cleve-Euler

Appendix Ib. (continued)

Pinnularia undula var. *cuneata* (Hustedt) Krammer
Pinnularia viridiformis Krammer
Pinnularia cf. *viridiformis* Krammer
Pinnularia sp. 1
Pinnularia sp. 2
Pinnularia sp. 3
Pinnularia sp. 4
Pinnularia sp. 5
Pinnularia sp. 6
Pinnularia sp. 7
Pinnularia sp. 8
Pinnularia sp. 9
Pinnularia sp. 10
Pinnularia sp. 11
Pinnularia sp. 12
Pinnularia sp. 13
Pinnularia sp. 14
Pinnularia sp. 15
Pinnularia sp. 16
Pinnularia sp. 17
Pinnularia sp. 18
Pinnularia sp. 19
Pinnularia sp. 20
Pinnularia sp. 21
Pinnularia sp. 22
Pinnularia sp. 23
Pinnularia sp. 24
Pinnularia sp. 25
Pinnularia sp. 26
Pinnularia sp. 27
Pinnularia sp. 28
Pinnularia sp. 29
Pinnularia sp. 30
Pinnularia sp. 31
Pinnularia sp. 32
Pinnularia sp. 33
Pinnularia sp. 34
Plagiotropis cf. *lata* (Cleve) Kuntze *

Appendix Ib. (continued)

Plagiotropis sp. 1 *
Plagiotropis sp. 2 *
Plagiotropis sp. 3 *
Pleurosigma cf. *salinarum* (Grunow) Grunow *
Pleurosigma sp. 1 *
Pleurosigma sp. 2 *
Sellaphora alastos (Hohn et Hellerman) Lange-Bertalot et Metzeltin
Sellaphora parapupula Lange-Bertalot
Sellaphora cf. *parapupula* Lange-Bertalot
Sellaphora pupula (Kützing) Mereschkowsky
Sellaphora cf. *pupula* (Kützing) Mereschkowsky
Sellaphora sp. 1
Sellaphora sp. 2
Sellaphora sp. 3
Stauroneis gracilis Ehrenberg
Stauroneis cf. *jarensis* Lange-Bertalot, Cavacini, Tagliaventi et Alfinito
Stauroneis lineolata Ehrenberg
Stauroneis neofossilis Lange-Bertalot et Metzeltin
Stauroneis cf. *nobilis* var. *baconiana* (Stodder) Reimer
Stauroneis phoenicenteron (Nitzsch) Ehrenberg
Stauroneis cf. *phoenicenteron* (Nitzsch) Ehrenberg
Stauroneis cf. *producta* Grunow
Stauroneis siberica (Grunow) Lange-Bertalot et Krammer
Stauroneis smithii group Grunow
Stauroneis staurolineata Reimer
Stauroneis thermicola (Petersen) Lund
Stauroneis wislouchii Poretzky et Anissimova
Stauroneis sp. 1
Stauroneis sp. 2
Stauroneis sp. 3
Stauroneis sp. 4
Stauroneis sp. 5
Stauroneis sp. 6
Stauroneis sp. 7
Stauroneis sp. 8

Appendix Ib. (continued)

Order: **Thalassiophysales**
Amphora cf. *caroliniana* Giffen *
Amphora laevissima Gregory *
Amphora lybica Ehrenberg
Amphora cf. *ostrearia* Kützing *
Amphora sp. 1 *
Amphora sp. 2 *
Amphora sp. 3
Amphora sp. 4
Amphora sp. 5 *
Amphora sp. 6 *
Amphora sp. 7 *
Amphora sp. 8 *
Amphora sp. 9 *
Amphora sp. 10 *
Amphora sp. 11 *
Halamphora cf. *acutiuscula* (Kützing) Z. Levkov
Halamphora coffeaeformis (Agardh) Z. Levkov

Order: **Bacillariales**
Denticula sp. 1 *
Hantzschia amphioxys (Ehrenberg) Grunow
Hantzschia sp. 1 *
Hantzschia sp. 2 *
Nitzschia aerophila Hustedt
Nitzschia angularis W. Smith
Nitzschia angustata (W. Smith) Grunow
Nitzschia cf. *bremensis* Hustedt
Nitzschia brevissima Grunow *
Nitzschia clausii Hantzsch
Nitzschia fonticola Grunow
Nitzschia graciliformis Lange-Bertalot et Simonsen
Nitzschia gracilis Hantzsch
Nitzschia incognita Leger et Krasske
Nitzschia cf. *intermedia* Cleve et Grunow
Nitzschia nana Grunow
Nitzschia obtusa W. Smith
Nitzschia cf. *palea* var. *debilis* (Kützing) Grunow

Appendix Ib. (continued)

Nitzschia cf. *paleaeformis* Hustedt
Nitzschia perminuta var. 1 (Grunow) M. Peragallo
Nitzschia perminuta var. 2 (Grunow) M. Peragallo
Nitzschia prolongata Hustedt
Nitzschia cf. *pseudofonticola* Hustedt
Nitzschia cf. *rosenstockii* Lange-Bertalot *
Nitzschia cf. *subtilis* Grunow
Nitzschia terrestris (Petersen) Hustedt
Nitzschia valdestriata Aleem etHustedt *
Nitzschia wuellerstoffii Lange-Bertalot
Nitzschia sp. 1
Nitzschia sp. 2
Nitzschia sp. 3
Nitzschia sp. 4 *
Nitzschia sp. 5
Nitzschia sp. 6
Nitzschia sp. 7
Nitzschia sp. 8
Nitzschia sp. 9
Nitzschia sp. 10
Nitzschia sp. 11 *
Nitzschia sp. 12
Nitzschia sp. 13
Nitzschia sp. 14
Nitzschia sp. 15 *
Tryblionella debilis (Arnott) Grunow *
Tryblionella plana (W. Smith) Pelletan
Tryblionella scalaris (Ehrenberg) Siver et Hamilton
Tryblionella sp. 1

Order: **Rhopalodiales**
Rhopalodia acuminata Krammer *
Rhopalodia brebissonii Krammer *
Rhopalodia supresemicirculata (Krasske) Krammer *

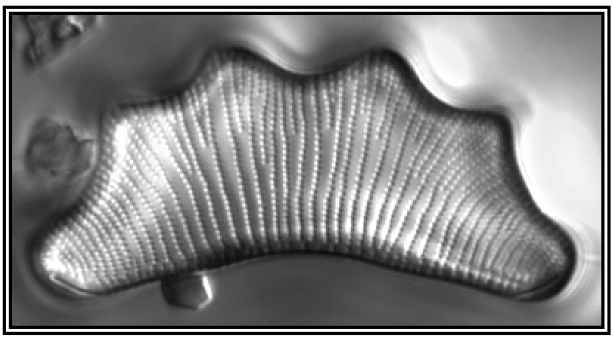
Appendix Ib. (continued)

Order: **Surirellales**
Entomoneis cf. *alata* Ehrenberg *
Entomoneis sp. 1 *
Stenopterobia anceps (Lewis) Van Heurck
Stenopterobia curvula (W. Smith) Krammer
Stenopterobia delicatissima (Lewis) Van Heurck
Stenopterobia cf. *densestriata* (Hustedt) Krammer
Stenopterobia gracilis P. Siver et L. Camfield
Surirella abies Cleve-Euler
Surirella amphioxys W. Smith
Surirella angusta Kützing
Surirella cf. *bifrons* Ehrenberg
Surirella biseriata Brébisson
Surirella brebissonii Brébisson *
Surirella cruciata A.W.F. Schmidt
Surirella cf. *linearis* W. Smith
Surirella linearis var. *constricta* Grunow
Surirella minuta Brébisson
Surirella cf. *tenera* Gregory
Surirella terryi W.A. Terry

Note: Less species is expected to remain unidentified when species-rich genera, such as *Navicula*, *Pinnularia* and *Nitzschia*, are more closely studied. Genera containing typically species of small sizes, such as *Psammothidium* and *Chamaepinnularia*, need to be observed using SEM for further taxonomical treatment.

Appendix II. Numbers of observed diatom genera and species within each systematic group (order or class) from freshwater and brackish sites of Acadia National Park, Maine, USA (G = genus, S = species).

Class/Subclass/Order	Freshwater & brackish		Freshwater		Exclusively brackish	
	G	S	G	S	G	S
COSCINODISCOPHYCEAE	**14**	**32**	**6**	**17**	**8**	**15**
THALASSIOSIROPHYCIDAE						
Thalassiosirales	4	13	4	7	0	6
COSCINODISCOPHYCIDAE						
Melosirales	2	2	0	0	2	2
Paraliales	1	1	0	0	1	1
Aulacoseirales	1	8	1	8	0	0
Coscinodiscales	3	4	0	0	3	4
BIDDULPHIOPHYCIDAE						
Triceratiales	1	1	0	0	1	1
RHIZOSOLENIOPHYCIDAE						
Rhizosoleniales	1	2	1	2	0	0
CHAETOCEROTOPHYCIDAE						
Chaetocerales	1	1	0	0	1	1
FRAGILARIOPHYCEAE	**17**	**72**	**13**	**53**	**4**	**19**
FRAGILARIOPHYCIDAE						
Fragilariales	14	59	12	43	2	16
Tabellariales	1	10	1	10	0	0
Licmophorales	2	3	0	0	2	3
BACILLARIOPHYCEAE	**61**	**570**	**48**	**473**	**13**	**97**
EUNOTIOPHYCIDAE						
Eunotiales	4	88	4	88	0	0
BACILLARIOPHYCIDAE						
Mastogloiales	1	2	0	0	1	2
Cymbellales	7	50	6	48	1	2
Achnanthales	7	66	7	41	0	25
Naviculales	32	278	24	238	8	40
Thalassiophysales	2	17	2	5	0	12
Bacillariales	4	47	3	37	1	10
Rhopalodiales	1	3	0	0	1	3
Surirellales	3	19	2	16	1	3
Total number of diatom taxa	**92**	**674**	**67**	**543**	**25**	**131**



I.
The algal flora of Acadia National Park, Maine

Northeastern Naturalist 18, 457–474

The algal flora of Acadia National Park, Maine

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ABSTRACT

The inland algal flora of Acadia National Park was studied based on over 200 samples from 119 localities. A total of 160 algal genera were found, representing 12 algal phyla. Among these were 140 new generic records for the Park. The most frequently encountered taxa were desmids and diatoms, and the genera and species in these groups were acidophilous, reflecting the low pH of the ponds, lakes, and streams of the Park. Ponds and streams were the most heavily sampled habitats in the Park, and coincidentally had the highest diversity (103 and 91 genera, respectively). Based on other similar studies, we estimate that the Park likely contains as many as 1000 algal species within its boundaries, indicating that the diversity is exceptionally high for an area of this size.

INTRODUCTION

Acadia National Park is located on the Atlantic coast of Maine and was established 90 years ago as the first national park east of the Mississippi (Tree and Oxnard 2003). It is composed of Mount Desert Island (MDI),

Park for use of researcher housing during the collection effort. The Humboldt Research Institute at Eagle Hill also provided some travel support to the authors in conjunction with a seminar taught at the institute concurrently with collection efforts. Markéta Krautová and Jan Pilný assisted in field collections.

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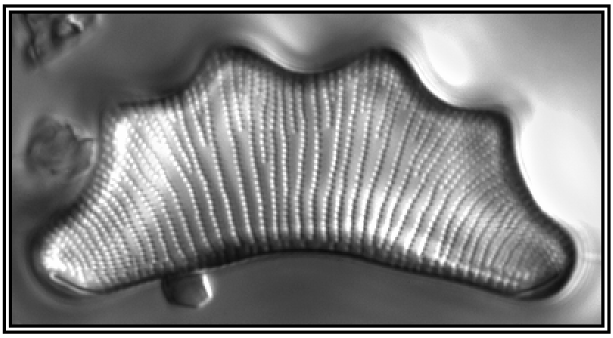

II.

Three new *Eunotia* (Bacillariophyta) species from Acadia National Park, Maine, USA

Phytotaxa (submitted)

Three new *Eunotia* (Bacillariophyta) species from Acadia National Park, Maine, USA

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ABSTRACT

Three new species in the diatom genus *Eunotia* were found in the freshwater ponds and streams of Acadia National Park, Maine, USA. *Eunotia novaeangliae sp. nov.* belongs to the *E. incisa* group, species with nose-like apices and terminal raphe fissures distant from the ends. It is most similar to *E. tenelloides* in that species cluster. *Eunotia panda sp. nov.* is in the *E. bilunaris* group, species with slight even curvature and smooth margins of the valves. *Eunotia spatulata sp. nov.* is most similar to *E. eurycephala*, but differs from that taxon by having straighter and significantly larger valves with more swollen apices. All three taxa were sufficiently abundant in the samples collected from the park that they could be found in both SEM and LM microscopes. *Eunotia novaeangliae* and *E. panda* have both been illustrated in other publications before but not named. All three species occurred in waters of low conductivity and pH, typical for the genus. Acadia National Park appears to be a hotspot for *Eunotia* species diversity, and further study of the oligotrophic waters of this site is certainly warranted.

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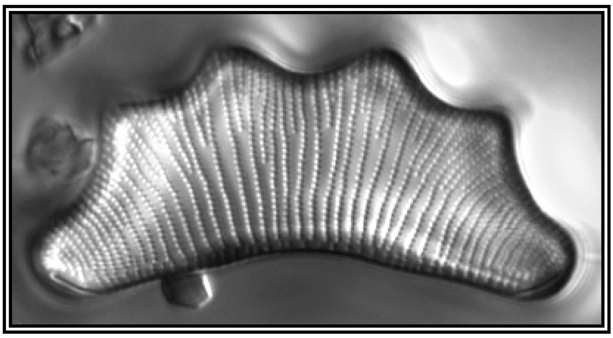

III.

Surirella terryi and *S. cruciata*: two rare diatoms from North America

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Surirella terryi and *S. cruciata*: two rare diatoms from North America

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ABSTRACT

Surirella cruciata A. Schmidt and *S. terryi* Terry are rare and poorly known diatom species originally described from North America and previously illustrated only by drawings. The goal of this study was to examine and document the morphology and distribution of these species. First photographs designating the lectotype of *S. terryi* and the neo- and epitypes of *S. cruciata* are presented. Our revision of the distribution records shows that both species are found mostly along the east coast of the USA with a main occurrence in the New England states, while records from outside North America were not confirmed. *Surirella terryi* and *S. cruciata* sometimes co-occur, although *S. terryi* is a strictly freshwater species, while *S. cruciata* tolerates wider range of salinities from strictly fresh to brackish waters.

from the Hustedt Collection, and Bart Van de Vijver provided photos of *S. terryi* from Beattie Pond, Connecticut, in the Van Heurck Collection.

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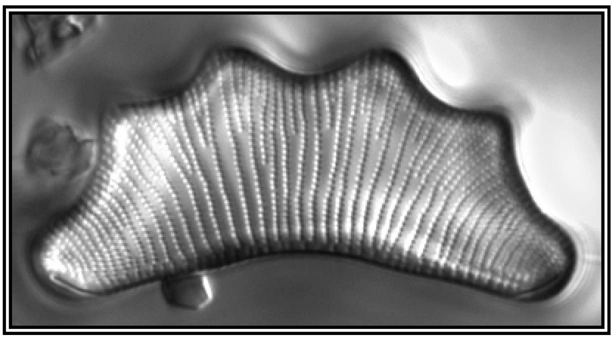

General Conclusions

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The general objective of this study was to document a complete diatom flora of Acadia National Park. This goal was, for now, fulfilled by presenting a list of encountered species in **Apendix I**. In total, 674 species in 92 genera have been observed within freshwater and brackish samples collected in the park, with only 25 genera and 131 species restricted to marine habitats (thus, giving 67 freshwater genera with 543 species, **Appendix II**). It is worth noticing here that many listed taxa remained unnamed. This was primarily caused by the convention that no names should be "force-fitted" on encountered diatom taxa, when a confident taxonomical identification could not be done. Species from 20 orders of centric, araphid and raphid diatoms were observed in this study, with the largest number of genera present in orders Naviculales, Fragilariales and Achnanthales. These three orders, however, contained the highest (even though not significant) numbers of encountered brackish taxa. Noticeably, the order Naviculales itself comprised nearly half of the documented freshwater species. Similarly, the top five most species-rich genera included over 40 % of encountered taxa. Those most species-rich genera were: *Eunotia* (84 taxa), *Pinnularia* (63 taxa), *Navicula* (45 taxa), *Neidium* (22 taxa) and *Stauroneis* (21 taxa, **Appendix I**). In fact, the richness of species in *Eunotia* is not entirely surprising, given the acidic and low-conductivity character of freshwater habitats within the park (Vaccarino et al. 2011 – **Paper I**), as this genus is typically found in those kinds of habitats. Given the fairly large numbers of encountered species and varieties within the above mentioned five genera themselves, it is clear that each of those genera would deserve special attention.

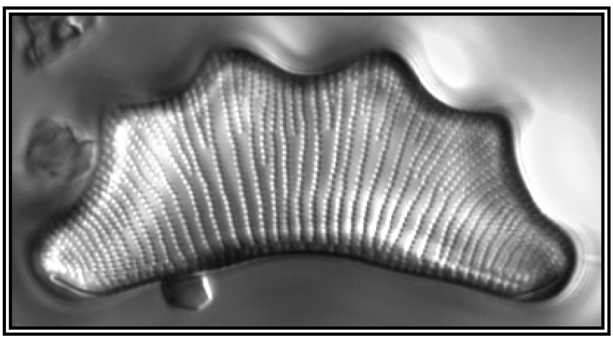
Eunotia has indeed been studied in closer detail before and yielded almost half of the encountered 77 taxa without names (Veselá 2010). As originally aimed, a corrected list of observed *Eunotia* species from that study has been prepared and is included as a part of **Appendix Ib.** It was found that 10 of the 33 unnamed species and varieties of *Eunotia* previously found within Acadia National Park have been described in publications within last four years (labeled in **Appendix Ib**). After this thorough research of recent literature, several Acadian *Eunotia* species still remained without names. Thanks to sufficient abundances in samples from the park, it was possible after all to describe three of the remaining unnamed species of *Eunotia*. Thus, *Eunotia novaeangliae* nom. prov., *E. panda* nom. prov., and *E. spatulata* nom. prov. have been proposed by using the previously described pluralistic approach (Veselá & Johansen, submitted – **Paper II**). Several of the remaining unnamed taxa from Acadia NP will be possibly be described in the future (by us or someone else), if sufficient populations are observed. Moreover, a separate publication documenting the genus *Eunotia* within the series *Bibliotheca Diatomologica* is planned to be prepared in the near future.

Overall, Acadia National Park proved to accommodate a noticeably large number of diatom species (Veselá 2010, Vaccarino et al. 2011 – **Paper I**, Veselá & Johansen, submitted – **Paper II**), including a number of new, rare and forgotten species from North America and the Holarctic. For example, *Eunotia novaeangliae* nom. prov. (Veselá & Johansen, submitted – **Paper II**) has apparently been seen by other authors before in samples collected in and around New England, USA, and Nova Scotia, Canada. However, it has probably never been present in such quantities, so that it would be clear, that this form is actually a well recognized species. This became obvious from studying samples from Acadia National Park, where *E. novaeangliae* nom. prov. was quite common (Veselá & Johansen, submitted – **Paper II**). A similar scenario will likely be experienced with of other taxa observed in the park. For example, this is likely the case of a distinct, although unnamed, *Peronia* species observed quite frequently in the park (unpublished data). This taxon has been reported by other authors, under the most commonly reported name, *Peronia fibula* (Brébisson) Ross, in samples from North

America, although, up to know, nobody seemed to discover a sufficient population so that they would recognize it as new to science.

Similarly, two very distinct *Surirella* species, *S. terryi* and *S. cruciata*, have been encountered several times within Acadia National Park. These two, quite large, *Surirella* species have not been documented anywhere in the commonly available taxonomic literature, and were nearly described as new to science by us. However, their names have finally been discovered (by accident) and their identities have been examined in detail, using the pluralistic approach including designation of types (Veselá et al. 2013 – **Paper III**). Identically, an interesting form of *Tabellaria* has been encountered in a single lake within Acadia National Park, which did not conform to any taxon documented in the commonly accessible diatom literature. By studying the whole genus in detail, it was found, that the variety *Tabellaria fenestrata* var. *asterionelloides* Grunow, which has also hardly been reported since the date of its description in 1881, seems to fit the taxon observed by us (unpublished data). In my opinion, we will encounter such situations much more often in the future, especially in the areas outside of Europe.

At last, all the hitherto acquired results suggest that Acadia National Park seems to be a diatom hot-spot, which has been providing, despite its small area, suitable conditions for survival and coexistence of many diatom species. Many of those diatoms have not been seen by scientists yet, or (due to various factors) occur extremely rarely, or have disappeared from the surrounding areas likely with the loss of clean and undisturbed habitats. Consequently, this park is indeed especially worthy of further study and strict protection for future generations.



Curriculum vitae

Curriculum vitae

PERSONAL DATA

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EDUCATION

2003–2007	Bachelor study in biology; Faculty of Biological Sciences, University of South Bohemia in České Budějovice, Czech Republic
	Bc. Thesis – Diverzita sinic a řas Vodárenského a Řasového potoka na ostrově Jamese Rosse, Antarktida. [Diversity and ecology of cyanobacteria and algae in Water-supply and Algal Creek on James Ross Island, Antarctica.]
2007–2009	Master study in biology; Department of Biology, John Carroll University, University Heights, Ohio, USA
	MSc. Thesis – The diatoms of Acadia National Park, Maine, with a detailed account of the Eunotiophycidae.
2007–2010	Master study in botany; Faculty of Science, University of South Bohemia in České Budějovice, Czech Republic
2011	Rigorous exam; Faculty of Science, University of South Bohemia in České Budějovice, Czech Republic
	RNDr. Thesis – The algal flora of Acadia National Park, Maine.
since 2009	Doctoral study in algology; Faculty of Science, University of South Bohemia in České Budějovice, Czech Republic

	Ph.D. Thesis – Diatoms of Acadia National Park, Maine, USA, with a detailed account on taxonomy and morphology of several remarkable species.

TEACHING ACTIVITIES

2007–2008	Principles of Biology I. and II. Practices (Graduate Assistant, John Carroll University)
2008–2009	Microbiology Practices (Graduate Assistant, John Carroll University)
2009	Algae as Bioindicators (Graduate Assistant, John Carroll University)
2010	Field course for freshmen, algology (Faculty of Science, University of South Bohemia)
2011	Practices in Phycology (Faculty of Science, University of South Bohemia)
2012, 2013	Assisting instructor in Marine biology field course (Faculty of Science, University of South Bohemia)
2013	Workshop in phycology at Lake Atitlán, Guatemala

EMPLOYMENT

2007–2009	Department of Biology, John Carroll University, University Heights, Ohio, USA (Graduate assistant)
since 2012	Faculty of Science, University of South Bohemia in České Budějovice: KONTAKT II/ AMVIS LH 12100 grant project "Diversity of cyanobacteria from tropical and subtropical regions." (Laboratory assistant)
since 2014	Institute of parasitology, Biology Centre, ASCR, v.v.i. (Researcher)

Training abroad

2010 Research stay at John Carroll University, University Heights, Ohio, USA (supervisor: prof. Jeffrey R. Johansen)

2011, 2012 McHenry Fellowship, Diatom Herbarium at the Academy of Natural Sciences of Philadelphia, PA, USA (supervisor: Dr. Marina Potapova)

2013 ERASMUS research stay at University of Antwerp, Belgium and National Botanic Garden of Belgium (supervisor: prof. Bart Van de Vijver)

Publications

In peer-reviewed scientific journals

Vaccarino, M.A., Veselá, J. & Johansen, J.R. (2011) The algal flora of Acadia National Park, Maine, U.S.A. *Northeastern Naturalist* 18: 457–474.

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2007 Veselá, J., Johansen, J.R. & Elster, J.: Floristic study of freshwater diatoms of northern James Ross Island, Antarctica. 19th North American Diatom Symposium, Douglas Lake, Michigan, USA (poster).

2011 Veselá, J.: The diatoms of Acadia National Park, Maine, USA, with a detailed account of the Eunotiophycidae. 5th Central European Diatom Meeting, Uniwersytet Szczeciński, Szczecin, Poland (poster).

2011 Veselá, J. & Johansen, J.R.: An attempt to revise the genus *Peronia* Bréb. et Atn. ex Kitton with possibly two new species. 21st North American Diatom Symposium, Flathead Lake Biological Station, Polson, Montana, USA (talk).

2012 Veselá, J. & Johansen, J.R.: Two rare *Surirella* species from Northeastern U.S. 6th Central European Diatom Meeting, Universität Innsbruck, Innsbruck, Austria (poster).

2012 Veselá, J. & Johansen, J.R.: Genus *Peronia* Bréb. et Arn. ex Kitton, with two species new to science. 22nd Internation Diatom Symposium, Ghent, Belgium (poster).

2013 Veselá, J.: Diatoms of Acadia National Park, Maine, USA: Another North American diatom hotspot? Nederlands-Vlaamse Kring van Diatomisten, Overasselt, Netherlands (talk).

2013 Veselá, J., Van de Vijver, B., Wetzel, C.E. & Ector, L.: Have you already seen *Caponea caribbea* Podzorski? Morphological observations on a structurally unique diatom from the Caribbean Region. 22nd North American Diatom Symposium, Bar Harbor, Maine, USA (poster).

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