THE DIFFERENCE DOTUS MAKES

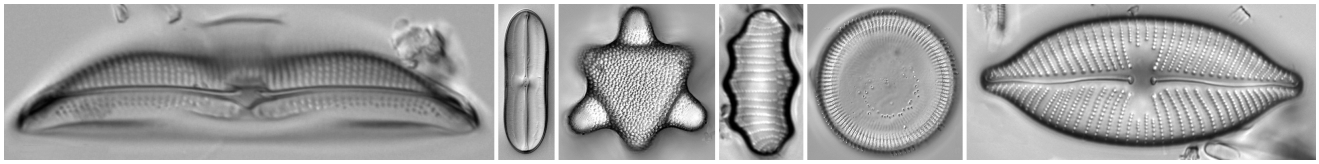
Final Project Report (EPA/GLEC #13434) by Mark Edlund & David Burge - St. Croix Watershed Research Station

November 2017

DOTUS

St.Croix Watershed Research Station

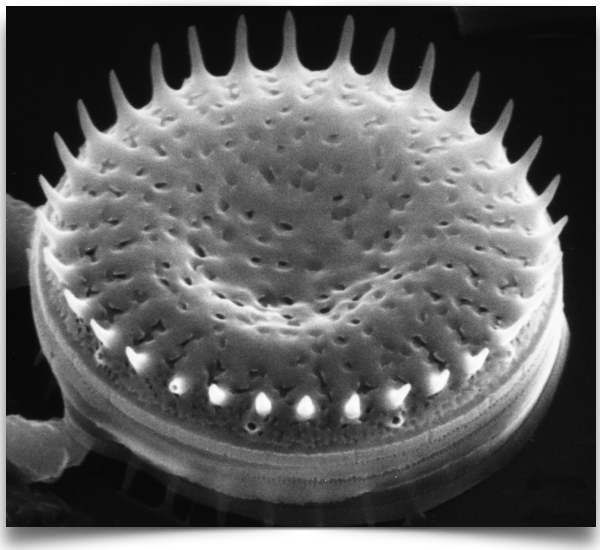
Science Museum of Minnesota



DOTUS

During 2016-2017 the US Environmental Protection Agency Office of Water supported (through GLEC PO#13434) development of 50 species pages for DOTUS—the Diatoms of the United States. DOTUS is tasked with documenting diatom diversity in North America in a web-based tool whose content comes from the community of users. Importantly, DOTUS seeks to provide the content necessary to confidently identify diatoms and ensure consistent taxonomy. Dr. Mark Edlund, Senior Scientist at the St. Croix Watershed Research Station, and David Burge, PhD student at the University of Minnesota, led the development of new content for DOTUS using collaboration, collections, and a newly engaged citizenry.

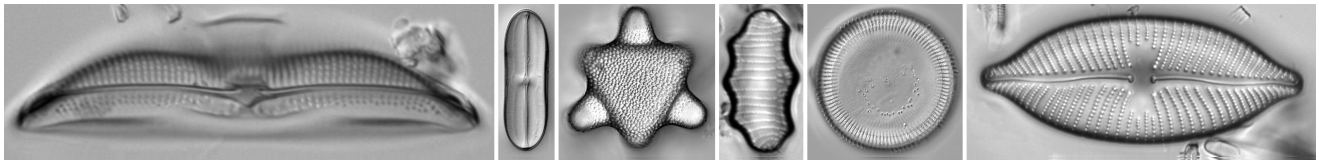
DOTUS = DIATOMS



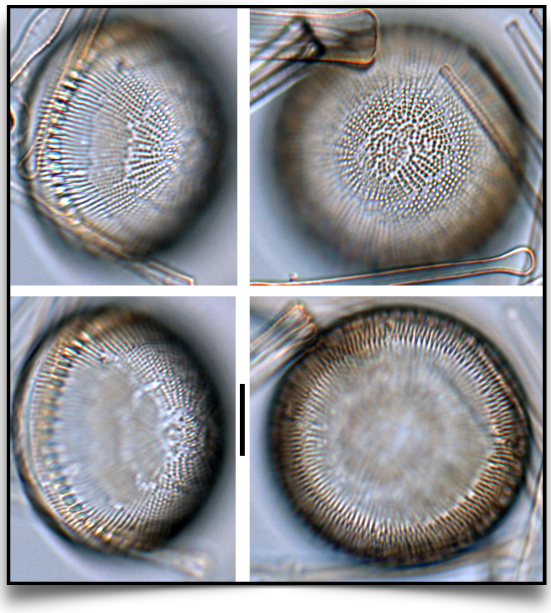
Diatoms are the most diverse group of algae, form the base of most aquatic foodwebs, and produce more than 20% of the earth's oxygen. If that is not enough, diatoms are also some of the most important indicator organisms used in water quality monitoring of streams and lakes and for paleoecology. For monitoring, scientists leverage the diatom's ability to grow in just about every aquatic habit, their rapid growth rate and response to environmental change, and their beautifully ornamented cell walls made of resistant biologically produced glass that have all the characters needed to identify each diatom to the species-level.

DOTUS = RIGOROUS SCIENCE

DOTUS works. As we close in on our 900th species page, DOTUS has received over 3.3 million page views. Each DOTUS page documents, describes, distinguishes, and differentiates each diatom taxon. Contributors carefully document a size series, the



ecology, and the history of each species using curated North American material. Measurements of specimens provide the data used to write a detailed description. Key distinguishing features are highlighted on every species page, and the information needed to differentiate the species from other closely related taxa allows a user to quickly reach a confident identification. Importantly, DOTUS pages are not just one person's taxonomic opinion. All pages go through a rigorous peer review process to ensure that the goals of DOTUS are being met—to provide content so users can confidently identify diatoms and ensure consistent taxonomy in research and monitoring.

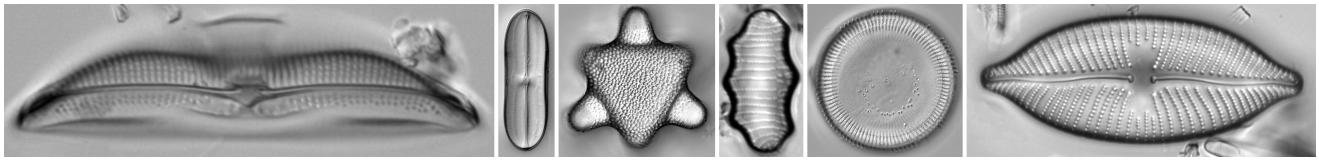


DOTUS = CITIZEN SCIENCE

Scientific rigor does not have to be limited to the lab, everyone can do science! To prove it, we engaged citizen scientists to help construct DOTUS pages using a unique opportunity through the Science Museum of Minnesota (SMM). SMM opens its research areas to the public several times a year, *Members Behind the Scenes*, and the SCWRS lets kids have the experience of viewing the micro-world through research grade microscopes. At one of these events, Mark Edlund drafted citizen scientists from age 5-16 to locate and measure specimens of *Lindavia bodanica* and *Hannaea superiorensis* and used kids' images and measurements to construct new DOTUS pages. The pages our newest scientists help create were public within a few days of the event!

DOTUS = COLLABORATIVE SCIENCE

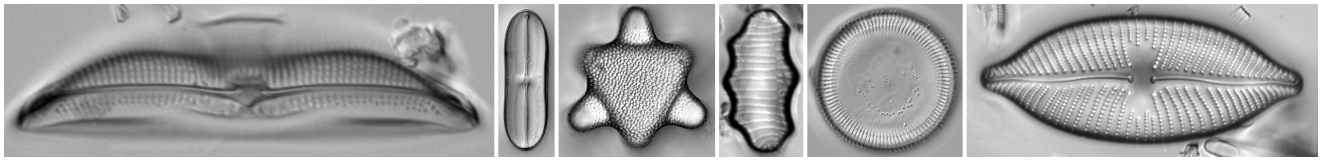
Diatomists, like diatoms, have their specialty niches. A community of diatomists contributes DOTUS content, and to complete 50 pages we needed to collaborate. DOTUS contributors Ian Bishop, Elizabeth Alexson, Shelly Wu, and Lynn Brant provided needed expertise and material. In addition to the scope lab at the SCWRS, research facilities at St. Cloud State University, the Institute for Arctic and Alpine Research (INSTAAR), and the



Iowa Lakeside Laboratory were used. Curated collections were accessed from herbaria at the SCWRS, INSTAAR, Iowa Lakeside Laboratory, and the Academy of Natural Sciences in Philadelphia from projects funded by the U.S. EPA, the U.S. Geological Survey, the State of Minnesota, and the National Park Service.

DOTUS = RESEARCH

DOTUS species pages both communicate research and translate to research. In the process of completing 50 pages, three papers were published to correct nomenclatural and taxonomic issues that came to light during species page preparation—issues that had to be corrected before species pages could go public. The journal, *Notulae Algarum*, an electronic journal focused on rectifying nomenclatural issues among algae and designed for rapid publication, was the perfect outlet for these works (Daniels et al. 2016, Edlund et al. 2017, Rarick et al. (2017). One of these publications resulted from collaboration of an undergraduate, teaching assistant, and faculty from the Iowa Lakeside Laboratory *Systematics and Ecology of Diatoms* course.



DOTUS FUNDING = RESULTS

Over 50 species pages were added to the DOTUS site with this funding. Species targeted were from difficult complexes encountered in federal monitoring projects (*Sellaphora* species), ecologically important groups (plankton including *Stephanodiscus* species, *Lindavia* species), and genera that had little or no previous content on DOTUS (*Fragilariforma*, *Semiorbis*, *Melosira*, *Oxyneis*, *Acanthoceras*, *Chaetoceras*). Other results including three peer-reviewed publications, outreach events, training, and DOTUS in the news.

Acanthoceras zachariasii	*Lacustriella lacustris*	*Placoneis explanata*
Amphora calumetica	*Lindavia bodanica*	*Sellaphora auldreekie*
Asterionella ralfsii v. americana	*Lindavia comensis*	*Sellaphora fusticulus*
Aulacoseira islandica	*Lindavia delicatula*	*Sellaphora laevissima*
Biremis undulata	*Lindavia eriensis*	*Sellaphora moesta*
Chaetoceros elmorei	*Lindavia michiganiana*	*Semiorbis catellifera*
Cyclotella quillensis	*Lindavia ocellata*	*Semiorbis rotundus*
Eunotia bidentula	*Luticola frenguellii*	*Stauroneis bovbjergii*
Eunotia charliereimeri	*Luticola ignorata*	*Staurosirella berolinensis*
Eunotia eruca	*Melosira dickiei*	*Staurosirella berolinensis*
Eunotia sarraceniae	*Melosira undulata v. normanii*	*Stephanodiscus binderanus*
Eunotia tauntoniensis	*Neidium sacoense*	*Stephanodiscus hantzschii*
Eunotia zazuminensis	*Orthoseira roeseana*	*Stephanodiscus hantzschii f. tenuis*
Fragilariforma constricta	*Oxyneis binalis*	*Stephanodiscus minutulus*
Fragilariforma polygonata	*Oxyneis binalis var. elliptica*	*Stephanodiscus parvus*
Hannaea superiorensis	*Pinnularia turfosifila*	*Ulnaria acus*
Hydrosera whampoensis	*Placoneis amphibola*	*Ulnaria delicatissima*

DOTUS in the news

https://www.smm.org/scwrs/fieldnotes/station-science-spotlight-behind-scenes
https://westerndiatoms.colorado.edu/about/news_story/3238/citizen_scientists_lend_a_hand
https://westerndiatoms.colorado.edu/about/news_story/3247/the_gomphonema_round_up_taxon_workshop
https://westerndiatoms.colorado.edu/about/project/3343/ecology_and_systematics_of_diatoms_course_2017
https://westerndiatoms.colorado.edu/about/project/3151/ecology_and_systematics_of_diatoms_course_2016

PUBLICATIONS

Rarick, J., Wu, S., Lee, S.S. and Edlund, M.B. 2017. The valid transfer of *Stauroneis goeppertiana* to *Luticola* (Bacillariophyceae). *Notulae Algarum* 29: 1-3.

Edlund, M.B., Burge, D.R.L., Spaulding, S.A. 2017. The transfer of *Navicula cuspidata* var. *obtusa* to *Craticula* (Bacillariophyceae). *Notulae Algarum* No. 19: 1-2.

Daniels, W.C., Novis, P.M. and Edlund M.B. 2016. The valid transfer of *Cyclotella bodanica* var. *intermedia* to *Lindavia* (Bacillariophyceae). *Notulae algarum* No. 14: 1-3.

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