

Desmids of selected New England ponds – a comparison to historical data

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2019 Les Mehrhoff Botanical Research Award Final Report

Background

The charismatic desmids belong to the green algal class Zygnemophyceae, the likely closest living relatives to land plants (Timme et al. 2012). They are known for their intricate cell shapes, which usually are symmetrical, composed of two semicells, and often with an ornamented surface. This morphological diversity has allowed for delimitation of over 5,000 desmid species.

Desmids are typical inhabitants of oligo, meso- or dystrophic water bodies and bogs, and while they rarely occur in great abundances, many species can co-occur even in a small pond or wetland (e.g., Fučíková et al. 2015). Because of this morphological variety, species-richness and ecological specificity, desmids have been suggested as biological indicators of water and habitat quality (Coesel 2001).

Study Sites

Pudding Pond (PP) is found in the Green Hills Preserve, a NH Nature Conservancy property between Conway and North Conway. This 22-acre water body stretches north to south along the railway and North South Rd. The pond was visited by G. M. Allen in the early 1900's and the desmids from this single collection were reported by J. A. Cushman (1905). Cushman marveled that Pudding Pond flora accounted for half of his New Hampshire desmid list. Today, Pudding Pond is still easy to find and access, and remains relatively undisturbed. Hawley Bog (HB) is a near-pristine bog near Charlemont, MA, also under the stewardship of the Nature Conservancy. A number of desmid species had been reported from HB by Webber (1967). Carver Pond (CP) is located in a public park near the edge of Bridgewater, MA. I have visited all three sites with undergraduate students in the past three summers, and collected plankton and periphyton samples.

Methods

Plankton was collected with a 10 µm mesh Wildco net. In the laboratory, the samples were examined using an Olympus BH2 photomicroscope equipped with an Amscope MU1000 camera. Species were identified using Prescott et al. (1972, 1975, 1977, 1981, 1983), and the (ever-changing) taxonomy verified against AlgaeBase (Guiry and Guiry 2018). The presence/absence data were analyzed and graphed in Microsoft Excel and in R version 3.6.0 using the vegan package.

Summary of results

All samples except the October collection from Pudding Pond are recorded in iNaturalist with pictures and cell measurements. Consistently with the previous two years, the 2019 collection did not reveal appreciably more biodiversity among Pudding Pond desmids, though for example *Staurastrum cerastes*, reported in 1905, was found in 2019 for the first time, meaning that perhaps more species are present but are rare and hard to find. Overall it appears that the Pudding Pond locality is no longer as diverse as reported by Cushman (1905). Also of note, 2017 and 2018 samples from HB contained *Micrasterias brachyptera*, a species thus far unreported from Massachusetts.

The comparison of species richness is presented in Table 1 and the desmid community breakdown by genus is presented in Fig. 1. Overall the species richness seems to have decreased dramatically at Pudding Pond, considerably also at Carver Pond, but increased in Hawley Bog. The last-mentioned increase is likely due to a more comprehensive survey aims compared to

Webber (1967), who focused only on a few taxa of interest. In the recent collections, only five of the species were shared with the 1967 species list, meaning that the vast majority of the species were newly reported from Hawley Bog. In terms of community composition, Carver Pond remained the most constant over time, as shown in the Jaccard-based dendrogram in Fig. 2. Nineteen species found in Carver Pond in 1903 were also found in the 2017-2019 collections.

Table 1. Comparison of species richness at the three focal localities in the historical records and in new data from 2017-2019. Numbers of species shared between historical and present data are also reported. These data do not include the complete 2019 data from Pudding Pond.

	Pudding Pond	Carver Pond	Hawley Bog
Historical	108	61	21
Present	34	38	66
Species shared	21	19	5

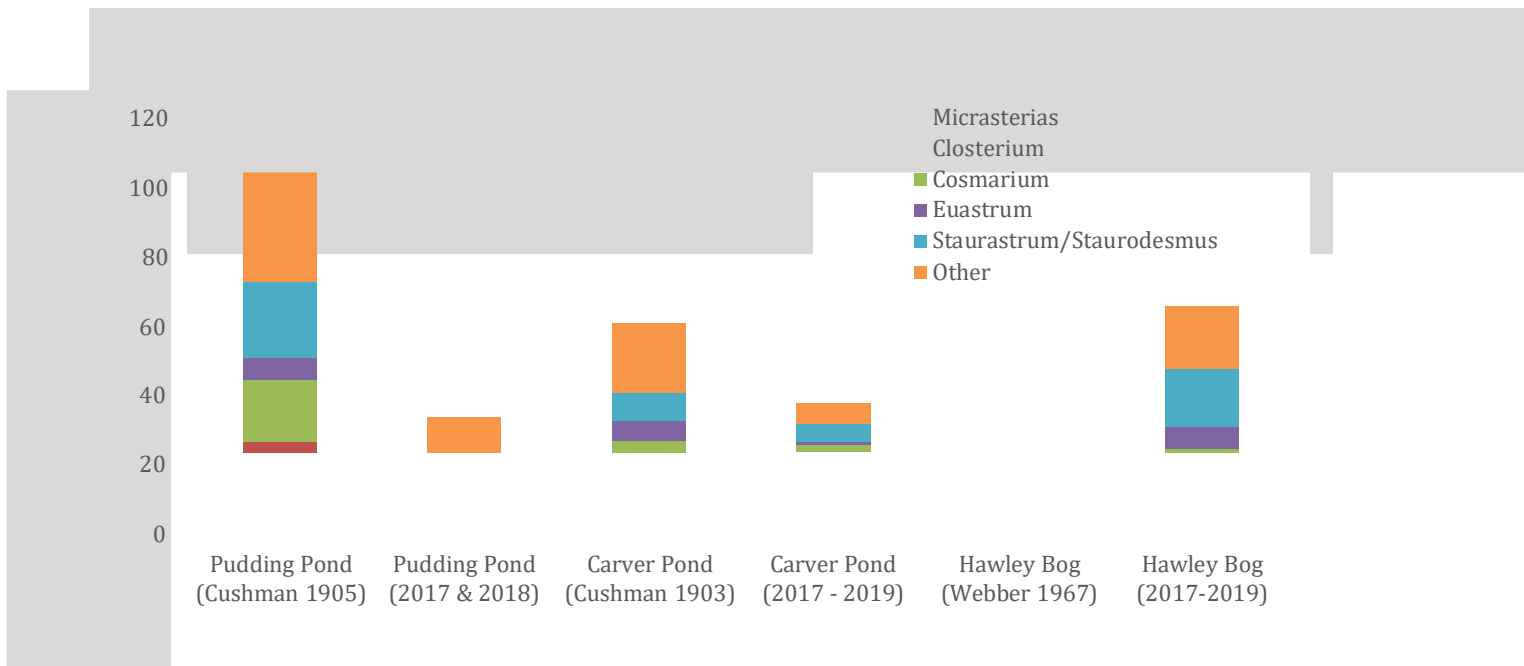


Fig. 1. Representation of the major desmid genera at the three localities, in historical publications and in recent collections. The data do not contain the complete 2019 records from Pudding Pond.

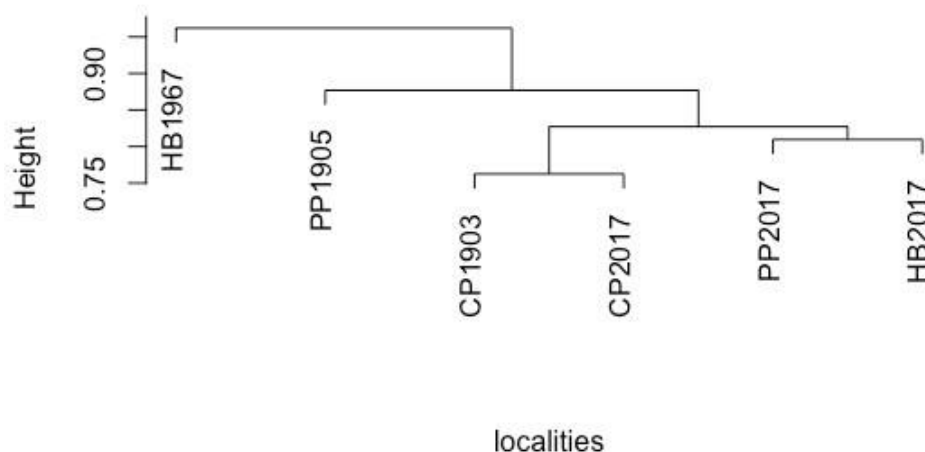


Fig. 2. Cluster dendrogram of sampled localities and their counterparts in historical publications, based on Jaccard similarity index, implemented in R.

Ongoing work

Having processed the 2019 field samples, I plan to finish the identification of the Pudding Pond samples in the coming semester, record them in iNaturalist, and finalize the community comparisons with the complete data set. Additionally, I will cross-reference the data with Coesel's (2001) "red list" as a proxy for water and habitat quality at each site. I hope to submit a manuscript of this floristic study to *Rhodora* this spring.

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