Catalog of Microscopic Organisms of the Everglades
Part 2—The Desmids of the Arthur R. Marshall
Loxahatchee National Wildlife Refuge

Scientific Investigations Report 2019–5074

U.S. Department of the Interior
U.S. Geological Survey
Acknowledgments

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We thank Donatto Suratt, National Park Service, and Rebekah Gibble, U.S. Fish and Wildlife Service, for collecting samples from the Arthur R. Marshall Loxahatchee National Wildlife Refuge. We also thank Kenneth Wagner for his thorough review and the early-career guidance he and the senior author received from Hannah Croasdale.
# Contents

Acknowledgments .................................................................................................................................................. iii
Abstract ................................................................................................................................................................... 1
Introduction ............................................................................................................................................................. 1
Methods .................................................................................................................................................................... 3
Results and Discussion .............................................................................................................................................. 3
*Closterium* Nitzsch ex Ralfs ..................................................................................................................................... 4
*Spinoclosterium* Bernard ...................................................................................................................................... 28
*Actinotenia* (Nägeli) Teiling................................................................................................................................... 29
*Bambusina* Kützing ............................................................................................................................................... 33
*Cosmarium* Corda ex Ralfs .................................................................................................................................... 34
*Cosmostadium* Brébisson ...................................................................................................................................... 101
*Desmidium* C. Agardh ex Ralfs .......................................................................................................................... 102
*Docidium* Brébisson ex Ralfs ................................................................................................................................ 107
*Euastrum* Ehrenberg ex Ralfs ..................................................................................................................................... 109
*Groenbladia* Teiling .............................................................................................................................................. 137
*Haplopora* Bando ................................................................................................................................................... 138
*Hyalotheca* Ehrenberg ex Ralfs ............................................................................................................................ 142
*Micrasterias* C. Agardh ex Ralfs ............................................................................................................................ 143
*Phymatoceros* Nordstedt ....................................................................................................................................... 158
*Pleurotaenium* Nägeli ............................................................................................................................................. 160
*Sphaerozoma* Ralfs ............................................................................................................................................... 166
*Spinocosmarium* Prescott & A.M. Scott ............................................................................................................... 170
*Spondylosium* Brébisson ex Kützing .................................................................................................................... 171
*Staurastrum* Meyen ex Ralfs ..................................................................................................................................... 173
*Staurodesmus* Teiling ........................................................................................................................................... 230
*Teilingia* Bourrelly ................................................................................................................................................... 242
*Tetramoros* Ralts ex Ralts ..................................................................................................................................... 245
*Triploceras* (Bailey ex Ralts) Bailey ..................................................................................................................... 248
*Xanthidi* Ehrenberg ex Ralts .................................................................................................................................... 251
*Gonatozygon* De Bary .......................................................................................................................................... 260
*Penium* Brébisson ex Ralts ..................................................................................................................................... 264
*Cylindrocystis* Meneghini ex De Bary ................................................................................................................... 268
*Spirotaenia* Brébisson ex Ralts ................................................................................................................................... 272
*Tortula* Brook ....................................................................................................................................................... 273
*Netricium* (Nägeli) Itzigsohn & Rothe .................................................................................................................. 274
References .................................................................................................................................................................. 277
Figures

1. Map showing location of the Arthur R. Marshall Loxahatchee National Wildlife Refuge, Florida, and the sampling locations for this study ................................. 2

2–274. Photographs showing:

2. Closterium morphology and terminology ............................................................... 4
3. Closterium abruptum var. canadense ................................................................. 5
4. Closterium acerosum ......................................................................................... 6
5. Closterium aciculare ....................................................................................... 7
6. Closterium cf. angustatum ............................................................................. 8
7. Closterium archerianum ............................................................................... 9
8. Closterium baillyanum .................................................................................10
9. Closterium costatum .....................................................................................11
10. Closterium cf. cynthia ................................................................................ 12
11. Closterium ehrenbergii ...............................................................................13
12. Closterium juncidum ..................................................................................14
13. Closterium kuetzingii ................................................................................ 15
14. Closterium libellula ....................................................................................16
15. Closterium lineatum ..................................................................................17
16. Closterium cf. littorale ................................................................................18
17. Closterium lunula .......................................................................................19
18. Closterium moniliferum ...........................................................................20
19. Closterium navicula ...................................................................................21
20. Closterium ralfsii var. hybridum ....................................................................22
21. Closterium striolatum ................................................................................23
22. Closterium turgidum ..................................................................................24
23. Closterium ulna ...........................................................................................25
24. Closterium venus .......................................................................................26
25. Closterium sp. ..............................................................................................27
26. Spinoclosterium cuspidatum .......................................................................28
27. Actinotaenium adelochondrum ....................................................................29
28. Actinotaenium diplosporum ......................................................................30
29. Actinotaenium sp. .......................................................................................31
30. Actinotaenium sp. .......................................................................................32
31. Bambusina borreri.....................................................................................33
32. Cosmarium morphology and terminology ..................................................34
33. Cosmarium amoenum ...............................................................................35
34. Cosmarium amoenum var. constrictum .......................................................36
35. Cosmarium angulosum ..............................................................................37
36. Cosmarium bimamillatum var. evolutum ....................................................38
37. Cosmarium binum ......................................................................................39
38. Cosmarium bioculatum var. hians ..............................................................40
39. Cosmarium botrytis ....................................................................................41
40. Cosmarium candianum .............................................................................42
41. Cosmarium claviferum .............................................................................43
42. Cosmarium clepsydra ...............................................................................44
43. Cosmarium contractum ................................................................. 45
44. Cosmarium dentatum ............................................................... 46
45. Cosmarium difficile ................................................................. 47
46. Cosmarium difficile var. depressum ......................................... 48
47. Cosmarium excavatum var. duplo-malus ................................. 49
48. Cosmarium exiguum ............................................................... 50
49. Cosmarium goniodes ............................................................. 51
50. Cosmarium granatum ............................................................. 52
51. Cosmarium cf. hammeri ........................................................ 53
52. Cosmarium impressulum ...................................................... 54
53. Cosmarium inaequalinotatum ............................................... 55
54. Cosmarium isthmochondrum ................................................. 56
55. Cosmarium lagoense ............................................................. 57
56. Cosmarium margaritatum ...................................................... 58
57. Cosmarium margaritatum var. rotundatum ............................. 59
58. Cosmarium meneghinii ......................................................... 60
59. Cosmarium moerlianum var. brasiliense ................................. 61
60. Cosmarium moniliforme var. indentatum ............................... 62
61. Cosmarium monomazum var. americanum ............................ 63
62. Cosmarium nymannianum .................................................... 64
63. Cosmarium obsoletum var. minus .......................................... 65
64. Cosmarium ordinatum .......................................................... 66
65. Cosmarium ornatum ............................................................ 67
66. Cosmarium orthostichum var. compactum ............................. 68
67. Cosmarium ovale var. subglabrum ......................................... 69
68. Cosmarium pachydernum ..................................................... 70
69. Cosmarium papiliferum ....................................................... 71
70. Cosmarium phaseolus .......................................................... 72
71. Cosmarium phaseolus var. minus ......................................... 73
72. Cosmarium cf. polygonum .................................................... 74
73. Cosmarium polygonum f. rectum .......................................... 75
74. Cosmarium cf. portianum var. orthostichum ......................... 76
75. Cosmarium pseudoconnatum .............................................. 77
76. Cosmarium pseudopyramidatum ......................................... 78
77. Cosmarium pseudoretusum ................................................ 79
78. Cosmarium pseudotaxichondrum ........................................ 80
79. Cosmarium pseudotaxichondrum var. trichondum f. scottii ... 81
80. Cosmarium pyramidatum .................................................... 82
81. Cosmarium quinarium ........................................................ 83
82. Cosmarium regnelli var. minimum ...................................... 84
83. Cosmarium regnesi .............................................................. 85
84. Cosmarium cf. smolandicum ............................................... 86
85. Cosmarium streblon ............................................................ 87
86. Cosmarium subnudiceps var. angulare ................................. 88
87. Cosmarium subretusiforme ................................................. 89
<table>
<thead>
<tr>
<th>No.</th>
<th>Taxon Name</th>
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<tbody>
<tr>
<td>88</td>
<td>Cosmarium taxichondrum var. ellipticum</td>
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<td>Cosmarium cf. tumidum var. tumidum f. minus</td>
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<td>Cosmarium variolatum</td>
<td>93</td>
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<td>92</td>
<td>Cosmarium variolatum var. elongatum</td>
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<td>Cosmarium variolatum var. incrassatum</td>
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<td>94</td>
<td>Cosmarium zonatum var. subcircularae</td>
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<td>Cosmocladium tuberculatum</td>
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<td>100</td>
<td>Desmidium aptogonum</td>
<td>102</td>
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<td>101</td>
<td>Desmidium aptogonum var. ehrenbergii</td>
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<td>Desmidium baileyi</td>
<td>104</td>
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<td>Desmidium graciliceps</td>
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<td>Desmidium swartzii</td>
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<td>Docidium baculum</td>
<td>107</td>
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<td>106</td>
<td>Docidium undulatum</td>
<td>108</td>
</tr>
<tr>
<td>107</td>
<td>Euastrum morphology and terminology</td>
<td>109</td>
</tr>
<tr>
<td>108</td>
<td>Euastrum attenuatum var. splendens</td>
<td>110</td>
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<td>Euastrum crassum</td>
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<td>Euastrum denticulatum</td>
<td>116</td>
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<td>115</td>
<td>Euastrum didelta var. crassum</td>
<td>117</td>
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<td>117</td>
<td>Euastrum evolutum</td>
<td>119</td>
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<td>Euastrum evolutum var. glaziovii</td>
<td>120</td>
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<td>119</td>
<td>Euastrum hypochondrum</td>
<td>121</td>
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<td>Euastrum insulare var. lacustre</td>
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<td>Euastrum oblongum</td>
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<td>Euastrum validum</td>
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</tr>
</tbody>
</table>
177. Staurastrum arcticum var. truncatum .................................................................................. 179
178. Staurastrum brachiopromines var. ventricosum ................................................................. 180
179. Staurastrum brasiliense var. lundellii .................................................................................. 181
180. Staurastrum capitulum ....................................................................................................... 182
181. Staurastrum cerastes ......................................................................................................... 183
182. Staurastrum connatum var. isthmosum ............................................................................. 184
183. Staurastrum depressiceps ................................................................................................. 185
184. Staurastrum dilatum ......................................................................................................... 186
185. Staurastrum geminatum .................................................................................................... 187
186. Staurastrum grallatorium .................................................................................................. 188
187. Staurastrum grallatorium var. forcipigerum ..................................................................... 189
188. Staurastrum hystrix ........................................................................................................... 190
189. Staurastrum inconspicuum ................................................................................................ 191
190. Staurastrum iotanum ......................................................................................................... 192
191. Staurastrum johnsonii var. bifurcatum ............................................................................. 193
192. Staurastrum laeve var. latidivergens ................................................................................ 194
193. Staurastrum lativenter ....................................................................................................... 195
194. Staurastrum leptacanthum var. brachycerum .................................................................... 196
195. Staurastrum leptocladum var. cornutum .......................................................................... 197
196. Staurastrum leptocladum var. sinuatum f. planum ............................................................. 198
197. Staurastrum longibrachiatum f. inflatum ......................................................................... 199
198. Staurastrum magnottae var. biradiatum .......................................................................... 200
199. Staurastrum minnesotense ............................................................................................... 201
200. Staurastrum neglectum ..................................................................................................... 202
201. Staurastrum nova-caesareae ............................................................................................ 203
202. Staurastrum octodontum var. tetrodontum ...................................................................... 204
203. Staurastrum cf. octoverrucosum ..................................................................................... 205
204. Staurastrum orbiculare var. denticulatum ....................................................................... 206
205. Staurastrum pingue var. evolutum ................................................................................... 207
206. Staurastrum cf. pinnatum var. floridense ....................................................................... 208
207. Staurastrum pinnatum var. reductum ............................................................................. 209
208. Staurastrum polytrichum .................................................................................................. 210
209. Staurastrum pseudoneglectum ......................................................................................... 211
210. Staurastrum quadrangulare ............................................................................................. 212
211. Staurastrum radians ........................................................................................................ 213
212. Staurastrum rotula .......................................................................................................... 214
213. Staurastrum sebaldi ........................................................................................................... 215
214. Staurastrum striolatum .................................................................................................... 216
215. Staurastrum subpygmaeum var. spiniferum ................................................................... 217
216. Staurastrum tetracerum ................................................................................................... 218
217. Staurastrum tohopekaligense ........................................................................................... 219
218. Staurastrum trifidum var. inflexum .................................................................................. 220
219. Staurastrum turgescens var. sparsigranulatum ................................................................. 221
220. Staurastrum vestitum ........................................................................................................ 222
221. Staurastrum sp. .................................................................223
222. Staurastrum sp. .................................................................224
223. Staurastrum sp. .................................................................225
224. Staurastrum sp. .................................................................226
225. Staurastrum sp. .................................................................227
226. Staurastrum sp. .................................................................228
227. Staurastrum sp. .................................................................229
228. Staurodesmus convergens ..................................................230
229. Staurodesmus cuspidatus ....................................................231
230. Staurodesmus cuspidatus var. curvatus ................................232
231. Staurodesmus dejectus .......................................................233
232. Staurodesmus dickiei ........................................................234
233. Staurodesmus glaber ........................................................235
234. Staurodesmus maximus ......................................................236
235. Staurodesmus octocornis ....................................................237
236. Staurodesmus cf. o’meeari ..................................................238
237. Staurodesmus pachyrynchus ..............................................239
238. Staurodesmus pachyrynchus var. pseudopachyrhynchum ....240
239. Staurodesmus subulatus .....................................................241
240. Teilingia morphology and terminology ................................242
241. Teilingia granulata ............................................................243
242. Teilingia quadrispinata f. evoluta ........................................244
243. Tetmemorus morphology and terminology ..........................245
244. Tetmemorus brebissonii .....................................................246
245. Tetmemorus granulatus .....................................................247
246. Triploceras gracile ............................................................248
247. Triploceras gracile var. bispinatum .....................................249
248. Triploceras verticillatum .................................................250
249. Xanthidium morphology and terminology ..........................251
250. Xanthidium antilopaeeum ...............................................252
251. Xanthidium antilopaeeum var. incrassatum ........253
252. Xanthidium antilopaeeum var. polymazum .......................254
253. Xanthidium armatum .......................................................255
254. Xanthidium concinnum .....................................................256
255. Xanthidium cristatum var. scrobiculatum .........................257
256. Xanthidium smithii ........................................................258
257. Xanthidium wewahitchkense ..........................................259
258. Gonatozygon morphology and terminology ........................260
259. Gonatozygon aculeatum ..................................................261
260. Gonatozygon brebissonii ...............................................262
261. Gonatozygon monotaenium ..............................................263
262. Penium morphology and terminology ...............................264
263. Penium cf. didymocarpum ...............................................265
264. Penium exiguum ............................................................266
265. Penium cf. margaritaceum ................................................267
| 266. | *Cylindrocystis* morphology and terminology | 268 |
| 267. | *Cylindrocystis* sp. | 269 |
| 268. | *Cylindrocystis* sp. | 270 |
| 269. | *Cylindrocystis* sp. | 271 |
| 270. | *Spirotaenia minuta* | 272 |
| 271. | *Tortitaenia obscura* | 273 |
| 272. | *Netrium digitus* | 274 |
| 273. | *Netrium lamellosum* | 275 |
| 274. | *Netrium oblongum var. cylindricum* | 276 |
## Conversion Factors

### U.S. customary units to International System of Units

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Abstract

The Arthur R. Marshall Loxahatchee National Wildlife Refuge (refuge), Boynton Beach, Florida, contains approximately 147,000 acres southeast of Lake Okeechobee. Water quality in the interior portion of the refuge is strongly influenced by rainfall, resulting in slightly acidic waters with low dissolved ions. Desmids, a unique, ornate group of green algae loosely associated with submerged vascular plants, were photo-documented for the first time in samples from the refuge. The canal system surrounding the refuge contains a high level of ions from agricultural runoff, and intrusion of this water into the refuge interior during high canal water levels may have altered some of the desmid population. A transect from the canal to the interior was sampled every 3 months, and the species present were photographed, identified, and catalogued. Approximately 260 unique taxa from 29 genera were encountered. The interior of the refuge had the greatest diversity of desmids; however, the areas of the refuge adjacent to the canals still contained a rich population of desmids. We postulate that the diversity of desmids indicates that the pristine portions of the refuge may be an important refugium for desmids, particularly for those species restricted to the subtropical parts of the United States. This collection of taxa, identified to species with most specimens, will allow a more detailed examination of water quality issues when co-located water quality data are collected.

Introduction

Desmids are a paraphyletic group of symmetrical green algae that belong to the class Zygnematophyceae. Desmids are made up of two groups: saccoderm desmids and placoderm desmids. Saccoderm desmids are in the order Zygnematales, with other common conjugating algae genera such as Mougeotia, Spirogyra, and Zygnema. Placoderm desmids are in the order Desmidiales and are characterized by median sutures and ornamented cell walls. This order is very species rich, with an estimated 32 genera and 1,234 species in North America (Hall and McCourt, 2015). They are most abundant in environments that have acidic, soft water, like the interior of the Arthur R. Marshall Loxahatchee National Wildlife Refuge (refuge). In part 1 of “Catalog of microscopic organisms of the Everglades” (Rosen and Mareš, 2016), cyanobacteria in the Everglades were photographed and identified. This volume focuses on the refuge, which is rich in desmid diversity and abundance. The goal of this publication is to provide photo documentation of desmids that live in the refuge, which can also be used to help identify most desmid species throughout the Everglades.

The refuge is located at 26° N latitude and 80° W longitude and is part of the northern Everglades. The land to the northwest of the refuge is part of the Everglades agricultural area, and the land to the east is predominantly urban (fig. 1). The refuge was established in 1951 by the Migratory Bird Conservation Act and protects wetland wildlife such as the snail kite and wood stork (U.S. Fish and Wildlife Service, 2018).

The refuge has historically been classified as an ombrotrophic wetland, meaning that the wetland ecosystem receives water and nutrients predominantly from rainfall (Gleason and Spackman, 1974; Browder and others, 1991; Miller and McPherson, 2008). This designation was based on composition and classification of periphyton throughout the Everglades. Calcareous periphyton was found in the peripheral regions of the refuge and can also be found in parts of Big Cypress, Taylor Slough, and other regions of the southern Everglades (Swift, 1987). The waters in these locations all had high calcium concentrations and a neutral to basic pH. The interior of the refuge had non-calcareous, desmid-rich periphyton and metaphyton. The sampling locations were selected to gather periphyton and metaphyton from the acidic, low mineral content interior portion of the refuge and were generally isolated from the canals. The low mineral content and presence of non-calcareous periphyton in the interior of the refuge indicate that it has historically been ombrotrophic. Since the construction of the canals along the perimeter, stormwater discharges have threatened the ombrotrophic quality of the interior regions of the refuge (Chen and others,
Figure 1. Location of the Arthur R. Marshall Loxahatchee National Wildlife Refuge, Florida, and the sampling locations for this study.

Base modified from ESRI and other Federal and State digital line data, various scales
South Florida Water Management District (SFWMD), 2018
Florida Department of Transportation Roads Characteristics inventory (RCI) dataset, 2019
TIGER/Line data from United States Census Bureau, 2018
University of Florida GeoPlan Center, 2015
Florida Department of Environmental Protection, Division of Environmental Assessment and Restoration, Watershed Monitoring Section, 2017
Universal Transverse Mercator, zone 17
North American Datum of 1983
Canal water intrusion and the associated inputs of dissolved ions into the refuge have the potential to affect aquatic ecosystems, particularly sensitive desmid communities that have been found in abundance in the interior portion of the refuge.

The refuge has been noted for its diverse desmid population (Swift and Nicholas, 1987), but little is known about how the population is being affected by the canal water intrusions into the refuge. A barrier to doing further research on this system is the lack of knowledge of the taxonomic composition of the desmid population in the refuge. This catalogue of desmid taxa found in the refuge will allow data to be obtained on the diversity of organisms, as well as allow future research on their response to changes in water chemistry.

Methods

Samples were collected from six locations on five dates over the course of 3 years (2016–2018) along an east to west transect shown in figure 1. Floating vegetation and associated water were collected by hand, placed in plastic containers, and kept on ice until transported to the U.S. Geological Survey (USGS) laboratory in Orlando, Florida. Live desmids were removed by gentle agitation of the vascular plant material, and many subsamples were examined from each of the 30 samples over a 3-year period.

Samples were placed on microscope slides and viewed under an Olympus BX51 light microscope with 200x, 400x, 600x, or 1,000x magnification. Photos of individual organisms were taken by using an Olympus DP74 camera. Scale bars embedded in the images were calibrated and sized by using CellSens camera software. Many of the photographs were generated by using a motorized z-stage, allowing individual images to be taken as the z-drive focused through the entire organism. These images were compressed into a single image, making an “extended focus image” that allowed for details on all focal planes to be viewed simultaneously.

Identification of the taxa present in the refuge required the use of desmid taxonomic reference literature. The “North American Flora” reference books were used and cited for all of the desmids identified in the refuge (Prescott and others, 1972, 1975, 1977, 1981, 1982, 1983). The taxonomic references provided only a line drawing of the taxa, and no image (digital or printed) was available for many of the taxa.

Results and Discussion

Analysis of samples from the refuge revealed a sizable community of desmids: 242 unique desmid taxa from 30 genera. In addition, 17 taxa could only be identified to the genus. The east interior site (fig. 1) had the highest diversity of desmids, with 174 taxa identified from this location during this study. The west perimeter site, which is near the canals, had the lowest diversity, with only 17 taxa identified. This low diversity was possibly caused by the altered hydrology and resultant plant community structure at this sampling location; the west perimeter of the refuge is dominated by *Typha*, which proliferates in environments with increased flow and nutrients (Newman and others, 1996). At the other five sampling locations, *Utricularia*, which is often associated with a greater presence of desmids (Schumacher, 1960), was the dominant form of aquatic vegetation.

About half of the species that are documented in this publication are common in the refuge. However, several species were rarely seen; some taxa were only in samples from one sampling location or in samples from one sampling date. While this catalogue represents most of the diversity of desmids in the refuge, some species were likely missed or are almost impossible to distinguish from others that have similar morphology.

Biodiversity and density of species in the samples were notably lower in the late summer than the during rest of the year. This could be explained by increased rain and flow through the refuge during the summer. The percentage of *Haplotaenium* desmid cells increased in all of the sampling locations during the summer. Swift and Nicholas (1987) noted that the cells of this genus (listed under the basionym *Pleurotaenium*) were the most numerous desmid cells that were found in periphyton samples in less impacted locations. The research questions that could be addressed were limited in this preliminary study because water-chemistry data were not collected at the time of sample collection. Additional data collection and research are needed to understand the effect of water quality on the tolerance of the numerous desmid species that are found in the refuge.

This publication includes a summary of the genera found in the refuge, as well as photographs of each species.
**Closterium Nitzsch ex Ralfs**

Cells are typically lunate or bow-shaped, many times longer than broad, and tapered to the apices. The cell wall may be smooth or have surface features such as costae, striations, or punctae that can aid in identification. Some cells have additional thickened portions of cell wall material called girdle bands. The curvature of the cell is critical for identification. Most species have a large vacuole near the apex that has granules of barium sulfate crystals (Brooks, 1981). Pyrenoids can often be seen along the length of the cell.

Twenty-three taxa of *Closterium* were identified in refuge (figs. 2–25). They were primarily in samples from the east interior site of the refuge (fig. 1). Only two species from this genus (*Closterium kuetzingii* and *Closterium turgidum*) were found in samples from the west perimeter and the west and east transition sites.

**Figure 2.**  
A, *Closterium juncidum* cells have girdle bands (GB) and striations (S).  
B, *Closterium lineatum* has striations made up of pores and a brown cell wall due to iron deposits.  
C, Barium sulfate granules (G) in a terminal vacuole are visible in this *Closterium baillyanum* cell. [µm, micrometer]
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium abruptum var. canadense Bourely

Figure 3. Closterium abruptum var. canadense.
Order Desmidiales  
Family Closteriaceae  
Genus *Closterium*  
Species *Closterium acerosum* (Schrank) Ehrenberg

Figure 4. *Closterium acerosum*. 
Order Desmidiales

Family Closteriaceae

Genus Closterium

Species Closterium aciculare T. West

Figure 5. Closterium aciculare.
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium cf. angustatum Kützing

Figure 6. Closterium cf. angustatum.
Order Desmidiales

Family Closteriaceae

Genus Closterium

Species Closterium archerianum Cleve ex P. Lundell

Figure 7. Closterium archerianum.
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium bailyanum (Brébisson ex Ralfs) Brébisson

Figure 8. Closterium bailyanum.
Order Desmidiales
Family Closteriaceae
Genus *Closterium*
Species *Closterium costatum* Corda ex Ralfs

Figure 9. *Closterium costatum*. 
Order Desmidiales

Family Closteriaceae

Genus Closterium

Species Closterium cf. cynthia De Notaris

Figure 10. Closterium cf. cynthia.
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium ehrenbergii Meneghini ex Ralfs

Figure 11. Closterium ehrenbergii.
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium juncidum Ralts

Figure 12. Closterium juncidum.
**Order** Desmidiales

**Family** Closteriaceae

**Genus** Closterium

**Species** *Closterium kuetzingii* Brébisson

Figure 13. *Closterium kuetzingii*. 
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium libellula Focke ex Nordstedt

Figure 14. Closterium libellula.
Order Desmidiales

Family Closteriaceae

Genus Closterium

Species *Closterium lineatum* Ehrenberg ex Ralfs

*Figure 15.* *Closterium lineatum.*
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium cf. littorale Gay

Figure 16. Closterium cf. littorale.
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium lunula Ehrenberg & Hemprich ex Ralfs
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium moniliferum Ehrenberg ex Ralfs

Figure 18. *Closterium moniliferum*.
Order Desmidiales
   Family Closteriaceae
   Genus Closterium
   Species Closterium navicula (Brébisson) Lütkemüller

Figure 19. Closterium navicula.
Order Desmidiaceae
Family Closteriaceae
Genus Closterium
Species Closterium ralfsii var. hybridum Rabenhorst

Figure 20. *Closterium ralfsii* var. *hybridum*. 
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species Closterium striolatum Ehrenberg ex Ralfs

Figure 21. Closterium striolatum.
Order Desmidiales
Family Closteriaceae
Genus Closterium
Species *Closterium turgidum* Ehrenberg ex Ralfs

Figure 22. *Closterium turgidum*. 
Order Desmidiales
Family Closteriaceae
Genus *Closterium*
Species *Closterium ulna* Focke ex W.B. Turner

Figure 23. *Closterium ulna.*
Order Desmidiales
Family Closteriaceae
Genus *Closterium*
Species *Closterium venus* Kützing ex Ralfs

*Figure 24.* *Closterium venus.*
Order Desmidiales

Family Closteriaceae

Genus *Closterium*

Species *Closterium* sp.

Figure 25. *Closterium* sp.
Spinoclosterium Bernard

The only species in this genus is *Spinoclosterium cuspidatum* (fig. 26). The cells of this species are shaped like many *Closterium* cells, but they have a large spine at each apex.

This species was rare in the refuge and was only found at the east interior site.

Order Desmidiales
Family Closteriaceae
Genus *Spinoclosterium*
Species *Spinoclosterium cuspidatum* (Bailey) Hirano

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Figure 26. *Spinoclosterium cuspidatum.*
Actinotaenium (Nägeli) Teiling

Cells have a very small median constriction and elongated semicells. The cells are always radially symmetric (circular) in apical view, which can aid in distinguishing them from other genera such as Cosmarium. The cell wall is smooth, although pores may be visible and can often be mistaken for granules. There is a single chloroplast in each semicell, which is either stellate or asteroid with a central pyrenoid.

Two identified species and two unidentified species of Actinotaenium were found in the refuge (figs. 27–30). This genus was found at all sites except the west perimeter. Actinotaenium cells were relatively rare in all samples.

Order Desmidiales  
Family Desmidiaceae  
Genus Actinotaenium  
Species Actinotaenium adelochondrum (Elfving) Teiling

Figure 27. Actinotaenium adelochondrum.
Order Desmidiales
Family Desmidiaceae
Genus Actinotaenium
Species *Actinotaenium diplosporum* (P. Lundell) Teiling

Figure 28. *Actinotaenium diplosporum.*
Order Desmidiales
  Family Desmidiaceae
  Genus Actinotaenium
    Species Actinotaenium sp.

Figure 29. Actinotaenium sp.
Order Desmidiales
Family Desmidiaceae
Genus *Actinotaenium*
Species *Actinotaenium* sp.

*Figure 30.* *Actinotaenium* sp.
**Bambusina Kützing**

Cells are barrel shaped and form filaments. They are swollen in the midregion, near the suture of the cell. The cell wall is mostly smooth, although rows of pores can sometimes be seen near the apex. The chloroplast is stellate and axial.

Only one species, *Bambusina borreri*, was found in the refuge (fig. 31). It was found at all sites except the west perimeter.

**Order** Desmidiales

**Family** Desmidiaceae

**Genus** Bambusina

**Species** Bambusina borreri (Ralfs) Cleve

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**Figure 31.** *Bambusina borreri*. 
**Cosmarium Corda ex Ralfs**

Cells are variable in shape but are compressed in apical view. The cell walls are often ornamented with granules, papillae, scrobiculations, and pores (fig. 32). This ornamentation and the shape (outline) of the cell and chloroplasts are often used to identify the species of cell.

*Cosmarium* was the most common genus in the refuge, with 66 taxa identified (figs. 32–98). This genus was found at all sites sampled. Some taxa, such as *Cosmarium ovale* var. *subglabrum* and *Cosmarium moniliforme* var. *indentatum*, were only found at the east interior site. Others, such as *Cosmarium pyramidatum* and *Cosmarium inaequalinotatum*, were more common and found at every site, including the west perimeter.

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**Figure 32.** *A*, *Cosmarium papilliferum* has papillae (P) and scrobiculations (S). *B*, *Cosmarium phaseolus* has a small protuberance in the midregion of the cell. *C*, *Cosmarium nymannianum* has a single large middle pore, surrounded by scattered, smaller pores. *D*, *Cosmarium isthmochondrum* is ornamented with granules.
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** Cosmarium  
**Species** Cosmarium amoenum Brébisson ex Ralfs

*Figure 33.* *Cosmarium amoenum.*
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species *Cosmarium amoenum* var. *constrictum* Scott & Grönblad

Figure 34. *Cosmarium amoenum* var. *constrictum*.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium angulosum Brébisson

Figure 35. Cosmarium angulosum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium bimamillatum var. evolutum C.E. Bicudo

Figure 36. Cosmarium bimamillatum var. evolutum.
Order Desmidiales
Family Desmidiaceae
Genus *Cosmarium*
Species *Cosmarium binum* Nordstedt

Figure 37. *Cosmarium binum.*
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium bioculatum var. hians West and West

Figure 38. Cosmarium bioculatum var. hians.
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** Cosmarium  
**Species** Cosmarium *botrytis* Meneghini ex Ralfs

*Figure 39. Cosmarium botrytis.*
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium candianum Delponte

Figure 40. Cosmarium candianum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium claviferum Cushman

Figure 41. Cosmarium claviferum.
Order Desmidiales

Family Desmidiaceae

Genus Cosmarium

Species Cosmarium clepsydra Nordstedt

Figure 42. Cosmarium clepsydra.
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** Cosmarium  
**Species** *Cosmarium contractum* Kirchner

*Figure 43.* *Cosmarium contractum.*
Order Desmidiales

Family Desmidiaceae

Genus *Cosmarium*

Species *Cosmarium dentatum* Wolle

Figure 44. *Cosmarium dentatum*. 
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium difficile Lütkemüller

Figure 45. Cosmarium difficile.
Order Desmidiales
Family Desmidiaceae
Genus *Cosmarium*
Species *Cosmarium difficile* var. *depressum* Scott & Grönblad

Figure 46. *Cosmarium difficile* var. *depressum*. 
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium excavatum var. duplo-maius (Wille) Kurt Förster

Figure 47. Cosmarium excavatum var. duplo-maius.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium exiguum Archer

Figure 48. Cosmarium exiguum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium goniodes West & West

Figure 49. Cosmarium goniodes.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium

Species Cosmarium granatum Brébisson ex Ralfs

Figure 50. Cosmarium granatum.
**Order** Desmidiales

**Family** Desmidiaceae

**Genus** Cosmarium

**Species** *Cosmarium cf. hammeri* Reinsch

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**Figure 51.** *Cosmarium cf. hammeri.*
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium impressulum Elfving

Figure 52. Cosmarium impressulum.
**Order** Desmidiales

**Family** Desmidiaceae

**Genus** Cosmarium

**Species** Cosmarium inaequalinotatum Scott & Grönblad

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**Figure 53.** *Cosmarium inaequalinotatum.*
Order Desmidiales
  Family Desmidiaceae
  Genus Cosmarium
  Species Cosmarium istmochondrum Nordstedt

Figure 54. *Cosmarium istmochondrum*. 
Cosmarium Corda ex Ralfs 57

Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium lagoense (Nordstedt) Nordstedt

Figure 55. Cosmarium lagoense.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium margaritatum (P. Lundell) J. Roy & Bisset

Figure 56. Cosmarium margaritatum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium margaritatum var. rotundatum Hirano

Figure 57. Cosmarium margaritatum var. rotundatum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium meneghinii Brébisson ex Ralfs

Figure 58. Cosmarium meneghinii.
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Cosmarium*  
**Species** *Cosmarium moerlianum var. brasiliense* Borge

*Figure 59. Cosmarium moerlianum var. brasiliense.*
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium moniliforme var. indentatum Scott & Grönblad

Figure 60. Cosmarium moniliforme var. indentatum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium monomazum var. americanum (Borge) Scott & Grönblad

Figure 61. Cosmarium monomazum var. americanum.
Order Desmidiales
Family Desmidiaceae
Genus *Cosmarium*
Species *Cosmarium nymannianum* Grunow

Figure 62. *Cosmarium nymannianum*. 
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** Cosmarium  
**Species** *Cosmarium obsoletum* var. *minus* Krieger and Gerloff

![Image of Cosmarium obsoletum var. minus](image)

*Figure 63. Cosmarium obsoletum var. minus.*
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium ordinatum (Børgesen) West & G.S. West

Figure 64. Cosmarium ordinatum.
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** Cosmarium  
**Species** Cosmarium ornatum Ralfs ex Ralfs

**Figure 65.** Cosmarium ornatum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium

Species Cosmarium orthostichum var. compactum (West & West)

Figure 66. Cosmarium orthostichum var. compactum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium ovale var. subglabrum West & West

Figure 67. Cosmarium ovale var. subglabrum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium pachydermum P. Lundell

Figure 68. Cosmarium pachydermum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium papilliferum Schmidle

Figure 69. Cosmarium papilliferum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium phaseolus Brébisson ex Ralfs

Figure 70. Cosmarium phaseolus.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium phaseolus var. minus (Boldt) Willi Krieger & Gerloff

Figure 71. Cosmarium phaseolus var. minus.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium cf. polygonum (Nägeli) Archer

Figure 72. Cosmarium cf. polygonum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium polygonum f. rectum Bicudo

Figure 73. Cosmarium polygonum f. rectum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium cf. portianum var. orthostichum Schmidle

Figure 74. Cosmarium cf. portianum var. orthostichum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium pseudoconnatum Nordstedt

Figure 75. Cosmarium pseudoconnatum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium pseudopyramidatum P. Lundell

Figure 76. Cosmarium pseudopyramidatum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium pseudoretusum F. Ducellier

**Figure 77.** Cosmarium pseudoretusum.
Order Desmidiales
Family Desmidiaceae
Genus *Cosmarium*
Species *Cosmarium pseudotaxichondrum* Nordstedt

**Figure 78.** *Cosmarium pseudotaxichondrum.*
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium pseudotaxichondrum var. trichondum f. scottii Prescott

Figure 79. Cosmarium pseudotaxichondrum var. trichondum f. scottii.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium pyramidatum Brébisson ex Ralfs

Figure 80. Cosmarium pyramidatum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium quinarium Lundell

Figure 81.  *Cosmarium quinarium*. 
Order Desmidiales
Family Desmidiaceae

Genus Cosmarium

Species Cosmarium regnellii var. minimum Eichler & Gutwinski

Figure 82. Cosmarium regnellii var. minimum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium regnesi Reinsch

Figure 83. Cosmarium regnesi.
Order Desmidiales
   Family Desmidiaceae
   Genus Cosmarium
   Species Cosmarium cf. smolandicum P. Lundell

**Figure 84.** Cosmarium cf. smolandicum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium streblon Scott & Grönblad

Figure 85. Cosmarium streblon.
Order Desmidiales
Family Desmidiaceae
Genus *Cosmarium*
Species *Cosmarium subnudiceps* var. *angulare* Scott & Grönblad

Figure 86. *Cosmarium subnudiceps* var. *angulare*. 
**Order** Desmidiales

**Family** Desmidiaceae

**Genus** Cosmarium

**Species** Cosmarium subretusiforme West & West

*Figure 87.* Cosmarium subretusiforme.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium taxichondrum var. ellipticum Förster

Figure 88. Cosmarium taxichondrum var. ellipticum.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium tenue Archer

Figure 89. Cosmarium tenue.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium

Species Cosmarium cf. tumidum var. tumidum f. minus Messikommer

Figure 90. Cosmarium cf. tumidum var. tumidum f. minus.
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** Cosmarium  
**Species** Cosmarium variolatum P. Lundell

*Figure 91. Cosmarium variolatum.*
Order Desmidiales
Family Desmidiaceae
Genus *Cosmarium*
Species *Cosmarium variolatum* var. *elongatum* Scott & Grönblad

Figure 92. *Cosmarium variolatum* var. *elongatum*.
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** Cosmarium  
**Species** *Cosmarium variolatum* var. *incrassatum* Scott & Grönblad

*Figure 93.* *Cosmarium variolatum* var. *incrassatum.*
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium zonatum var. subcirculare A.M. Scott & Grönblad

Figure 94. Cosmarium zonatum var. subcirculare.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium sp.

Figure 95. Cosmarium sp.
Order Desmidiales
Family Desmidiaceae
Genus Cosmarium
Species Cosmarium sp.

Figure 96. Cosmarium sp.
**Order** Desmidiales

**Family** Desmidiaceae

**Genus** Cosmarium

**Species** Cosmarium sp.

*Figure 97.* Cosmarium sp.
Order Desmidiales
  Family Desmidiaceae
  Genus Cosmarium
  Species Cosmarium sp.

Figure 98. Cosmarium sp.
**Cosmocladium Brébisson**

Cells form colonies held together by gelatinous strands and enclosed in mucilage. The individual cells are small and constricted with elliptical semicells. By themselves, individual cells can be indistinguishable from small *Cosmarium* species.

Only one species, *Cosmocladium tuberculatum*, was identified in samples from the refuge (fig. 99). It was found at several sites, including the east interior and west perimeter sites.

**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Cosmocladium*  
**Species** *Cosmocladium tuberculatum* Prescott

**Figure 99.** *Cosmocladium tuberculatum.*
Desmidium C. Agardh ex Ralfs

Cells are attached by apical processes to form filaments. Filaments often twist along the long axis of the filament, giving it a distinctive appearance. They are typically rectangular in side view with a slight constriction in the midregion; some species are triangular in apical view. The chloroplast is axial and has paired lobes that extend into each angle of the semicell.

Five Desmidium taxa were identified in samples from the refuge (figs. 100–104). They were found at all sites except the west perimeter site. This genus, particularly the species Desmidium aptogonum, was common in most samples. Only a single filament of Desmidium swartzii was found, making it very rare in the refuge.

Order Desmidiales
Family Desmidiaceae
Genus Desmidium
Species Desmidium aptogonum Brébisson ex Kützing

Figure 100. Desmidium aptogonum.
Order Desmidiales
Family Desmidiaceae
Genus Desmidium
Species Desmidium aptogonum var. ehrenbergii Kützing

Figure 101. Desmidium aptogonum var. ehrenbergii.
Order Desmidiales
Family Desmidiaceae
Genus Desmidium
Species Desmidium baileyi (Ralfs) Nordstedt

Figure 102. Desmidium baileyi.
Order Desmidiales

Family Desmidiaceae

Genus Desmidium

Species Desmidium graciliceps (Nordstedt) Lagerheim

Figure 103. Desmidium graciliceps.
Order Desmidiales
Family Desmidiaceae
Genus Desmidium
Species Desmidium swartzii C. Agardh ex Ralfs
**Docidium Brébisson ex Ralfs**

Cells are long and cylindrical with two rows of granules along the midregion of the cell. The apex is usually smooth but can have teeth in some species. The cell wall is smooth or punctate. The chloroplasts are axial and stellate with pyrenoids down the length of the cell.

Two species, *Docidium baculum* and *Docidium undulatum*, were identified in samples from the refuge (figs. 105–106). This genus was not abundant at any site and was absent from the west perimeter.

**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** Docidium  
**Species** Docidium baculum Brébisson ex Ralfs

*Figure 105. Docidium baculum.*
Order Desmidiales
   Family Desmidiaceae
   Genus *Docidium*
   Species *Docidium undulatum* Bailey

Figure 106. *Docidium undulatum*. 
*Euastrum* Ehrenberg ex Ralfs

Cells are solitary and vary in size and shape. The semicell is divided into an incised polar lobe and one or more lateral lobes. The cells are often ornamented with granules, spines, pores, or verrucae (fig. 107). Sometimes the cell has a single pore that completely penetrates the cell wall, creating a pore organ. A single chloroplast is in each semicell.

Twenty-seven *Euastrum* taxa were identified in samples from the refuge (figs. 108–134). Only one of these, *Euastrum elegans*, was found at the west perimeter site. Several species were rare, such as *Euastrum marianopoliense*, *Euastrum pectinatum var. lobuliferum*, and *Euastrum ventricosum var. rectangulare*.

**Figure 107.**  
*A*, *Euastrum validum var. glabrum f. inflatum* has a very large pore organ (P) on either side of the cell.  
*B*, *Euastrum evolutum* cells are ornamented with spines and granules.  
*C*, *Euastrum ciastonii* has a central protuberance with four granules, as well as short spines at the apex.
Order Desmidiales
  Family Desmidiaceae
  Genus *Euastrum*

  Species *Euastrum attenuatum* var. *splendens* (Fritsch & Rich) Grönlad & A.M. Scott

Figure 108. *Euastrum attenuatum* var. *splendens.*
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum bidentatum* var. *quadrioculatum* Scott & Prescott

Figure 109. *Euastrum bidentatum* var. *quadrioculatum*. 
Order Desmidiales
Family Desmidiaceae
Genus Euastrum
Species Euastrum cf. binale Ehrenberg ex Ralfs

Figure 110. Euastrum cf. binale.
**Order** Desmidiales

**Family** Desmidiaceae

**Genus** Euastrum

**Species** Euastrum ciastonii Raciborski

*Figure 111. Euastrum ciastonii.*
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum cornubiense* West & West

Figure 112. *Euastrum cornubiense.*
Order Desmidiales
Family Desmidiaceae
Genus Euastrum
Species Euastrum crassum Ralfs

Figure 113. Euastrum crassum.
Order Desmidiales
  Family Desmidiaceae
  Genus *Euastrum*
  Species *Euastrum denticulatum* F. Gay

Figure 114. *Euastrum denticulatum*. 
Order Desmidiales
Family Desmidiaceae
Genus Euastrum
Species Euastrum didelta var. crassum Ralfs

Figure 115. Euastrum didelta var. crassum.
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum elegans* Ralfs

Figure 116. *Euastrum elegans.*
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum evolutum* (Nordstedt) West & West

Figure 117. *Euastrum evolutum.*
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*

Species *Euastrum evolutum* var. *glaziovii* (Børgesen) West & G.S. West

*Figure 118. Euastrum evolutum* var. *glaziovii.*
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum hypochondrum* Nordstedt

Figure 119. *Euastrum hypochondrum.*
Order Desmidiales
Family Desmidiaceae
Genus Euastrum
Species Euastrum informe f. oculatum Scott and Prescott

Figure 120. *Euastrum informe f. oculatum*. 
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum insulare* var. *lacustre* (Messikommer) Krieger

*Figure 121.* *Euastrum insulare* var. *lacustre.*
Order Desmidiales
Family Desmidiaceae
Genus Euastrum
Species Euastrum intermedium var. longicolle Borge

Figure 122. Euastrum intermedium var. longicolle.
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum lapponicum* var. *protuberans* Prescott

*Figure 123.* *Euastrum lapponicum* var. *protuberans.*
Order Desmidiales
  Family Desmidiaceae
  Genus *Euastrum*
  Species *Euastrum luetkemuelleri* Ducellier

*Figure 124.* *Euastrum luetkemuelleri.*
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum marianopoliense* Irène-Marie

Figure 125. *Euastrum marianopoliense.*
Order Desmidiales
   Family Desmidiaceae
   Genus Euastrum
   Species Euastrum oblongum Ralfs

Figure 126. Euastrum oblongum.
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum pectinatum* var. *lobuliferum* Scott & Prescott

Figure 127. *Euastrum pectinatum* var. *lobuliferum*. 
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*

Species *Euastrum pinnatum* Ralfs

Figure 128. *Euastrum pinnatum*. 
**Order** Desmidiales

**Family** Desmidiaceae

**Genus** Euastrum

**Species** *Euastrum sibiricum* var. *reductum* Prescott & Scott

*Figure 129.* *Euastrum sibiricum* var. *reductum*.
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum sublobatum* Brébisson ex Ralfs

Figure 130. *Euastrum sublobatum.*
**Order** Desmidiales

**Family** Desmidiaceae

**Genus** *Euastrum*

**Species** *Euastrum turneri* West

![Image of *Euastrum turneri*](image.png)

**Figure 131.** *Euastrum turneri.*
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum validum* West & West

Figure 132. *Euastrum validum.*
Order Desmidiales
Family Desmidiaceae
Genus Euastrum
Species Euastrum cf. validum var. glabrum f. inflatum Prescott

Figure 133.  *Euastrum cf. validum var. glabrum f. inflatum.*
Order Desmidiales
Family Desmidiaceae
Genus *Euastrum*
Species *Euastrum ventricosum* var. *rectangulare* Prescott & Scott

Figure 134. *Euastrum ventricosum* var. *rectangulare*. 

![Image of Euastrum ventricosum var. rectangulare](image-url)
**Groenbladia Teiling**

Cells are cylindrical and form filaments. The median constriction may be distinct and shallow or inconspicuous. The surface of the cell is smooth, and the filaments are often surrounded by a mucilaginous sheath. A single plate-like chloroplast is in each cell.

Only one species from this genus, *Groenbladia undulata* var. *perundulata*, was identified in samples from the refuge. It was found in all sites except the west perimeter site (fig. 135).

**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Groenbladia*  
**Species** *Groenbladia undulata* var. *perundulata* (Grönblad) Kurt Förster

![Figure 135. *Groenbladia undulata* var. *perundulata*.](image)
**Haplootaenium Bando**

Cells of this genus are straight and cylindrical. The midregion is slightly inflated and constricted, and the apices are round and unornamented. The cell wall lacks ornamentation and there is no terminal vacuole, which differentiate this genus from *Pleurotaenium*.

Two species and a total of four taxa were identified from the refuge (figs. 136–139). These cells were common and are one of the most common cell types found in periphyton mats (Swift and Nicholas, 1987).

**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Haplootaenium*  
**Species** *Haplootaenium minutum* (Ralfs) Bando

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**Figure 136. Haplootaenium minutum.**
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Haplotenium*  
**Species** *Haplotenium minutum var. crassum* (West) Cambra Sánchez

![Image of Haplotenium minutum var. crassum](image)

**Figure 137.** *Haplotenium minutum var. crassum.*
Order Desmidiales
Family Desmidiaceae
Genus *Haplotaenium*
Species *Haplotaenium minutum* var. *excavatum* (Ralfs) Bando

**Figure 138.** *Haplotaenium minutum* var. *excavatum*. 
Order Desmidiales
Family Desmidiaceae
Genus Haplotaenium
Species Haplotaenium rectum (Delponte) Bando

Figure 139. Haplotaenium rectum.
Hyalotheca Ehrenberg ex Ralfs

The cells of this genus are cylindrical and about as long as they are broad. They are slightly constricted, and rows of pores surround the cell near the apices. The chloroplast is axial and lobed.

Hyalotheca dissiliens was the only species of this genus found in the refuge (fig. 140). These cells were uncommon and typically found at the east and west interior sites.

Order Desmidiales
Family Desmidiaceae
Genus Hyalotheca
Species Hyalotheca dissiliens Brébisson ex Ralfs

Figure 140. Hyalotheca dissiliens.
**Micrasterias C. Agardh ex Ralfs**

Cells are large and laterally compressed. Each semicell has a polar lobe and one or more lateral lobes, which may be divided many times, depending on the species. Some cells are ornamented with spines or granules (fig. 141). There is one chloroplast per semicell that almost entirely fills the cell.

Fourteen *Micrasterias* taxa were identified in samples from the refuge (figs. 142–155). Most of the cells occurred at the east interior site, with none found at the west perimeter site.

![Figure 141](image)

**Figure 141.**  
A, *Micrasterias johnsonii* has two spines at the end of each lobe, as well as short rows of spines on the surface of the cell along the incisions.  
B, *Micrasterias mahabuleshwarensis* var. *ringens* f. *glabra* has granules along the margins of the cell.
Order Desmidiales
Family Desmidiaceae
Genus Micrasterias
Species Micrasterias abrupta West & G.S. West

Figure 142. Micrasterias abrupta.
Order Desmidiales
Family Desmidiaceae
Genus Micrasterias
Species Micrasterias alata Wallich

Figure 143. Micrasterias alata.
Order Desmidiales

Family Desmidiaceae

Genus Micrasterias

Species Micrasterias dichotoma Wolle

Figure 144. Micrasterias dichotoma.
Order Desmidiales
Family Desmidiaceae
Genus Micrasterias
Species Micrasterias foliacea Bailey ex Ralts

Figure 145. Micrasterias foliacea.
Order Desmidiales

Family Desmidiaceae

Genus *Micrasterias*

Species *Micrasterias furcata* C. Agardh ex Ralfs

Figure 146. *Micrasterias furcata.*
Order Desmidiales

Family Desmidiaceae

Genus *Micrasterias*

Species *Micrasterias furcata* var. *alata* (Prescott & A.M. Scott) K. Förster

Figure 147. *Micrasterias furcata* var. *alata*. 
Order Desmidiales
Family Desmidiaceae
Genus Micrasterias
Species Micrasterias johnsonii var. johnsonii f. bispinata Prescott & Scott

Figure 148. Micrasterias johnsonii var. johnsonii f. bispinata.
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** Micrasterias  
**Species** Micrasterias laticeps Nordstedt

Figure 149. *Micrasterias laticeps.*
Order Desmidiales
Family Desmidiaceae
Genus *Micrasterias*
Species *Micrasterias mahabuleshwarensis var. ringens f. glabra* Prescott & Scott

Figure 150. *Micrasterias mahabuleshwarensis var. ringens f. glabra*. 

10 μm
Order Desmidiales
Family Desmidiaceae
Genus Micrasterias
Species Micrasterias pinnatifida (Kützing) Ralfs

Figure 151. Micrasterias pinnatifida.
Order Desmidiales
Family Desmidiaceae
Genus *Micrasterias*
Species *Micrasterias radiosa* Ralfs

Figure 152. *Micrasterias radiosa.*
Order Desmidiales
Family Desmidiaceae
Genus *Micrasterias*
Species *Micrasterias radiosa* var. *elegantior* (G.S. West) Croasdale

Figure 153. *Micrasterias radiosa* var. *elegantior*. 
Order Desmidiales
  Family Desmidiaceae
  Genus *Micrasterias*
  Species *Micrasterias torreyi* Bailey ex Ralfs

Figure 154. *Micrasterias torreyi*. 
Order Desmidiales
Family Desmidiaceae
Genus *Micrasterias*
Species *Micrasterias truncata* Brébisson ex Ralfs

Figure 155. *Micrasterias truncata.*
**Phymatodocis Nordstedt**

Cells are asymmetric in all views and form filaments. The cells have a rectangular outline with rounded processes and a constriction between the semicells. The cell walls are covered with fine, dense pores. The single chloroplast in each semicell extends into the processes of the semicells.

Only one species of this genus was found in the refuge (figs. 156–157). These cells were not uncommon but tended to be found at more pristine sites like the east interior and east transition sites.

*Figure 156. Phymatodocis nordstedtiana* cell viewed from top. The fine pores on the cell walls and the four rounded processes are evident in this image.
Order Desmidiales
Family Desmidiaceae
Genus Phymatodocis
Species Phymatodocis nordstedtiana Wolle

Figure 157. Phymatodocis nordstedtiana.
Pleurotaenium Nägeli

Cells are straight and cylindrical. The base of each semicell is slightly inflated, divided by a shallow median constriction. The cell wall can be smooth, punctate, or have other surface features (fig. 158). The apices may have teeth or granules. Each cell has several chloroplasts and a large vacuole, often with granules, at the apex of each semicell.

Five Pleurotaenium species were found in the refuge (figs. 158–163). Pleurotaenium trabecula was the only species of this genus found at the west interior site.

Figure 158. A, Pleurotaenium trabecula has fine pores on the surface of the cell wall. B, Pleurotaenium constrictum has granules at the apex of each semicell and fine pores scattered along the cell wall. C, Pleurotaenium verrucosum has large, thin, rectangular areas that are smaller and more irregular at the base of the semicell.
Order Desmidiales
Family Desmidiaceae
Genus Pleurotaenium
Species Pleurotaenium constrictum (Bailey) H.C. Wood

Figure 159. *Pleurotaenium constrictum.*
Order Desmidiales
  Family Desmidiaceae
  Genus Pleurotaenium
    Species Pleurotaenium cf. maximum (Reinsch) Lundell

Figure 160. Pleurotaenium cf. maximum.
Order  Desmidiales
  Family  Desmidiaceae
  Genus  Pleurotaenium
  Species  Pleurotaenium subcoronulatum (Turner) West & West

Figure 161.  *Pleurotaenium subcoronulatum.*
Order Desmidiales
Family Desmidiaceae
Genus Pleurotaenium
Species Pleurotaenium trabecula (Ehrenberg) Nägeli

Figure 162. Pleurotaenium trabecula.
Order Desmidiales
Family Desmidiaceae
Genus Pleurotaenium
Species Pleurotaenium verrucosum (Ralfs) H.C. Wood

Figure 163. *Pleurotaenium verrucosum.*
Sphaerozosa Ralfs

Semicells reniform and form filaments. They are connected by two apical processes on opposite sides of the cell (fig. 164). The cell wall is smooth or can have rows of pores. The chloroplasts are axial and lobed.

*Sphaerozosa filiforme, Sphaerozosa laeve, and Sphaerozosa laeve var. latum* were found in the refuge (figs. 165–167). They were common at the east interior site and were not found in the west perimeter site.

![Figure 164](image)

*Figure 164.* This filament of *Sphaerozosa laeve* cells shows the apical processes that connect the cells together on opposite sides. Two of these processes are on each semicell.
Order Desmidiales
Family Desmidiaceae
Genus Sphaerozosma
Species Sphaerozosma filiforme Ralfs

Figure 165. *Sphaerozosma filiforme.*
Order Desmidiales
Family Desmidiaceae
Genus Sphaerozosma
Species Sphaerozosma laeve (Nordstedt) Thomasson

Figure 166. *Sphaerozosma laeve.*
Order Desmidiales
Family Desmidiaceae
Genus Sphaerozosma
Species Sphaerozosma laeve var. latum West & West

Figure 167. Sphaerozosma laeve var. latum.
Spinocosmarium Prescott & A.M. Scott

Cells are elliptical or semicircular with a deep constriction. The basal angles of the semicells have either a single spine or a pair of spines. The surface of the cell is often ornamented with granules or verrucae.

One species, Spinocosmarium quadridens, was identified in samples from the refuge (fig. 168). It was found at all sites except the west perimeter site.

Order Desmidiales
Family Desmidiaceae
Genus Spinocosmarium
Species Spinocosmarium quadridens (H. C. Wood) Prescott & A. M. Scott

Figure 168. Spinocosmarium quadridens.
**Spondylosium Brébisson ex Kützing**

Cells are variable in shape and size and form filaments, with the entire apex of each cell joined to the adjacent cell and always with a distinct constriction at the joining of the semicells. This separates *Spondylosium* from *Hyalotheca* or *Desmidium*. The cell surface is smooth, sometimes with fine pores.

Two species, *Spondylosium planum* and *Spondylosium pulchrum*, were identified in samples from the refuge (figs. 169–170). This genus was common at all sites except the west perimeter site.

**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Spondylosium*  
**Species** *Spondylosium planum* (Wolle) West & G.S. West

![Figure 169. Spondylosium planum.](image)
Order Desmidiales
Family Desmidiaceae
Genus *Spondylosium*
Species *Spondylosium pulchrum* (Bailey) W. Archer

Figure 170. *Spondylosium pulchrum.*
**Staurastrum Meyen ex Ralfs**

Cell shape and size are variable. In most species, the cell is drawn out into two or more processes, lobes, or spines. The cell wall can have granules, verrucae, spines, or pores. The processes can also be ornamented (fig. 171). The chloroplast is axial and extends to each angle of the cell.

Fifty-six taxa from this genus were identified in samples from the refuge (figs. 172–227). Some of the more common species were *Staurastrum connatum* var. *isthmosum*, *Staurastrum inconspicuum*, and *Staurastrum tetracerum*. Some species were very rare, such as *Staurastrum arctiscon* var. *truncatum* and *Staurastrum tohopekaligense*. While only some species from this genus were found at the west perimeter site, they were all considered common in the samples and found at other sites in the refuge.

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**Figure 171.**  
A, *Staurastrum grallatorium* has arms that are ornamented down the length and tipped with three teeth, as well as apical verrucae.  
B, *Staurastrum magnottae* var. *biradiatum* has two pairs of diverging spines on opposite sides of each semicell. The margins of the cell are also ornamented with verrucae.  
C, *Staurastrum striolatum* has rounded lobes, which are covered in small granules arranged in concentric circles around each lobe.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum anatinum* Cooke & Wills

Figure 172. *Staurastrum anatinum.*
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum anatinum var. truncatum West
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum anchora West & G.S. West

Figure 174. *Staurastrum anchora.*
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum cf. ankyroides var. pentacladum G.M. Smith

Figure 175. *Staurastrum* cf. *ankyroides* var. *pentacladum*. 
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum arachne var. gyrans (L.N. Johnson) A.M. Scott & Grönblad

Figure 176. Staurastrum arachne var. gyrans.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum arctiscon* var. *truncatum* Irénée-Marie

Figure 177. *Staurastrum arcticosum* var. *truncatum*. 
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*

Species *Staurastrum brachioprominens* var. *ventricosum* Scott & Grönblad

Figure 178. *Staurastrum brachioprominens* var. *ventricosum.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum brasiliense* var. *lundellii* West & G.S. West

Figure 179. *Staurastrum brasiliense* var. *lundellii*. 
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum capitulum Brébisson

Figure 180.  Staurastrum capitulum.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum cerastes* Lundell

Figure 181. *Staurastrum cerastes.*
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum connatum var. isthmosum A.M. Scott & Grönblad

Figure 182. *Staurastrum connatum* var. *isthmosum*. 
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species *Staurastrum depressiceps* A.M. Scott & G.L. Grönblad

![Staurastrum depressiceps](image)

**Figure 183.** *Staurastrum depressiceps.*
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum dilatatum (Ehrenberg) Ralfs

Figure 184. Staurastrum dilatatum.
Order Desmidiales

Family Desmidiaceae

Genus *Staurastrum*

Species *Staurastrum geminatum* Nordstedt

**Figure 185.** *Staurastrum geminatum.*
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum grallatorium Nordstedt

Figure 186. *Staurastrum grallatorium.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum grallatorium* var. *forcipigerum* Lagerheim

Figure 187. *Staurastrum grallatorium* var. *forcipigerum*. 
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum hystrix* Ralfs

Figure 188. *Staurastrum hystrix*. 
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum inconspicuum Nordstedt

Figure 189. Staurastrum inconspicuum.
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum iotanum Wolle

Figure 190. Staurastrum iotanum.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum johnsonii* var. *bifurcatum* Scott & Grönblad

Figure 191. *Staurastrum johnsonii* var. *bifurcatum*. 
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum laeve* var. *latidivergens* Scott & Grönblad

**Figure 192.** *Staurastrum laeve* var. *latidivergens.*
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Staurastrum*  
**Species** *Staurastrum lativenter* Scott & Grönblad

*Figure 193.* *Staurastrum lativenter.*
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum leptacanthum var. brachycerum Scott & Grönblad

Figure 194. *Staurastrum leptacanthum* var. *brachycerum*.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum leptocladum* var. *cornutum* Wille

Figure 195. *Staurastrum leptocladum* var. *cornutum*. 
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*

Species *Staurastrum leptocladum* var. *sinuatum* f. *planum* G.M. Smith

Figure 196. *Staurastrum leptocladum* var. *sinuatum* f. *planum*.
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum longebrachiatum f. inflatum Scott & Grönblad

Figure 197. Staurastrum longebrachiatum f. inflatum.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum magnottae* var. *biradiatum* A.M. Scott & Grönblad

Figure 198. *Staurastrum magnottae* var. *biradiatum*. 
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum minnesotense* Wolle

Figure 199. *Staurastrum minnesotense.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum neglectum* G.S. West

Figure 200. *Staurastrum neglectum.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum nova-caesareae* Wolle

*Figure 201. Staurastrum nova-caesareae.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum octodontum* var. *tetrodontum* A.M. Scott & Grönblad

*Figure 202. Staurastrum octodontum* var. *tetrodontum.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum cf. octoverrucosum* A.M. Scott & Grönblad

Figure 203. *Staurastrum cf. octoverrucosum.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum orbiculare* var. *denticulatum* Nordstedt

Figure 204. *Staurastrum orbiculare* var. *denticulatum*.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum pingue* var. *evolutum* (W. West & G.S. West) G.W. Prescott

Figure 205. *Staurastrum pingue* var. *evolutum*. 
**Order** Desmidiales

**Family** Desmidiaceae

**Genus** *Staurastrum*

**Species** *Staurastrum cf. pinnatum var. floridense* A.M. Scott & Grönblad

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**Figure 206.** *Staurastrum cf. pinnatum var. floridense.*
Order Desmidiales

Family Desmidiaceae

Genus *Staurastrum*

Species *Staurastrum pinnatum* var. *reductum* Krieger

Figure 207. *Staurastrum pinnatum* var. *reductum*. 
Order Desmidiales

Family Desmidiaceae

Genus *Staurastrum*

Species *Staurastrum polytrichum* (Perty) Rabenhorst

Figure 208.  *Staurastrum polytrichum.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum pseudoneglectum* Scott & Grönblad

Figure 209. *Staurastrum pseudoneglectum.*
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum quadrangulare Brébisson

Figure 210. *Staurastrum quadrangulare.*
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum radians West & West

Figure 211. Staurastrum radians.
Order Desmidiales

Family Desmidiaceae

Genus *Staurastrum*

Species *Staurastrum rotula* Nordstedt

Figure 212. *Staurastrum rotula.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum sebaldi* Reinsch

Figure 213. *Staurastrum sebaldi.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*

Species *Staurastrum striolatum* (Nägeli) W. Archer
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum subpygmaeum var. spiniferum A.M. Scott & Grönblad

Figure 215. Staurastrum subpygmaeum var. spiniferum.
Order Desmidiales
Family Desmidiaceae
Genus Staurastrum
Species Staurastrum tetracerum Ralfs ex Ralfs

Figure 216. *Staurastrum tetracerum.*
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Staurastrum*  
**Species** *Staurastrum tohopekaligense* Wolle

**Figure 217.** *Staurastrum tohopekaligense.*
Order Desmidiales

Family Desmidiaceae

Genus *Staurastrum*

Species *Staurastrum trifidum* var. *inflexum* West & West

*Figure 218. Staurastrum trifidum* var. *inflexum.*
**Order** Desmidiales

**Family** Desmidiaceae

**Genus** Staurastrum

**Species** Staurastrum turgescens var. sparsigranulatum Scott & Grönblad

*Figure 219.*  Staurastrum turgescens var. sparsigranulatum.
Order  Desmidiales
   Family  Desmidiaceae
   Genus  Staurastrum
   Species  Staurastrum vestitum Ralfs

Figure 220.  Staurastrum vestitum.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum* sp.

Figure 221. *Staurastrum* sp.
Order Desmidiales
  Family Desmidiaceae
  Genus *Staurastrum*
  Species *Staurastrum* sp.

Figure 222. *Staurastrum* sp.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum* sp.

Figure 223. *Staurastrum* sp.
Order Desmidiales
  Family Desmidiaceae
  Genus Staurastrum
  Species Staurastrum sp.

Figure 224. Staurastrum sp.
Order Desmidiales
  Family Desmidiaceae
  Genus Staurastrum
  Species Staurastrum sp.

Figure 225. Staurastrum sp.
Order Desmidiales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum* sp.

Figure 226. *Staurastrum* sp.
Order Desmidales
Family Desmidiaceae
Genus *Staurastrum*
Species *Staurastrum* sp.

**Figure 227.** *Staurastrum* sp.
Cells are usually deeply constricted and vary in shape. Each angle of the semicell has a single spine, the key characteristic separating this genus from *Staurastrum*. The surface of the cell wall can have fine pores or granules. The chloroplast is axial and extends to each angle of the cell.

Twelve *Staurodesmus* taxa were identified in samples from the refuge (figs. 228–239). Only one, *Staurodesmus convergens* var. *laportei*, was found at the west perimeter site.

**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Staurodesmus*  
**Species** *Staurodesmus convergens* Ehrenberg ex Ralfs

![Figure 228. *Staurodesmus convergens.*](image)
Order Desmidiales
Family Desmidiaceae
Genus Staurodesmus
Species Staurodesmus cuspidatus (Brébisson) Teiling

Figure 229. *Staurodesmus cuspidatus.*
Order Desmidiales
Family Desmidiaceae
Genus Staurodesmus
Species Staurodesmus cuspidatus var. curvatus (West) Teiling

Figure 230. *Staurodesmus cuspidatus var. curvatus.*
Order Desmidiales
Family Desmidiaceae
Genus Staurodesmus
Species Staurodesmus dejectus (Brébisson) Teiling

Figure 231. *Staurodesmus dejectus.*
Order Desmidiales
Family Desmidiaceae
Genus Staurodesmus
Species Staurodesmus dickiei (Ralfs) S. Lillieroth

Figure 232. *Staurodesmus dickiei.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurodesmus*
Species *Staurodesmus glaber* (Ralfs) Teiling

Figure 233. *Staurodesmus glaber.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurodesmus*
Species *Staurodesmus maximus* (Borge) Teiling

**Figure 234.** *Staurodesmus maximus.*
**Order** Desmidiaceae  
**Family** Desmidiaceae  
**Genus** *Staurodesmus*  
**Species** *Staurodesmus octocornis* (Ehrenberg ex Ralfs) Stastny, Skaloud & Neustupa

*Figure 235.* *Staurodesmus octocornis.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurodesmus*
Species *Staurodesmus* cf. *omearae* (W. Archer) Teiling

Figure 236. *Staurodesmus* cf. *omearii.*
Order Desmidiales
Family Desmidiaceae
Genus *Staurodesmus*

Species *Staurodesmus pachyrhynchus* (Nordstedt) Teiling

Figure 237. *Staurodesmus pachyrhynchus.*
Order Desmidiales
Family Desmidiaeae
Genus Staurodesmus
Species Staurodesmus pachyrhynchus var. pseudopachyrhynchum (Wolle) Teiling

Figure 238. Staurodesmus pachyrhynchus var. pseudopachyrhynchum.
Order Desmidiales
Family Desmidiaceae
Genus *Staurodesmus*
Species *Staurodesmus subulatus* (Kützing) Croasdale

**Figure 239.** *Staurodesmus subulatus.*
**Teilingia Bourrelly**

Cells of this genus form filaments. They are distinguished from *Spondylosium* cells by small granules at the apex of the cell and may not appear attached along the entire apex where two cells met (fig. 240). The cells are typically small with axial chloroplasts.

Two taxa, *Teilingia granulata* and *Teilingia quadrispinata f. evoluta*, were identified in samples from the refuge (figs. 241–242). Both taxa were only found at the east interior, west interior, and east transition sites.

![Figure 240](image)

**Figure 240.** *A*, *Teilingia quadrispinata f. evoluta* and *B*, *Teilingia granulata* both have apical granules (AG) which can be seen in both images.
Order Desmidiales
Family Desmidiaceae
Genus Teilingia
Species Teilingia granulata (J. Roy & Bisset) Bourrelly

Figure 241. *Teilingia granulata.*
Order Desmidiales
Family Desmidiaceae
Genus Teilingia
Species Teilingia quadrispinata f. evoluta (Scott & Grönblad) Croasdale

Figure 242. Teilingia quadrispinata f. evoluta.
**Tetmemorus Ralfs ex Ralfs**

Cells are cylindrical with an apical incision. Pores are often visible on the cell’s surface (fig. 243) and can be evenly distributed or arranged in lines across the cell.

Two species of this genus, *Tetmemorus brebissonii* and *Tetmemorus granulatus*, were identified in samples from the refuge (figs. 244–245). Both species were only found at the east and west interior sites.
Order Desmidiales
Family Desmidiaceae
Genus *Tetmemorus*
Species *Tetmemorus brebissonii* (Menegh.) Ralfs

Figure 244. *Tetmemorus brebissonii.*
**Order** Desmidiales  
**Family** Desmidiaceae  
**Genus** *Tetmemorus*  
**Species** *Tetmemorus granulatus* Brébisson ex Ralfs

Figure 245. *Tetmemorus granulatus*. 
Triploceras (Bailey ex Ralfs) Bailey

Cells are solitary, with two polar lobes tipped with spines at the apex. The cells have very little incision in the midregion and are slightly tapered. The cell has whorls of processes that are tipped with spines or teeth.

Two species and three taxa of this genus were identified in samples from the refuge (figs. 246–248). This genus was found at all sites except the west perimeter site.

Order Desmidiales
Family Desmidiaceae
Genus Triploceras
Species Triploceras gracile Bailey

Figure 246. Triploceras gracile.
Order Desmidiales
Family Desmidiaceae
Genus Triploceras
Species Triploceras gracile var. bispinatum Taylor

Figure 247. *Triploceras gracile* var. *bispinatum*. 
Order Desmidiales
Family Desmidiaceae
Genus Triploceras
Species Triploceras verticillatum (Bailey) Bailey

Figure 248. Triploceras verticillatum.
**Xanthidium Ehrenberg ex Ralfs**

Cells are solitary and deeply constricted. Each angle of the cell has two spines (fig. 249). The cell wall is often thickened in the midregion and can sometimes be ornamented with granules, spines, or verrucae in this region.

Eight taxa from this genus were identified, as well as one that could only be identified to the genus (figs. 250–257). In the refuge, these cells were commonly found at the east and west interior sites and very rarely found at the west perimeter site.

**Figure 249.**  
*A, Xanthidium antilopaeum var. incrassatum* has a thickened midregion devoid of the fine pores that cover the rest of the cell wall. *Xanthidium antilopaeum* is an incredibly variable species, and three taxa of this species were found in the refuge.  
*B, Xanthidium armatum* cells can have a central area containing bifurcate teeth or spines.
Order Desmidiales
  Family Desmidiaceae
  Genus *Xanthidium*
  Species *Xanthidium antilopaeum* Kützing

Figure 250. *Xanthidium antilopaeum.*
Order Desmidiales
Family Desmidiaceae
Genus *Xanthidium*
Species *Xanthidium antilopaeum* var. *incrassatum* (Grönblad) Förster

Figure 251. *Xanthidium antilopaeum* var. *incrassatum*. 
Order Desmidiales
Family Desmidiaceae
Genus *Xanthidium*
Species *Xanthidium antilopaeum* var. *polymazum* Nordstedt

Figure 252. *Xanthidium antilopaeum* var. *polymazum*. 
Order Desmidiales
Family Desmidiaceae
Genus Xanthidium
Species Xanthidium armatum Brébisson ex Ralfs

Figure 253. Xanthidium armatum.
Order Desmidiales
Family Desmidiaceae
Genus *Xanthidium*
Species *Xanthidium concinnum* Archer
Order Desmidiales

Family Desmidiaceae

Genus *Xanthidium*

Species *Xanthidium cristatum* var. *scrobiculatum* A.M. Scott & Grönblad

Figure 255. *Xanthidium cristatum* var. *scrobiculatum*. 
Order Desmidiales
Family Desmidiaceae
Genus Xanthidium
Species Xanthidium smithii W. Archer

Figure 256. *Xanthidium smithii.*
Order Desmidiales
Family Desmidiaceae
Genus Xanthidium
Species *Xanthidium wewahitchkense* Scott & Grönblad

**Figure 257.** *Xanthidium wewahitchkense.*
Gonatozygon De Bary

Cells can be solitary or in filaments (fig. 258). The cell is always cylindric, though the apices may vary in shape. The cell wall can be smooth or covered with granules or spines. One chloroplast is in each semicell, and it can vary in shape among species.

Three species of Gonatozygon were identified in samples from the refuge (figs. 259–261). Of these, Gonatozygon monotaenium was common and tended to form filaments of two or more cells. Gonatozygon brebissonii was only found as solitary cells and only at the east interior and east transition sites. Gonatozygon aculeatum was very rare and only found at the east interior site.

Figure 258. This Gonatozygon monotaenium filament is made up of three cells, connected at the apices.
Order Desmidiales
Family Desmidiaceae
Genus Gonatozygon
Species Gonatozygon aculeatum W.N. Hastings

Figure 259. Gonatozygon aculeatum.
Order Desmidiales
Family Desmidiaceae
Genus Gonatozygon
Species Gonatozygon brebissonii De Bary

Figure 260. Gonatozygon brebissonii.
Order Desmidiales

Family Desmidiaceae

Genus Gonatozygon

Species Gonatozygon monotaenium De Bary

Figure 261. Gonatozygon monotaenium.
**Penium Brébisson ex Ralfs**

Cells are solitary and cylindrical. The cells have no distinct isthmus (fig. 262A) and can have girdle bands (fig. 262B). The cell is often ornamented and can appear brown from iron deposits. One chloroplast is in each semicell, and it is typically axial.

Three different species of *Penium* were identified in samples from the refuge (figs. 263–265). All the species were rare and typically found at the east interior site.

![Figure 262.](image)

**Figure 262.**  
A, This *Penium exiguum* cell has iron deposits that make the cell wall appear brown. B, Girdle cells and a punctate cell wall are visible in this *Penium cf. didymocarpum* cell.
Order Desmidiales
Family Peniaceae
Genus Penium
Species Penium cf. didymocarpum Lundell

Figure 263. Penium cf. didymocarpum.
Order Desmidiales
Family Peniaceae
Genus Penium
Species *Penium exiguum* West

**Figure 264.** *Penium exiguum.*
**Order** Desmidiales

**Family** Peniaceae

**Genus** *Penium*

**Species** *Penium* cf. *margaritaceum* Brébisson

*Figure 265.* *Penium* cf. *margaritaceum.*
**Cylindrocystis Meneghini ex De Bary**

Cells are solitary and cylindric. The cell is not constricted, and the cell wall is smooth. Each cell has one to two stellate or asteroid chloroplasts (fig. 266). Reproductive characteristics are often required to identify species.

Based on the vegetative characteristics of the cells, three distinct *Cylindrocystis* taxa were identified in the samples (figs. 267–269). These cells were only found at the east interior, west interior, and east transition sites of the refuge and were not common at any of these sites.

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**Figure 266.**  
*A* A wide-green image of *Cylindrocystis* sp. shows the stellate shape of the chloroplast inside the cell.  
*B* A light microscopy image of the same cell.
Order Zygnematales
Family Mesotaeniaceae
Genus Cylindrocystis
Species Cylindrocystis sp.

Figure 267. Cylindrocystis sp.
Order Zygnematales
Family Mesotaeniaceae
Genus Cylindrocystis
Species Cylindrocystis sp.

Figure 268. Cylindrocystis sp.
Order Zygnematales
Family Mesotaeniaceae
Genus Cylindrocystis
Species Cylindrocystis sp.

Figure 269. Cylindrocystis sp.
**Spirotaenia Brébisson ex Ralfs**

Cells are elongate and solitary and vary in size and shape. The cell wall is smooth and unconstricted. A single twisting parietal chloroplast extends the entire length of the cell and makes at least one turn.

Only one species, *Spirotaenia minuta*, was identified in samples from the refuge (fig. 270). This species was exceedingly rare and was only found in two samples: one from the east interior site and one from the west transition site.

**Order** Zygmematales  
**Family** Mesotaeniaceae  
**Genus** *Spirotaenia*  
**Species** *Spirotaenia minuta* Thuret

![Image of Spirotaenia minuta](image)

**Figure 270.** *Spirotaenia minuta.*
**Tortitaenia Brook**

Cells are solitary and taper to the apices. The cell wall is smooth and unconstricted. In each cell, a single axial chloroplast with twisted ridges runs along the length of the cell.

Only one species, *Tortitaenia obscura*, was identified in samples from the refuge (fig. 271). This species was very rare and was only found at the east interior and west transition sites.

**Order** Zygnematales  
**Family** Mesotaeniaceae  
**Genus** Tortitaenia  
**Species** *Tortitaenia obscura* (Ralfs) Brook

![Figure 271. *Tortitaenia obscura* (2 cells).](image)
**Netrium (Nägeli) Itzigsohn & Rothe**

Cells are straight and at least two times longer than broad. The cell wall is smooth and the midregion is not constricted. One stellate chloroplast is in each semicell.

Three species from this genus were identified in samples from the refuge (figs. 272–274). *Netrium digitus* was the most common species of the three and was found often at the east interior, west interior, and east transition sites. *Netrium lamellosum* and *Netrium oblongum* var. *cylindricum* were rare and only found at the east interior site.

**Order** Zygnematales  
**Family** Mesotaeniaceae  
**Genus** Netrium  
**Species** *Netrium digitus* (Brébisson ex Ralfs) Itzigsohn & Rothe

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**Figure 272.** *Netrium digitus.*
Order Zygnematales
Family Mesotaeniaceae
Genus Netrium
Species Netrium lamellosum (Brébisson) Lütkemüller

Figure 273. *Netrium lamellosum.*
Order Zygnematales
Family Mesotaeniaceae
Genus *Netrium*

Species *Netrium oblongum* var. *cylindricum* West & West

Figure 274. *Netrium oblongum* var. *cylindricum*.
References


