MICROORGANISMS: THE FOUNDATION OF AQUATIC ECOSYSTEMS IN A NORTHWEST U. S. CITY'S PARKS: A SNAPSHOT OF THE INVISIBLE WORLD. PART 3: FRESHWATER RESULTS.

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The freshwater sites: Goodhope Pond at Pine Ridge Park, Edmonds Marsh and Willow Creek in Edmonds, Washington, varied fairly drastically in the number of species found, with Goodhope Pond having the largest variety and Willow Creek the least. All sites did provide a fair number of specimens.

Diatoms were probably the easiest for us to identify, at least to genus. The samples from freshwater had similar, if not identical, floras to each other. Living *Pinnularia*, *Diatoma*, *Gomphonema*, *Navicula*, *Nitzschia*, *Stauroneis*, *Ulnaria* and others, filled some samples from freshwater. Unfortunately, none of these have common names. They exist primarily as floating cells or strings of cells, slime on rocks and vegetation, epiphytes on algae, or crawling encased cells on various substrates. Although invisible to the naked eye individually, they are virtually everywhere in water, mud, soil or aquatic plant surfaces.

However, unlike the salt water site, diatoms were not always dominant, especially in Goodhope Pond, which had a large number of other organisms, including ciliates, flagellates, green algae, desmids, and occasional rotifers. An earlier (late March) preliminary sample at Goodhope Pond also included a planarian and a chironomid larva. The pond is now often seasonal and when full usually has a population of ducks, mallards being the most abundant species. This causes a large bloom of several species of *Spirogyra* and other green algae.

Our sample site at Edmonds Marsh did have a large number of diatoms, but may have been somewhat atypical as in mid-marsh there were obvious bright green mats of *Spirogyra* and probably other green algae. Diatoms dominated there and at Willow Creek. *Navicula* spp. were common, other freshwater genera were abundant in the samples as well.

Most of the microorganisms that we found are necessary components of their ecosystem, forming the near bottom of the food pyramid, but occasionally, often because of human activity, organisms that are not so benign take over and may cause major problems, such as red tides in salt water or eutrophic conditions in freshwater. That said, most microorganisms are beneficial to their particular ecosystem and for that reason alone we should be very careful what we dump into streams, lakes and ponds.

Following is a photographic sampling of our results. These are followed with tables of the species found that we were able to at least place in some taxonomic category, usually at least to genus. These are, of course, not definitive of the biota, being only snapshot samples on only two dates during the year and only on subsamples examined under the microscope. We identified the material based on standard texts and checked the names, when possible, against current names on the internet. We also, as noted in our first article, got some help from both iNaturalist and Diatom Forum members. Our identifications are however tentative and we would be happy to get corrections.

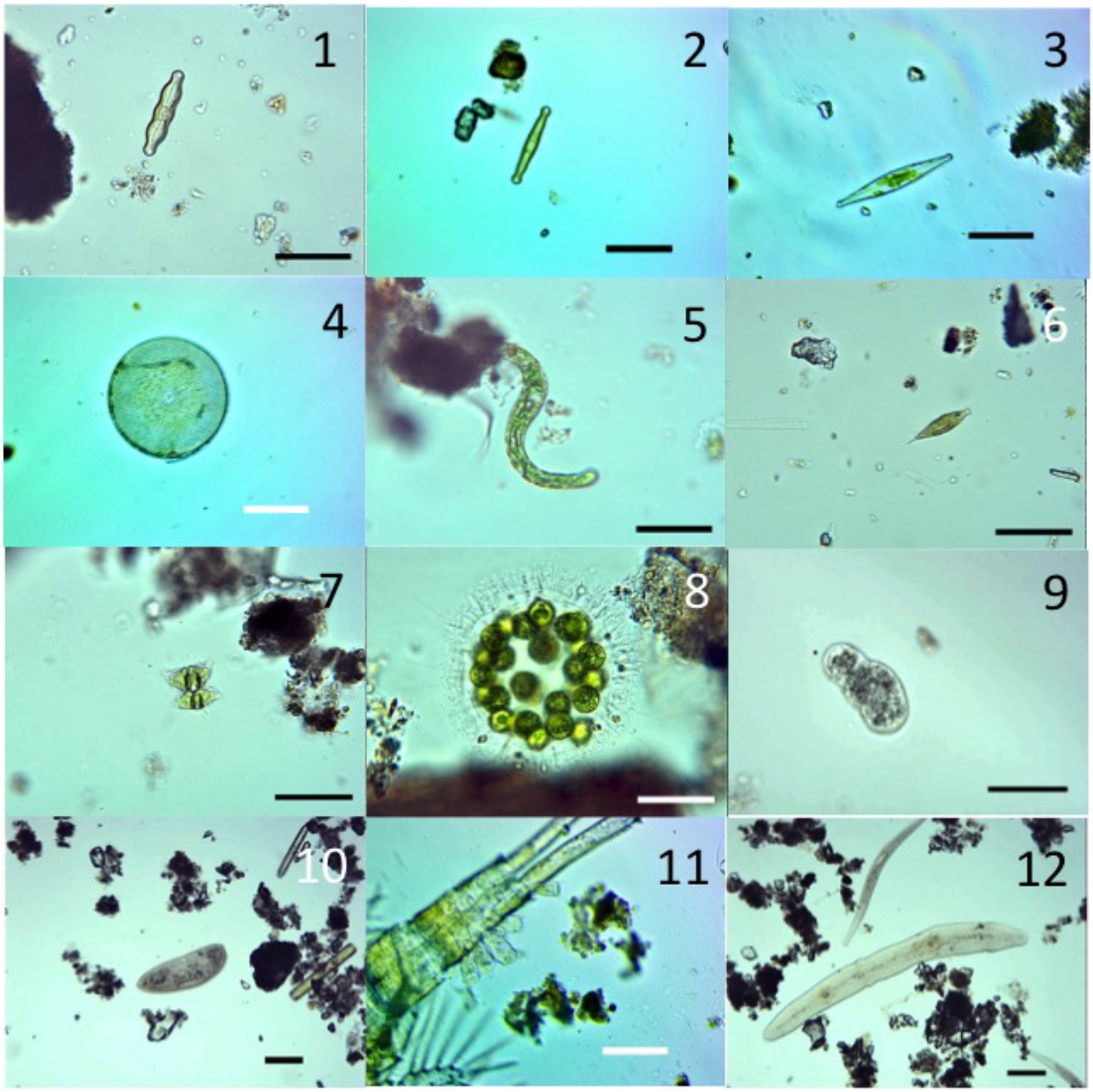

Plate 1. Goodhope Pond, Pine Ridge Park. Representative Microorganisms. May 12, 2021: Fig. 1. Diatom: *Neidium* Sp. Fig. 2. Diatom: *Pinnularia nodosa* Fig. 3. Diatom: *Stauroneis* sp. Fig. 4. Diatom: *Thalassiosira* sp.? Fig. 5. Flagellate: *Euglena* sp. Fig. 6. Flagellate: *Leptocinclis acus* Fig. 7. Desmid: *Staurastrum* sp. Fig. 8. Chlorophycean green alga: *Eudorina* sp. Fig. 9. Amoeba: Unknown genus Fig. 10. Ciliate: Unknown genus Fig. 11. Ciliate: *Vorticella*? On dead copepod Fig. 12. Flatworm: Catenulida sp. and ciliate *Spirostomum* sp. Scale bars Fig. 1-9 = 50 µm. 10-12 = 100 µm.

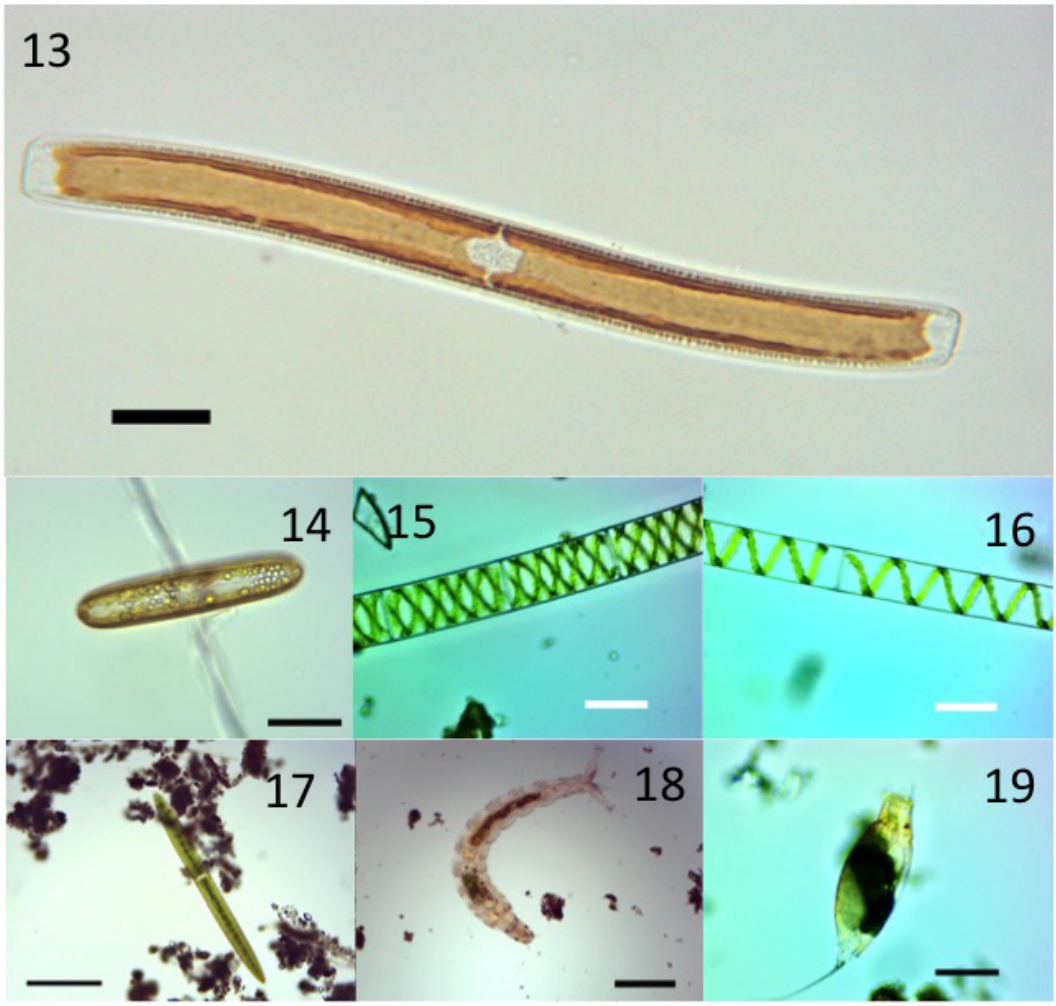

Plate 2. Goodhope Pond, Pine Ridge Park. Representative Microorganisms. June 26, 2021: Fig. 13. Diatom: *Nitzschia sigmoidea* Fig. 14. Diatom: *Pinnularia* sp. Fig. 15. Green Alga: *Spirogyra* sp. 2 Fig, 16: Green Alga: *Spirogyra* sp. 3. Fig. 17. Desmid: *Closterium acerosum* Fig. 18. Chironomid larva Fig. 19. Rotifer: *Trichocerca* sp. Scale bars Fig. 13-14 = 50 µm, Fig. 15 = 200 µm Fig. 16-19 = 100 µm.

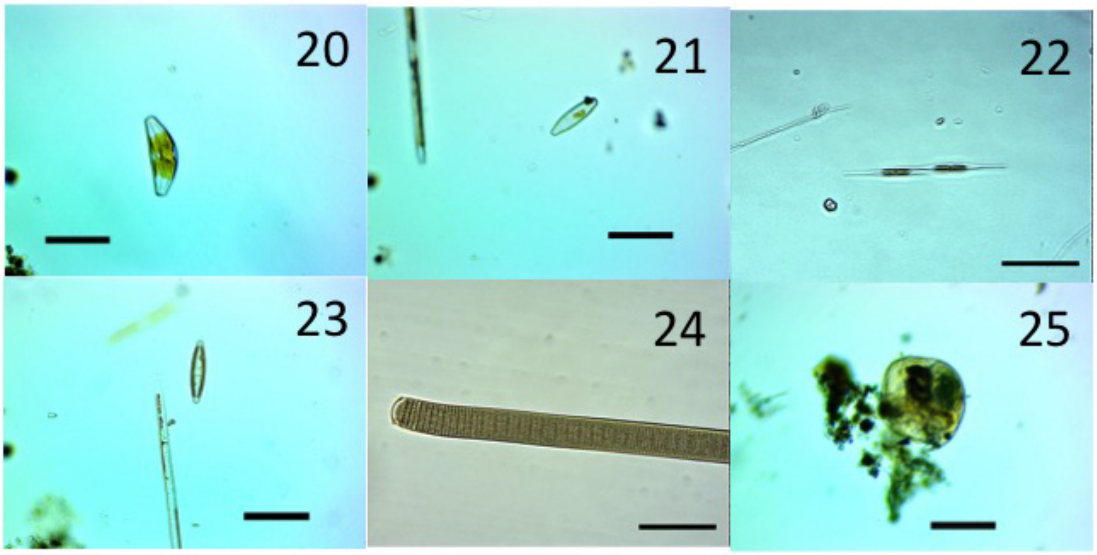

Plate 3. Edmonds Marsh. Representative Microorganisms. May 12, 2021: Fig. 20. Diatom: *Cymbella* sp. Fig. 21. Diatom: *Diatoma* sp. Fig. 22. Diatom: *Nitzschia* sp. Fig. 23. Diatom: *Navicula* sp. 1 Fig. 24. Cyanobacteria: *Oscillatoria* sp. Fig. 25. Cladocera: Chydorinae water flea. Scale bars Fig. 20-24 = 50 µm, Fig. 25 = 100 µm.

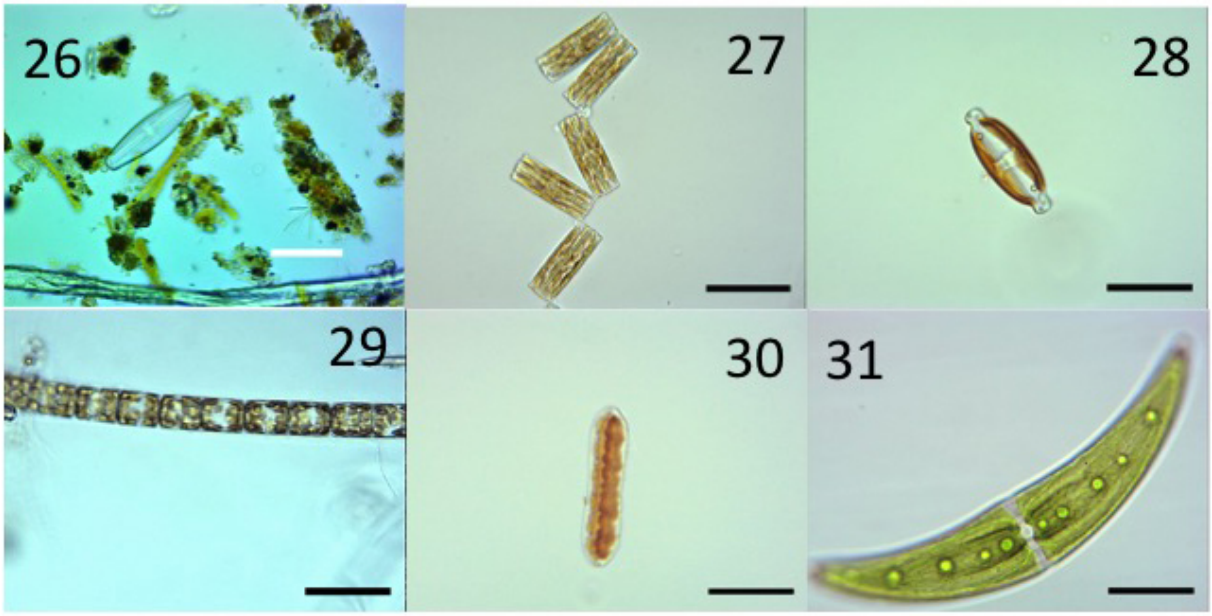

Plate 4. Edmonds Marsh. Representative Microorganisms. June 26, 2021. Fig. 26. Diatom: *Navicula* sp. 2 Fig. 27. Diatom: *Diatoma* sp. (girdle view) Fig. 28. Diatom: *Stauroneis* sp. Fig. 29. Diatom: *Melosira* sp., Fig. 30. Diatom: *Surirella* (*librile*?) valve view Fig. 31. Desmid. *Closterium* sp. Scale bars = 50 µm.

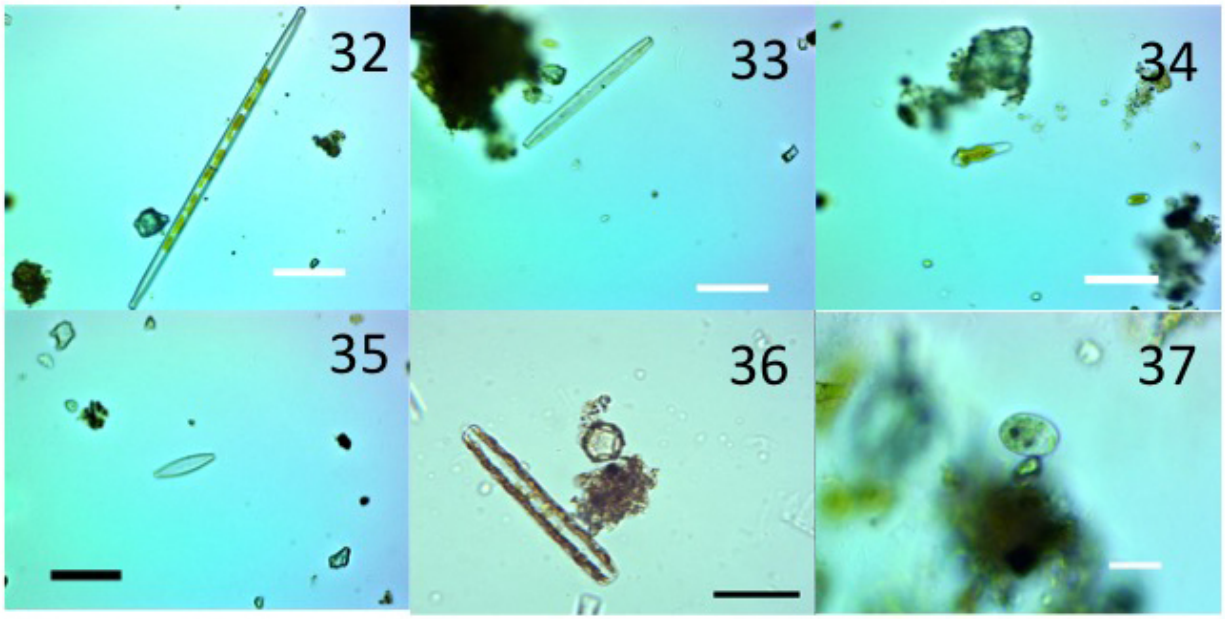

Plate 5. Willow Creek. Representative Microorganisms, May 12 and June 26, 2021. Fig. 32. Diatom: *Ulnaria ulna* (May 12) Fig. 33. Diatom: *Tabularia* sp. (June 26) Fig. 34. Diatom: *Gomphonema acuminata* (June 26) Fig. 35. Diatom: *Navicula* sp. 3. (June 26) Fig. 36. Diatom: Unknown (June 26) Fig. 37. Ciliate from pool near creek taken in April 2021 in preliminary sample. Scale bars = 50 µm.

Goodhope Pond, Pine Ridge Park, May 12, 2021

Diatoms
Neidium sp.?
Navicula sp.
Nitzschia sp.
Pinnularia nodosa
Pinnularia sp.1
Pinnularia sp.2
Stauroneis sp. 1
Stauroneis sp. 2
Thalassiosira sp.?

Green algae
Eudorina sp.
Mougeotia sp.
Spirogyra sp. 1
Spirogyra sp. 2
Ulothrix sp.
Zygnema sp.

Golden algae
Synura sp.

Desmids
Closterium moniliferum
Closterium sp.
Staurastrum controversum

Euglenoids
Astasia sp.
Euglena sp.
Lepocinclis acus
Phacus stokesii
Trachelomonas armata
Trachelomonas sp.

Amoeba
Unknown amoeba

Ciliates
Unknown large ciliate
Spirostomum sp.
Vorticella sp.

Rotifers
Beauchampiella eudactylota?

Platyhelminths (flat worms)
Catenulida sp.

Cladocera

Daphnia sp.
Bosmina sp.

Copepod
Unknown nauplius

Amphipod
Unknown amphipod

Goodhope Pond, Pine Ridge Park, June 26, 2021

Diatoms
Navicula sp.
Nitzschia sigmoidea
Pinnularia spp.
Stauroneis spp.

Green algae
Spirogyra sp. 2
Spirogyra sp. 3
Mougeotia sp.
Ulothrix sp.

Desmids
Closterium acerosum
Closterium strialatum
Closterium aciculare
Pleurotaenium trabecula

Euglenoids
Euglena sp.

Rotifers
Trichocera sp.

Diptera
Chironomid larva.

Edmonds Marsh, May 12, 2021

Cyanobacteria
Oscillatoria sp.

Diatoms
Melosira varians
Cymbella sp.
Diatoma sp.
Gomphonema sp.
Navicula sp.
Nitzschia sp.
Pinnularia sp.
Ulnaria ulna

Desmids
Closterium moniliferum

Cladocera
Chydoridae water flea

Edmonds Marsh, June 26, 2021

Cyanobacteria
Oscillatoria sp.

Diatoms
Melosira varians
Melosira undulata
Surirella librile
Navicula sp.
Diatoma sp.

Desmids
Closterium sp.

Willow Creek, May 12, 2021

Cyanobacteria
Oscillatoria sp.

Diatoms
Diatoma sp.
Melosira varians
Melosira undulata
Navicula sp.
Surirella librile

Desmids
Closterium sp.

Willow Creek, June 26, 2021.

Cyanobacteria
Oscillatoria sp.

Diatoms
Melosira varians
Nitzschia longissima
Nitzschia sp.
Navicula sp. 1
Surirella librile
Ulnaria ulna

Desmids
Closterium sp.

Euglenoids
Ploetia sp.
Astasia sp.

Part 1 and part 2 can be read in the September and October issues.

Comments to the two authors welcomed via David B. Richman, email – tithonia65 AT gmail DOT com.

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