Visual Guide to Benthic Cyanobacteria Blooms

I. Background

Cyanobacteria live in nearly every aquatic habitat. Some cyanobacteria are capable of producing a variety of toxins, such as neurotoxins, liver toxins, kidney toxins, and reproductive toxins. Collectively known as "cyanotoxins," these compounds can cause numerous health effects in humans and animals (wildlife, dogs, etc.) that range from skin rash and vomiting to nerve damage and, in some circumstances, death. Cyanobacteria can quickly grow during favorable conditions (typically high nutrients and high temperatures), and in some cases can produce toxins.

Please photograph and report heavy growths in streams (or lakes) that could be cyanobacteria blooms.

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This guide contains images of the three most common groups of algae in streams.

II. Benthic Cyanobacteria

While harmful algal blooms (HABs) are caused by algae or cyanobacteria that grow suspended in the water column (planktonic), some algae grow attached to the bottom (benthic). Benthic cyanobacteria can form dense growths that appear as films along the bottom that may become detached and float to the surface. The color of these growths is diverse, ranging from vibrant yellow-green, drab olive, to burgundy and dusky brown or black. The form of growth may look fuzzy (but no long strands), form hollow orbs, or grow in leathery mats with veins or ribs. Mats may also include mixtures of cyanobacteria and other non-toxic algae. Mats of cyanobacteria do not always contain toxins, but it's best to be cautious if you suspect cyanobacteria are present in large numbers. Avoid skin contact, as some people experience rashes. Do not drink water or allow pets to drink water, and wash hands thoroughly with drinkable water before handling food to avoid ingesting toxins. Avoid splashing or getting water in your eyes, ears, nose or mouth.

Only lab tests can determine if toxins are present within a mat. Field tests can be used to identify if species of algae capable of producing toxins are present. All species of benthic toxic algae have the same abilities to control their buoyancy, the "Jar Test" is a good field method to determine if you are looking at a species of toxic algae or something else (see AD P-14 Attachment 2 for more information).

In general, benthic toxic algal mats are:

- Brown, tan or green in color
- Veiny, leathery, globby or feathery in texture
- Mucous-y and bubbly

Figure 1. Cyanobacteria *Anabaena* on shoreline.

Figure 2. Cyanobacteria *Anabaena* detail (bright green growths).

Figure 3. Cyanobacteria *Anabaena* spire detail

Figure 4. Cyanobacteria *Anabaena* spires and detached mats floating on the surface

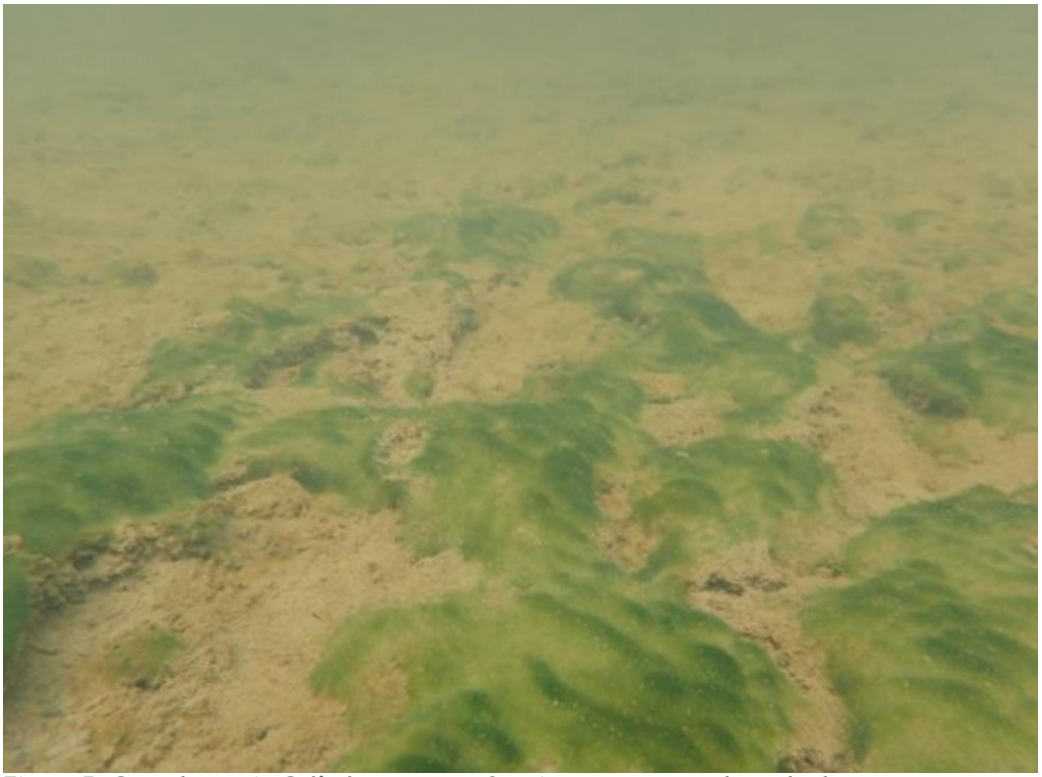

Figure 5. Cyanobacteria *Cylindrospermum* forming green mats along the bottom.

Figure 6. Cyanobacteria *Geitlerinema* (green vertical growth).

Figure 7. Cyanobacteria *Geitlerinema* detail (green vertical growths).

Figure 8. Cyanobacteria *Nostoc*. Forms hollow spheres or hollow elongated fingers.

Figure 9. Cyanobacteria *Oscillatoria*. Note fuzzy appearance, but strands are not long.

Figure 10. *Oscillatoria* on submerged branches. Note fuzzy appearance, but strands are not long.

Figure 11. Cyanobacteria *Phormidium*. Note leathery growths with veins.

Figure 12. Cyanobacteria *Phormidium*. Note leathery growths with veins.

Figure 13. Cyanobacteria *Phormidium*. Note leathery and 'veined' texture.

Figure 14. Cyanobacteria *Phormidium*. Note leathery appearance.

Figure 15. New growths Cyanobacteria *Microcoleus* (green color).

Figure 16. Mature growths of Cyanobacteria *Microcoleus*. The yellow-brown color is similar to diatoms. Note ridges and veining, which does not occur in diatoms growths.

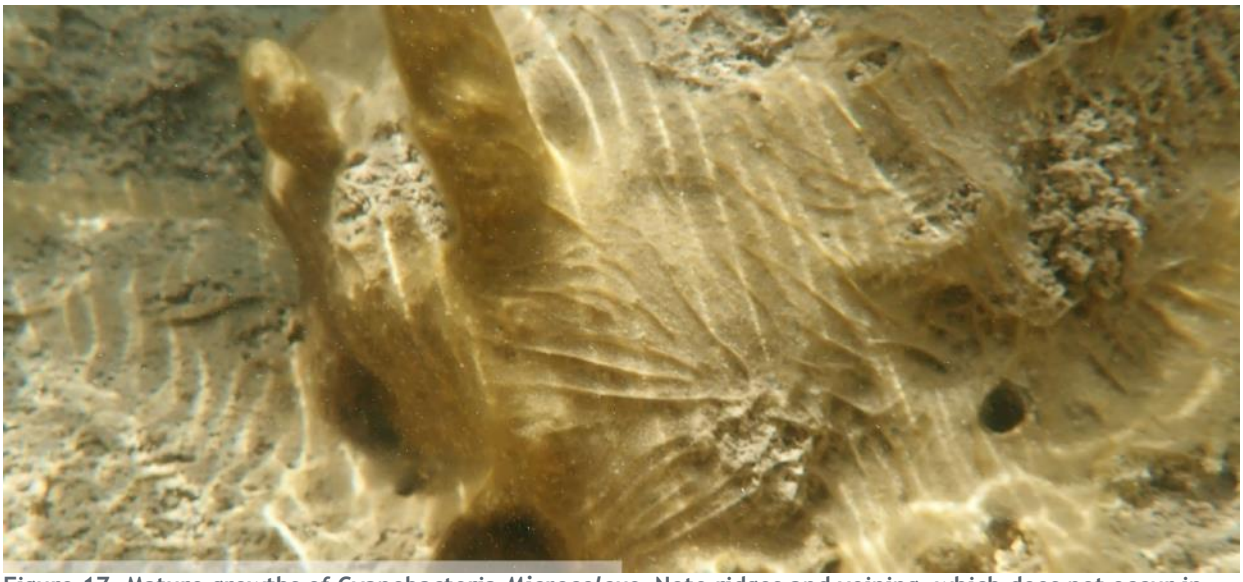

Figure 17. Mature growths of Cyanobacteria *Microcoleus*. Note ridges and veining, which does not occur in diatoms growths.

Figure 18. Mature *Microcoleus* growing over submerged vegetation. Note ridges and veining, which does not occur in diatoms growths.

Figure 19. *Nostoc* species

Figure 20. *Nostoc* sp. (dark nodules) and harmless filamentous green algae (bright green filaments)

Figure 21. *Nostoc* sp.

III. Didymo and other stalked Diatoms (non-toxic)

Stalked diatoms such as *Didymosphenia geminata* ("*Didymo*") can form dense growths in streams that may be confused cyanobacteria blooms. Stalked diatoms have stalks are clear or white, and a single cell at the tips of the stalk that is yellow/brown. New growths of Didymo appear yellow/brown because the cells at the tips of stalks are still attached. As the growths mature, some of the cells become detached from the stalks, making the white stalks more visible. Microscopic images of *Didymo* show the unique structure of these algae, and help to describe what to look for in the field. Diatom growths do not appear leathery, ribbed, or veined. Diatoms do not produce cyanotoxins.

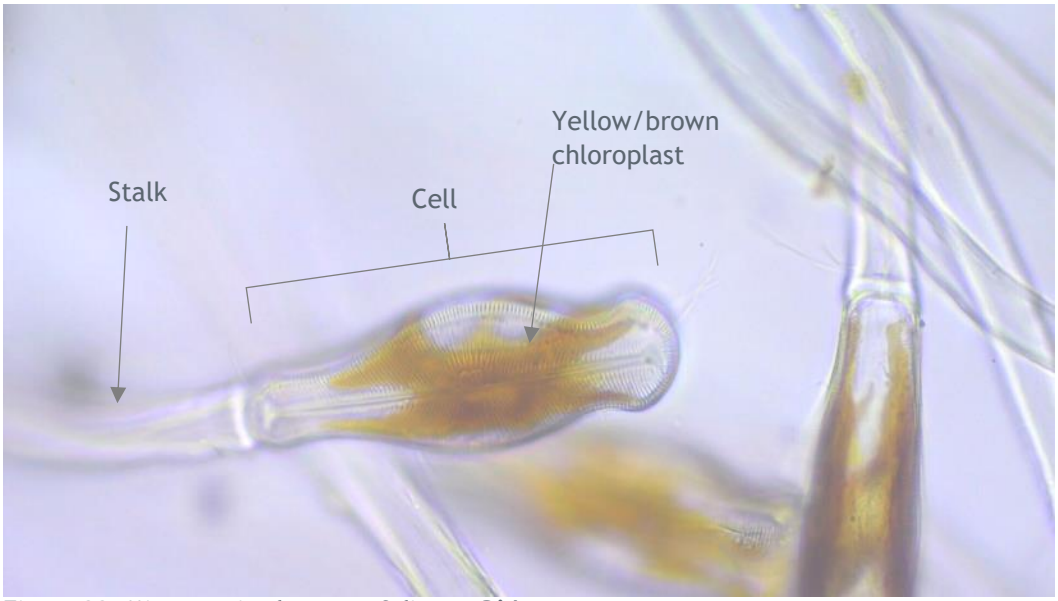

Figure 22. Microscopic close-up of diatom *Didymo*.

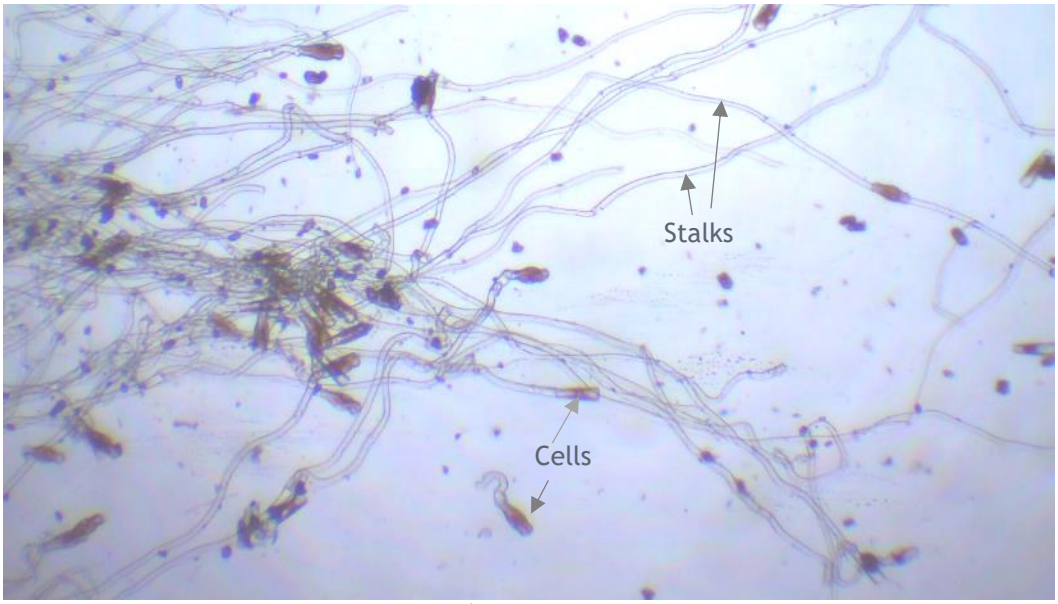

Figure 23. Microscopic photo of diatom *Didymo*.

Figure 194. Stalked diatoms growing on rocks.

Figure 25. Close-up of stalked diatoms on a rock. Note yellow/brown color.

Figure 26. Close-up of stalked diatoms coating a rock. Note yellow/brown color. Stalks are longer than previous image. Long strands of green interspersed are filamentous green algae.

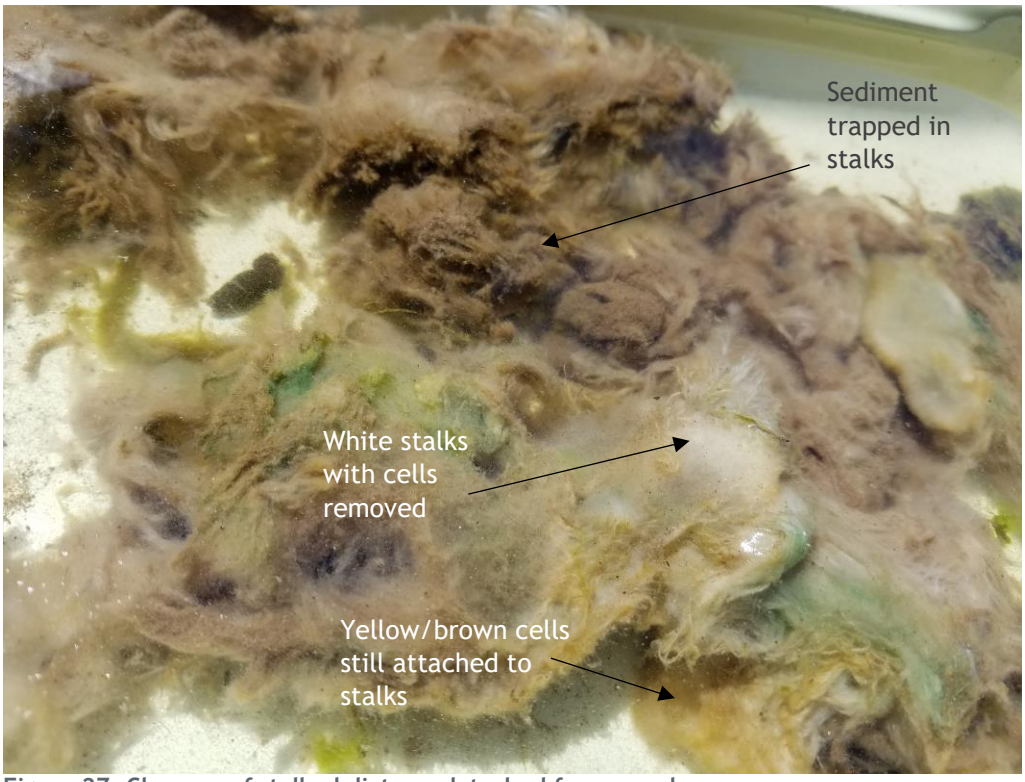

Figure 27. Close-up of stalked diatoms detached from a rock.

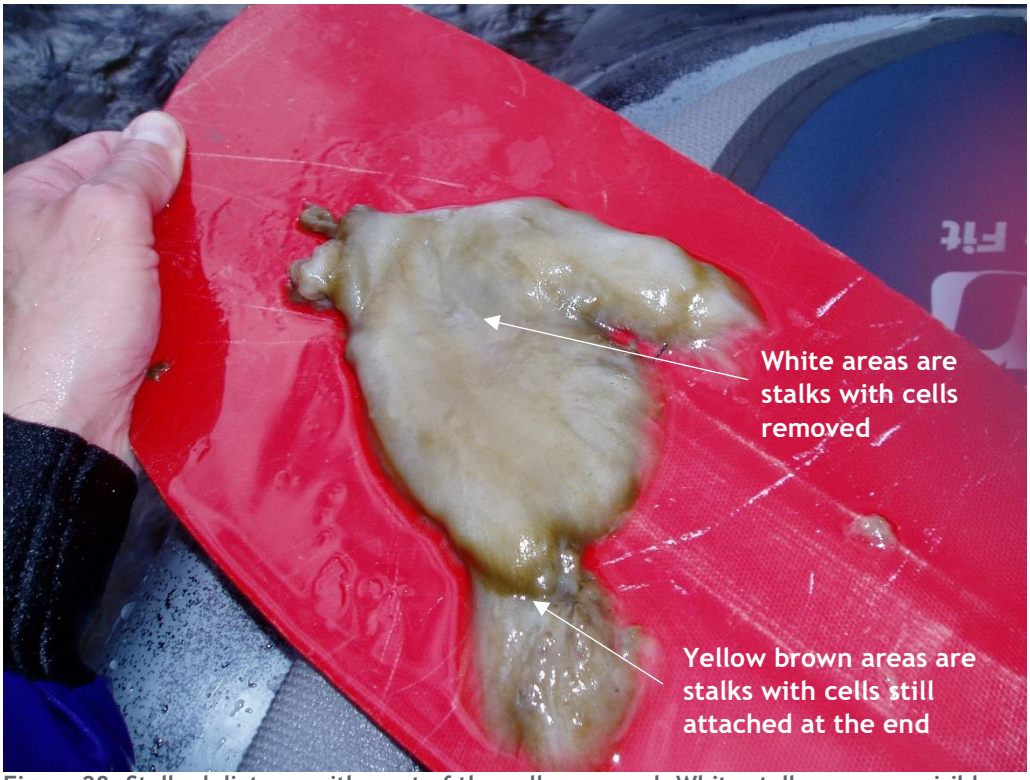

Figure 28. Stalked diatoms with most of the cells removed. White stalks are very visible.

Figure 29. Close-up of stalked diatoms with about 50% of the cells removed from the stalks.

Figure 30. Stalked diatoms growing around aquatic vegetation.

IV. Green Algae

Benthic green algae can also form dense growths along stream bottoms that may be confused for cyanobacteria. The color of these growths is typically bright yellow-green, green or olive green. The form of growth is often long filaments (much longer than cyanobacteria), and in some cases can form small “leaves”. Green algae growths are not ribbed or veined. Green algae do not produce cyanotoxins.

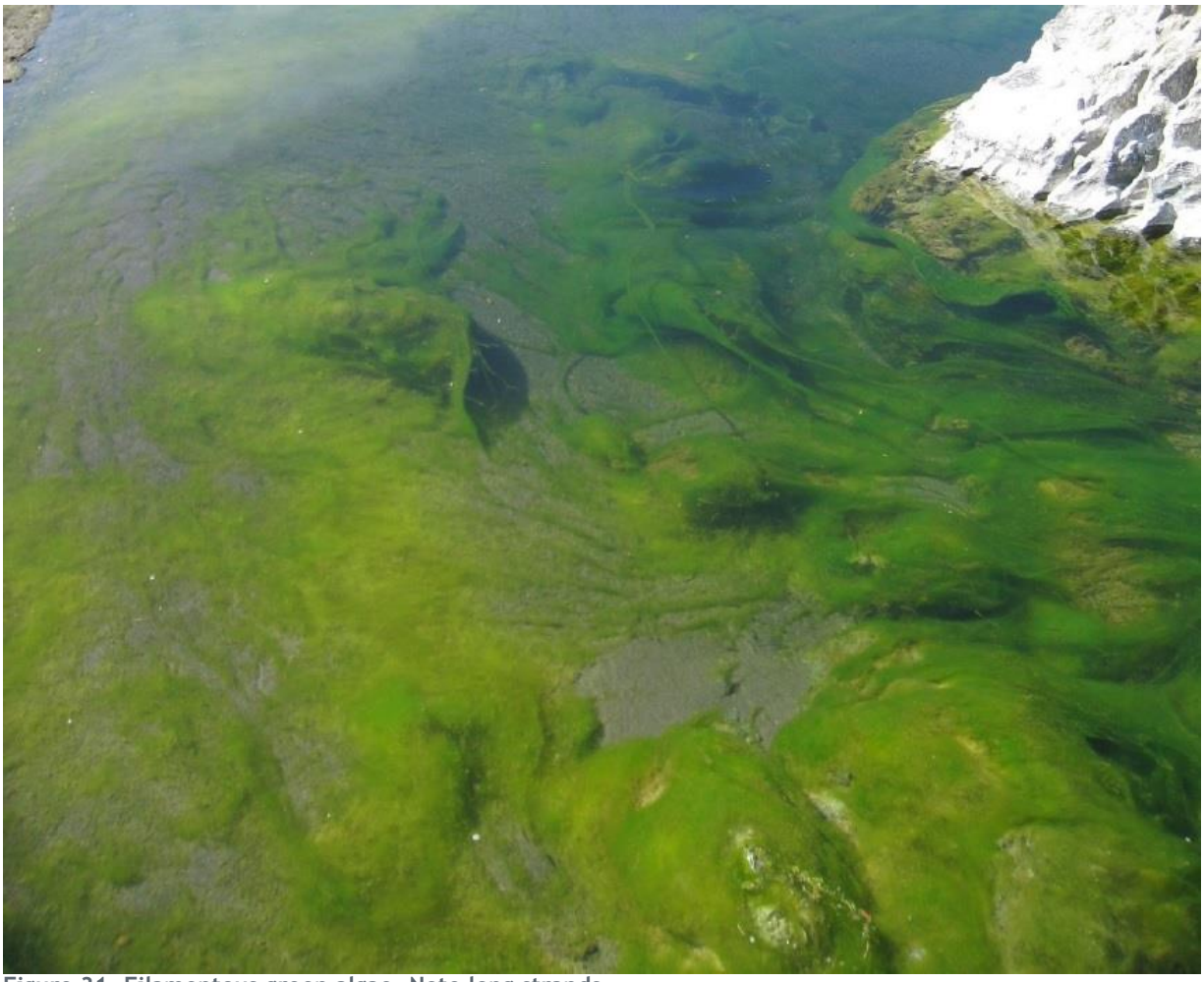

Figure 31. Filamentous green algae. Note long strands.

Figure 32. Filamentous green algae and moss. Note long strands.

Figure 33. Filamentous green algae. Green algae filaments are much longer than cyanobacteria.

Figure 34. Green alga *Ulothrix* in Black Sulphur Creek.

Figure 35. Green alga *Spirogyra* in the Poudre River. *Spirogyra* strands are long and feel silky.

Figure 20. Green alga *Prasiola* in the White River. Note leaf-like structures, which do not occur in cyanobacteria growths.

Figure 37. Green alga *Cladophora* in the North Fork White River. Note the long strands. *Cladophora* strands are long and feel rough like a cotton ball.

Figure 38. Green alga *Cladophora* in the North Fork White River. Growths tend be greater in the fastest flowing parts of the channel.