4. Field Guide to Aquatic Phenomena

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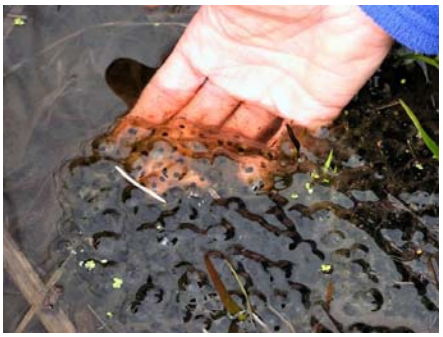
The University of Maine Mitchell Center
www.umaine.edu/WaterResearch

When you are testing, you are sure to come upon some strange or unusual natural things. They could be in the water, floating on the surface or along the shoreline.

Lakes and streams don't always appear or behave the way we expect. Something that at first glance looks like pollution actually might be a natural occurrence. Water can be full of strange colors, unidentified blobs, and swimming creatures, all part of the variation and diversity of the aquatic world.

This chapter is provided to help you identify some common freshwater phenomena, and help you to distinguish pollution from something natural.

If you can't figure out what you are looking at in the stream, call the Department of Planning at 914-995-4400 and we will try and help you solve the mystery.



A. Why is water different colors?

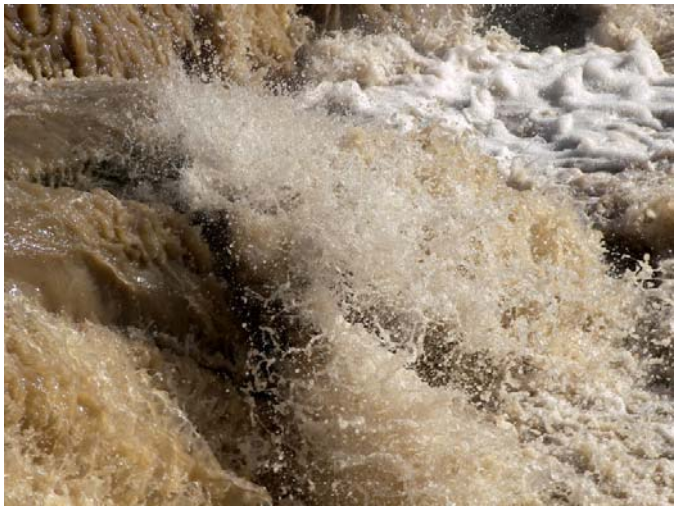
When we think of a lake or river, we picture clear, blue water. But water color can range from red to brown to green to gray. The color you see is the result of material in the water that reflects back different wavelengths of the light spectrum. This material can be either dissolved or suspended. Dissolved material may make water look clear and blue or clear and brown. Suspended particles in the water intercept light and reflect back color to our eyes, making water look muddy brown, cloudy green, or gray.

Blue water
Clear, blue water does not contain a lot of the particles or dissolved, colored material that intercepts and reflects light. (Think of a clear blue sky versus a hazy, smoggy sky--the hazy air has more particles in it). As a result, the longer wavelengths of light toward the blue part of the light spectrum penetrate into the water, and the blue is reflected back to our eyes. The darker the blue, the deeper the water. Shallow areas appear lighter blue or greenish blue.

Clear water
Why do some lakes and rivers have no color? Clear water has less dissolved and suspended material. Mountain streams that start as snowmelt or runoff are often clear, because they run over bare rock without sediment or vegetation. Seepage lakes in sand and gravel settings may also look clear, and shallow water is clear because there is not enough depth for the long, blue wavelengths of light to travel and be reflected back.

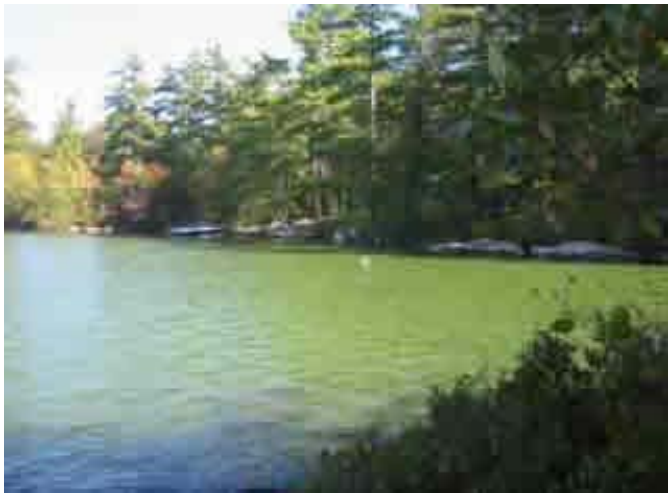
Clear brown or reddish water
Sometimes water is clear but brown like tea or root beer. The color is the result of dissolved organic material from the breakdown of plants and animals. The material leaches into slow moving streams and lakes from surrounding forests, bogs and wetlands, and stains the water brown or reddish brown.

Muddy or murky brown water
Suspended material causes water to look murky or cloudy (this is sometimes referred to as turbidity). Eroding soil can make water muddy brown in color. Strong winds and waves may stir up sediment from a lake bottom, and water near shore may look cloudy as a result. During spring snowmelt, rivers may appear brown as heavy rains and snowmelt send a pulse of sediment, grit, and dust into streams.



Gray or cloudy water
Runoff from urban areas can make water look gray, as in this stream that drains an area that has a lot of commercial and industrial development (parking lots, buildings, roads).

Green water
Suspended particles of living material can impart a hue to the water. Green water probably has a large population of algae (microscopic plants). Algae and other microscopic organisms have colored pigments. When they grow in large numbers ("bloom"), they can color certain areas or entire lakes and streams. Blooms of an organism called Euglena may appear red. A bloom of diatoms, a kind of algae, can look brown.



B. What's that floating on the water?

Yellowish powder or dust
A yellowish powder or dust on the surface of water in spring and early summer is probably pollen from pine and other trees. Pollen can also collect in clumps or blobs. Lines of pollen may be left on rocks as water levels drop in early summer. After becoming water-logged, the pollen sinks to the bottom or may collect in coves along the shore.

Oily Sheen
An oily sheen that reminds you of rainbow puddles in an asphalt parking lot might be from spilled petroleum. A spill of just one gallon of oil is enough to form a film across the surface of a four-acre lake.

Oily sheens can also come from natural sources. Some bacteria that live in waterlogged places get their energy from iron and manganese, and as these harmless bacteria grow and decompose, the iron may appear oily or form red or orange films, fluffs, and coatings. Leptothrix can also excrete manganese, which looks like black slime.

The breakdown of organic material also can leave an oily sheen on the water surface. In the spring and summer, a dark cloud in the water accompanied by an oily sheen could be the outer skins of insect cases left behind from a hatch of aquatic insects. The larvae of mayflies and some other aquatic insects molt and shed their skins as they leave the water and become flying adults. The skins are called exuvia. Exuvia can be seen floating on the water or can accumulate on wave-swept shores, where they are sometimes mistaken for fish kills. You can find dragonfly skins attached to docks, plants, and objects near shore. As exuvia decompose, an oily film sometimes forms on the water surface. A diatom bloom can also leave oil behind as the algal cells die.

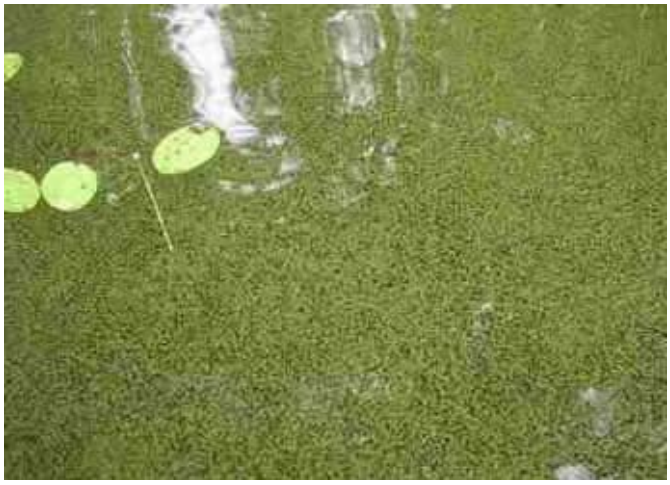
Pollen

Natural oily sheen

Is it a petroleum spill or a natural oil sheen?

Poke the sheen with a stick. If the sheen swirls back together immediately, it's petroleum. If the sheen breaks apart and does not flow back together, it is from bacteria or other natural source.

Floating green stuff
Fuzzy, green floating dots on lakes and in the top few feet of water, or tiny tapioca-like balls might be an algae called Gleotrichia echinulata. Gleotrichia (glee-oh-trick-ee-ah) usually appear mid-summer for brief periods, but can persist longer in some lakes. The presence of Gleotrichia does not necessarily indicate poor water quality since it is commonly present in lakes that have good water clarity. Wind and currents can concentrate them in one part of the lake and high densities can collect in coves.



Gleotrichia

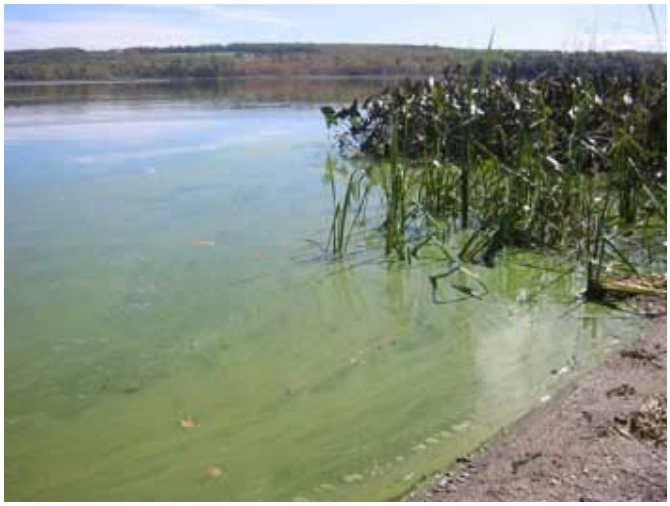
Don't mistake floating plants like duckweed and water meal for algae. Duckweed look like miniature lily pads, with a flat, round floating leaf and a tiny root. Water meal also floats but does not have a root, it is a round grain-like plant, about the size of a poppy seed.

Duck weed

Algae blooms
Green or bluish-green scum or film on the surface of a lake, pond, or stream might be a bloom of blue-green algae. Lots of algae can also color the water green.

The presence of algae in a lake or stream does not mean the water is polluted. A diverse community of algae is healthy. Algae are an important source of food and oxygen for other plants and animals in the water.

Sometimes, certain conditions might favor a species that is normally rare in a lake or stream. With the right temperature, light, and nutrients in the water, the rare organism might multiply rapidly, forming a bloom. When an algae bloom is persistent or occurs routinely, too many nutrients may be entering the water. Nutrients (especially phosphorus) fertilize a lake just as they fertilize your lawn or garden, causing microscopic plants in the lake to grow.



Algae bloom

Foam

Foam is often seen along lake shores and on streams and rivers. Most foam is natural and does not indicate pollution. Foam forms when water is mixed with air, such as by a waterfall or waves breaking against shore. Plants and animals release organic compounds as they decompose, and these compounds lessen the surface tension of water and create bubbles.

Biodegradable detergents and reduction of pollution from wastewater treatment plants have reduced the occurrence of pollution-related foam. If the foam smells fragrant or perfumey, it may be from a nearby spill or waste discharge pipe. Natural foam may smell fishy or earthy, and may be white, off-white, or brownish, and breaks apart easily when disturbed

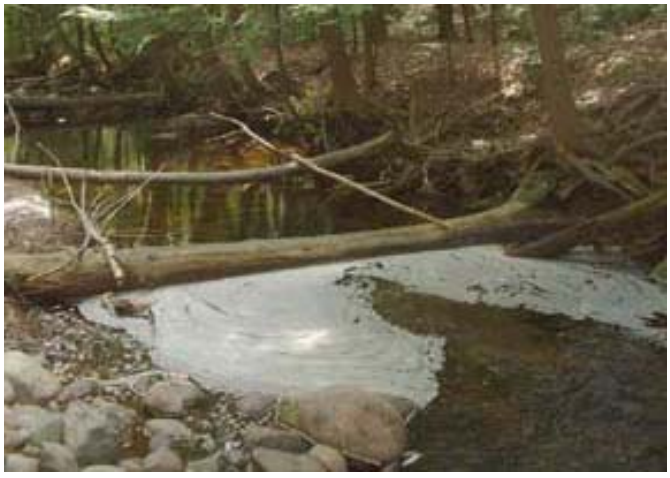
When foam is not naturally occurring it could potentially be harmful to the environment. Cleaning agents can destroy the sensitive membranes of fish, making them susceptible to parasites and infections. Fish kills are not uncommon in areas of high detergent runoff and foaming. There are ways of determining whether foam is natural or chemical:

Natural

- White or off-white color
- Earthy or fish-like smell
- Occurs near a strong current or strong flow
- Occurs near presence of some decomposing organic matter

Chemical

- Tan, brown, or murky color
- Flower- or perfume-like smell
- Occurs near a point of runoff (pipes, inflow due to rain, asphalt, etc.)
- Occurs with weak flow and/or no current

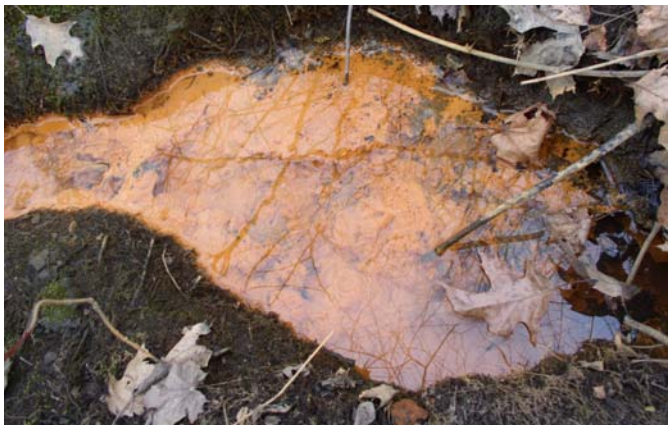


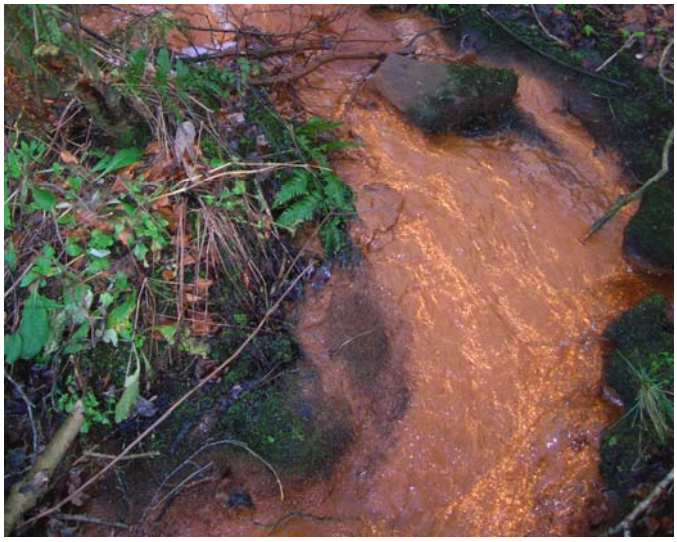
C. What's that stuff in the water?

Orange slime or fluff
Orange stuff is produced by a group of bacteria that use iron as an energy source. This is the same group of bacteria that create oily sheens. The masses of bacteria excrete slimy or fuzzy-looking material as they grow and reproduce, and the slime becomes coated with rusty iron hydroxide. This is usually a natural phenomenon and is generally associated with acidic soils, however in large amounts (orange fluff that fills a stream bed) iron bacteria might indicate pollution.

In some areas, iron-rich groundwater may seep to the surface, and the iron drops out as it becomes exposed to air. In this case, the iron will appear as an orange crust or stain, and will not be fuzzy-looking.

To distinguish between an oil spill and iron bacteria, break up the oily sheen on the water with a branch. If the sheen immediately goes back together the substance is oil; if remains broken, then it is most likely iron bacteria. If iron bacteria is detected avoid skin contact, but feel free to continue monitoring.





Iron Bacteria
Photos: en.wikipedia.org/wiki/Iron_bacteria

Freshwater sponges
Greenish spongy-looking clumps attached to submerged sticks and plant stems in clear, well-oxygenated lakes might be freshwater sponges. There are about 150 species of freshwater sponges, which are often mistaken for aquatic plants or algae. Most sponges are green, because they have algae living in their tissues. Freshwater sponges vary in size from a less than an inch to three feet. They are most commonly seen in summer or fall. They may appear sporadically and be abundant in a lake one year and absent the following year. They are usually finger-shaped, and can look soft or hard. Sponges are strong enough to be picked up without falling apart, unlike many kinds of algae.

Photo: Milwaukee Public Museum

Fresh Water Sponge
Photos: http://dnr.wi.gov/org/es/science/citizen/

Bryozoans

Bryozoans
There are other jelly-like blobs that can be confused with egg masses. Bryozoans, sometimes seen attached to submerged sticks or docks, are animals similar but unrelated to corals. What looks like an individual is a colony of animals, each with a whorl of swirling tentacles. Different species look different: some are wispy and moss-like (giving rise to a common name of "moss animals"), others are large and round, gelatinous, firm, and slimy to the touch. While they may be unsightly on piers and docks, bryozoans are not a water pollution problem and in fact help to filter water.

Frog eggs

Egg masses
Jelly-like masses and clumps floating on the surface of shallow, calm waters or attached to sticks under the water might be the egg masses of insects, fish, or amphibians. Frog eggs usually look like a round mass and float on the water surface. Salamander eggs are huge masses with lots of jelly, and may or may not be attached to plants or sticks below the surface of the water. Toad eggs are laid in a string and usually are attached to plants and sticks. While amphibian eggs are found in masses, fish eggs and other eggs may be found individually or in small groups. Long, flat, purplish ribbons that wrap around plant stems or lie over sand bars and brush are yellow perch eggs. These can be seen in early spring.

Nostoc

Slimy spheres on the bottom
Gelatinous balls seen on the bottom of lakes, especially in clear lakes where light reaches the bottom or in shallow, calm waters, are colonies of Nostoc, a blue-green algae (cyanobacteria). While they look slimy, the balls are fairly hard and tough, and can range from a fraction of an inch to larger than a golf ball. These algae are not a concern and do not indicate bad water quality. They are also sometimes seen on damp forest floors and in ditches.

Algae
Green hairlike strands, green "cotton candy" and green clumps are formed by filamentous algae. These colonies of microscopic plants live in shallow water on the bottom near shore or on submerged objects. Clouds often form in spring after heavy runoff or following a long hot spell in the summer.

Greenish-yellow clouds that look like cotton candy in shallow water near the shoreline are groups of algae known as metaphyton. Metaphyton, made up of several different kinds of algae, may be a foot or more in length. Unlike the planktonic algae that result in whole-lake blooms, metaphyton do not affect lake transparency and are usually localized phenomena. These kind of algae do not necessarily indicate that there are excess nutrient levels in the water.

Grabbing a handful of metaphyton yields only a few stringy, slimy threads of filamentous algae.

Should you be concerned about algae?

The presence of algae in a lake or stream does not mean the water is polluted. A diverse community of algae is healthy. Algae are an important source of food and oxygen for other plants and animals in the water.

With the right temperature, light, and nutrients in the water, the rare organism might multiply rapidly, forming a bloom. When an algae bloom is persistent or occurs routinely, too many nutrients may be entering the water. Nutrients (especially phosphorus) fertilize a lake just as they fertilize your lawn or garden, causing microscopic plants in the lake to grow.

Call the Department of Planning at 914-995-4400 if you have a concern with algae.

Clumps of algae in a stream

Metaphyton clouds in a lake.

Strands of algae from a drainage pipe

D. What's that along the shoreline?

Lines on rocks along the shore
Lines on rocks along the shore are a result of fluctuating water levels, and can be created by several different phenomena.

Algae that live on the surface of the water can adhere to rocks and dry in a line. A wet black zone of algae will also form where the water meets the air.

Bands of bare rock just above the black algae layer are areas where winter ice has scoured the rock. Above the bare scour zone is often a band of moss or lichens, where there is enough water and condensation for the lichen to live but above the zone of ice damage. Lichens grow so slowly that they are a good indicator of how high the ice is pushed in winter.

Insect cases
Sometimes, piles of insect cases that wash to shore might appear to be masses of small dead fish. The larvae of mayflies and some other aquatic insects molt and shed their skins as they leave the water and become flying adults. The skins are called exuvia, and can be seen floating on the water or piled up on wave-swept shores, where they are sometimes mistaken for fish kills. As exuvia decompose, an oily film sometimes forms on the water surface. Only if there is a real reason to suspect poisoning or contamination should you notify authorities of a fish kill.

Dragonfly skin

You can find dragonfly skins attached to docks, plants, and objects near shore.

Fish Kills
Fish kills are rarely the result of toxic pollution. Causes include decreased oxygen levels, especially during hot, windless days where nutrient runoff and algae growth have used up oxygen, viral or bacterial infections, and lack of food. Fish can be stranded when water levels drop. Some fish die after migration or spawning (like suckers). Smelts die from moderate stress, such as high temperatures or low oxygen. Winter fish kills can occur when oxygen is used up beneath the ice.

Common Causes of Fish Kills

- Discharges or spills of potentially dangerous chemicals, contaminated runoff, or industrial effluents. Specific examples include chemical fertilizers rich in nitrogen and phosphorus, pesticides, and human and animal waste.
- The degradation of a natural waterway by interference in the natural flow and the build-up of excessive nutrients.
- Drainage from soils containing acid sulfate, common in coastal areas. This leads to low pH (high acidity) of the water.
- Excessive aquatic plant growth, such as algae, due to overabundant nutrient concentrations in water bodies. This can cause fish kills through super saturation of oxygen during the day (excess oxygen is toxic to fish), and from oxygen depletion at night (when photosynthesis ceases but algal and plant respiration continues).
- Rainfall sufficient to cause organic debris runoff reaching water bodies. This promotes rapid bacterial decay and resulting oxygen depletion problems.
- Disruption of bottom sediments in waterways, where large quantities of nutrient-rich organic matter often accumulate. When mixed into the water, the organic matter causes bacterial decay and subsequent oxygen depletion.

If your team believes a fish kill is occurring at your monitoring site, discontinue monitoring and contact the Department of Planning as soon as possible.