Standard Operating Procedure (SOP) 3.5.3

By Erick Burres*

Introduction to Monitoring Freshwater Algae

What Are Algae?

Algae are a large and diverse group of simple, typically autotrophic organisms. Algae are made up of two broad groups. Macrophytes are large and are often attached to rocks and other surfaces and can be seen with the unaided eye. Phytoplankton, which are suspended in the water column, usually require a microscope for individual organisms to be seen, unless present in large quantities. Algae provide refugia and food for aquatic fauna and are an ecological assemblage that responds to perturbation.

Why Monitor Algae:

Bioassessments, like monitoring algae, provide indications of cumulative impacts of multiple stressors, not just water quality. Abnormal increases of algae within a stream can indicate increases in nutrients such as phosphate or nitrogen. An increase in algae cover or biomass can also be an indicator of a loss of, or a lack of, stream cover. Habitat used by benthic macro invertebrates can also be lost due to abnormal algal growth. This type of an assessment contributes to the understanding of the biological community condition and reflects on both short-term and long-term effects and directly evaluates the condition of the water resource.

Protocol for Monitoring for Freshwater Algae

Note: This is an introductory and educational method for monitoring algae. For guidance on monitoring algae for ambient and targeted water monitoring projects please refer to the Surface Water Ambient Monitoring Program (SWAMP) document "Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California (11/16/09)"

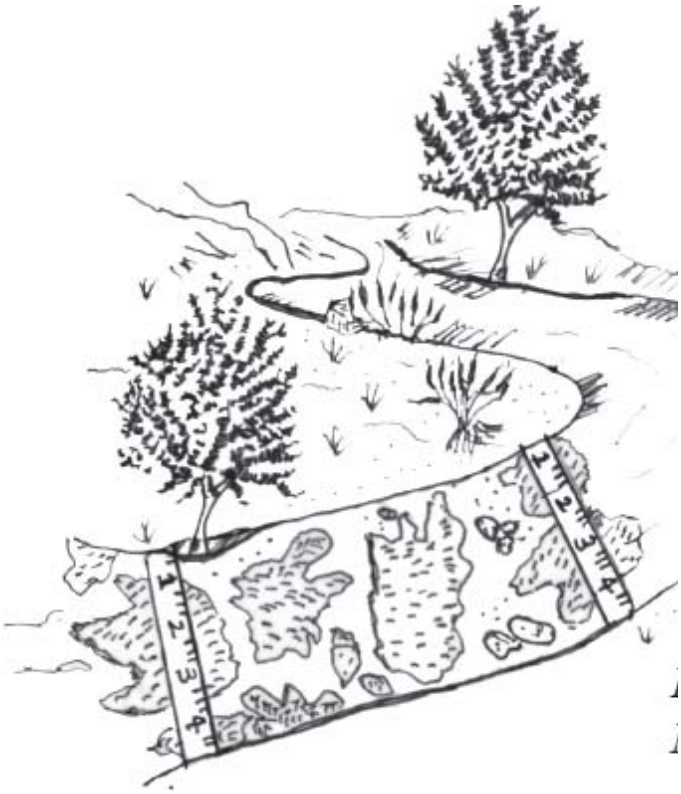
1. Find an area at your monitoring site that is a long glide (slow, steady flowing, relatively shallow area) or a combination of glide and riffle (fast flowing shallow area with some turbulence).

2. Make sure the area you select represents what algal coverage is like throughout the entire stream reach. *Do not select areas that have unusually high or low amounts of algae when compared to the rest of the stream reach.*

3. Choose the starting location where you will begin your algae measurement and hammer a stake contained in the field kit into the ground at the wetted edge (where the land and water meet). This is Transect 1.

4. Extend the stadia rod (stick used to measure stream depth) or a tape measure at a 90 degree angle across the stream. The stadia rod or tape measure should be inline with the upstream stake (Figure 3-42).

5. While standing directly above the stadia rod or tape measure, calculate the amount and types of algae the stadia rod or tape measure passes through for transect 1 (Figure 3-42). Note: Use algae picture identification cards and descriptions to identify algae types.



6. Record the result(s) of Transect 1 on the *Freshwater Floating Algae and Mat Algae* Field Sheets.

7. Place a second stake at a representative location downstream for Transect 2. For example, if your stream reach has sections with algae and without algae select a transect from each of those conditions. This will ensure that algae measurement represent the conditions at the site.

8. Repeat steps 4-6 on Transect 2 and record the data on the Algae Field sheets.

9. Calculate the percentage of total floating and mat algae cover on the Freshwater Algae Field Sheets.

For example, the wetted width of the stream along the first transect is 10 ft. wide with no floating algae (pg. 3-60). The first 3 ft. is solid Cladophora (CL/RZ) mat algae, and then there are no algae for 1 ft., followed by 4 ft. of thick diatoms (DT) mat algae, and 2 ft of no algae. Transect 2 has a wetted width of 6 ft. with no

floating algae. The first 3 ft. has no algae, followed by 2 ft of Cladophora (CL/RZ), and 1 ft of no algae.

Freshwater Floating (FLT.) Algae

Date: July 4, 03 Site Name/#: Malibu Creek #1
Time: 3:30 Am Recorder(s): Lucy (Pretty girl) Van P.
TRANSECT 1 (T-1)
% Canopy Cover (CC-1) 70% Wetted Width (WW-1) 10.0

Distance on tape as a range i.e. 0-.7 ft.	Algae Type	Algae in Feet
0 – 10.0 ft	NONE	0
	Sum Impaired T-1	0

TRANSECT 2 (T-2)
% Canopy Cover (CC-2) 80% Wetted Width (WW-2) 6.0 ft

Distance on tape	Algae Type	Algae in Feet
		0
	Sum T-2	0

Sum T-1 0 + Sum T-2 0 = Total FLT. 0
WW-1 10.0 + WW-2 6.0 = Total WW 16.0

10. Record the total percent cover of floating and mat algae on the *Biological floatables* section of the *Site Conditions* field sheet. **You can have more than 100% coverage if you add both floating and mat algae together if floating algae is found floating above mat algae.**

Your program manager will calculate the floating *algae types and %* and *mat algae types and %* of the *Site Conditions* field sheet.

Freshwater Attached (Mat) Algae

TRANSECT 1 (T-1)

Distance on tape as a range i.e. 0-.7 ft.	Algae Type	Algae in Feet
0 - 3.0 ft	CL/RZ	3.0
3 - 4.0 ft	NONE	—
4.0 - 8.0 ft	Dt	4.0
8.0 - 10.0 ft	NONE	—
	Sum Impaired T-1	7.0

TRANSECT 2 (T-2)

Distance on tape as a range i.e. 0-.7 ft.	Algae Type	Algae in Feet
0 - 3.0 ft	NONE	—
3.0 - 5.0 ft	CL/RZ	2.0
5.0 - 6.0 ft	NONE	0.0
	Sum T-2	2.0

Sum MAT T-1 7.0 **+ Sum T-2** 2.0 **= Total MAT** 9.0

Divide the total Mat & Floating Algae by Total WW to calculate % Covers.

Total MAT = 9.0 (Divide) 16.0 **Total WW** (100) = 56 **% Mat Cover**

Total FLT = 0 (Divide) 16 **Total WW** (100) = 0 **% FLT Cover**

Algae Descriptions

Floating algae is almost always one of two types:

***Enteromorpha* (EN)** is lime green to dark green in color and when examined closely has a hollow tube shape that resembles an intestine or sausage casing.

Diatoms can be green or brownish in color and generally have small bubbles throughout. *Diatoms* will easily break up when rubbed between your fingers. *Diatoms* that are thicker than 3 millimeters (slightly thicker than a nickel) are recorded as ***DT.***

Mat algae is attached to the bottom of the stream and can be one of 6 types:

Diatoms may also be attached as mats. They are brown and may be a thin film on rocks and sandy bottoms. *Diatoms* appear as a fuzzy coating on rocks, plants or sandy bottoms, or they may be long strands streaming in the water. They break apart easily if you disturb them. *Diatoms* that are thicker than 3 millimeters (slightly thicker than a nickel) are recorded as ***DT.***

***Chara* (CH)** has a stalk with thin "branches" along it in rings. It can be mistaken for a vascular plant. It attaches to the bottom and grows up toward the surface.

***Cladophora* (CL/RZ)** is fine and stringy, or filamentous. It may float on the surface, attached by a stalk to the substrate (the dark green "hair" algae), or it may grow more like a mat on a shallow rock. *Cladophora* is generally found in shallow, well oxygenated riffle parts of the stream. Either way, it is recorded as mat algae.

***Rhizoclonium* (CL/RZ)** is usually attached to the bottom or rocks, and grows like a turf or mat. It has a similar appearance as *Cladophora*, but we generally find it in deeper, slower flowing water of glides and pools.

***Spyrogyra* (SP)** is similar to *Cladophora* but is very slimy and usually lighter green. It often looks wispy or cloudy in the water column.

***Enteromorpha* (EN)** is a bright green bladder filled with air, and floats on the surface. It may also be attached to the bottom instead of free floating. It is often found in intertidal zones and can withstand periods of dessication. Often, *Enteromorpha* is mixed with other algae, when it is attached to the bottom.

Unidentified macroalgae is what we call algae that we can see but cannot identify.

ALGAE FIELD IMAGES

Floating algae:

Enteromorpha

Diatoms

Mat algae:

Diatoms

Chara

Cladophora

Rhizoclonium

Spyrogyra

Enteromorpha

Freshwater Attached (Mat) Algae

Date: _____ **Site Name/#:** _____

Time: _____ **Recorder(s):** _____

TRANSECT 1 (T-1)

% Canopy Cover (CC -1) _____ **Wetted Width (WW-1)** _____

Distance on tape as a range i.e. 0-.7 ft.	Algae Type	Algae in Feet
	Sum Impaired T-1	

TRANSECT 2 (T-2)

% Canopy Cover (CC -2) _____ **Wetted Width (WW-2)** _____

Distance on tape	Algae Type	Algae in Feet
	Sum T-2	

Sum T-1 _____ **+ Sum T-2** _____ **= Total FLT.** _____

WW-1 **+ WW-2** **= Total WW**

Freshwater Floating (FLT.) Algae

TRANSECT 1 (T-1)

Distance on tape as a range i.e. 0-.7 ft.	Algae Type	Algae in Feet
	Sum Impaired T-1	

TRANSECT 2 (T-2)

Distance on tape as a range i.e. 0-.7 ft.	Algae Type	Algae in Feet
	Sum T-2	

Sum MAT T-1 _____ + **Sum T-2** _____ = **Total MAT** _____

Divide the total Mat & Floating Algae by Total WW to calculate % Covers.

Total MAT = (Divide) _____ **(100) =** ☐ **% Mat Cover**

Total WW =

Total FLT = (Divide) _____ **(100) =** ☐ **% FLT Cover**

Total WW =

* **References:**

This Standard Operating Procedure first appeared in **"The Freshwater and Marine Team Field Guide** adapted from: The Malibu Creek Watershed Stream Team Field Guide by Heal the Bay; Revisions by: Mark Abramson, Shelley Luce, Beth Tanner- Heal the Bay and Kerry Flaherty Kathleen Snow- SCMI as prepared for The Southern California Marine Institute and was Funded by: Environmental Protection Agency 319 h funds to SCMI. February 2003

This edition by Erick Burres, State Water Resources Control Board-Clean Water Team. June 2008