

Teach Yourself: Conspicuous Algal Growth in Waterways

A Technique for Field Characterising
Conspicuous Algal Growth in Urban
and Rural Waterways.

Stephen Skinner

Conspicuous Algae?

- Primary producers in aquatic systems form a complex, with biofilms, periphyton, aquatic and emergent plants, phytoplankton and the **scum!**
- Scum gets overlooked: it is not always there, it cannot be quantitatively collected easily, and you cannot put a name on it in the field.
- Well, this just might help...

What You Do

- This approach is an ‘in the field’ approach:
- You look at the Conspicuous Algal Growth (or scum)
- You estimate the cover of Conspicuous Algal Growth, to gauge **Abundance**.
- You note the colour of the Conspicuous Algal Growth
- You touch and squeeze the Conspicuous Algal Growth
- You smell the Conspicuous Algal Growth
- You use the Key or Flow-Chart to find the **Form** of the Conspicuous Algal Growth
- The precise taxonomy still requires microscopic confirmation

Getting Started

- Scum you can usually see...some of the other algae maybe a little harder to find.
- Check the bottom: are there any green fuzzy bits? ...or gritty brown, or watery blue, coatings? ...or skins with curls or bubbles? ..or anything else vaguely plant like?
- Do the same for the edges and the emergent vegetation.
- Look at the water column, and through the aquatic vegetation.

Cover

- If you can see most of the bottom, the reeds and loosestrife isn't shaggy, there is nothing streaming through the water column and no visible skin on top, then it's a 1.
- It is also a 1 if there is just a few shreds of algal material about.
- A 2 for abundance implies that there is easily seen but scattered algal material somewhere in the water body.
- A 3, 4, or 5 implies more and more cover of all of the water body. That is why rafts, that only really fill the surface, not the whole water column, get a 4, and diatom coats or cyanobacterial ones, mostly leaving the water clear get a 3.

Abundance

- Abundance is an assessment of **what is there**. It is **not** on its own a determination of waterway health.
- While a score of 5 may refer to choking blanket weed, it may describe a spring flush of Water Net, or the dense but benign formation of a carpet of stoneworts.
- Equally, a score of 1 may indicate a shaded waterway with a balanced ecology or a scoured and empty waterscape following spate.



A clear stream bottom with little or no algal growth,
Algal Abundance score 1

The cobbles and grit may have a slight cover of diatoms, and there may be occasional tufts of green, but there is little visible algal growth.



Tufts of algae, giving an **Algal Abundance score of 2**

Here there is a scatter of light algal cover, with around 30 to 50 % of the surface showing algal growth. A common feature of rivers and creeks in spring, this is usually *Stigeoclonium* or *Klebsormidium*.



Crusts or coatings give an **Algal Abundance score of 3.**

Diatoms and some filamentous cyanobacteria may put a fine coating of algal growth on the substrate, either the stream bottom or snags and similar objects in the waterway. These coatings are common in the ACT in winter months.



Rafts of suspended or floating algae give an **Algal Abundance Score of 4**

With the spring influx of nutrients many filamentous algae show a growth spurt. The sunny and warm weather promotes plenty of photosynthetic activity, and bubbles of oxygen become trapped in the matrix. Up come the rafts of algae.

Carpets of stoneworts or blankets of filamentous algae can fill most of the water column giving an **Algal Abundance** score of **5**.

When there is an abundance of nutrients in a waterway, blanket weed or other filamentous algae can thrive .

Soft bottoms and still or slow flowing water promote carpets of stoneworts.



Algal Form, in the field

- To find out the form, the observer needs to use **visual** clues (shape, size, numbers, colour), **tactile** clues (feel and consistency) and **olfactory** clues (smells).
- The score awarded to each 'form' of alga is constructed from the local algal distribution. Algae found in pristine headwaters locally will get a high score. Algae with a wide locality tolerance will get lower scores. Nuisance algae get lowest scores.

Colour

- Green algae range from a lemon yellow to a dirty grey-orange, but are generally mid greens.
- Red algae are pink, chocolate or bluish (the marine ones are red).
- Velvet moss is usually dark, mat green; *Tribonema* can be bright green (but as it is similar in behaviour and form to *Klebsormidium* it doesn't matter)
- Diatoms range from khaki to rusty to chocolate, and sometimes sickly blue.
- The cyanobacteria generally favour dark colours, purple, crimson, bottle green or inky, but can be muddy grey
- Plankton usually are blue-green or red

Feel

- Cyanobacteria are usually slimy
- Diatoms are gritty and disintegrate
- Most of the rest are felt-like, and may or may not disintegrate
- Silkweeds and *Draparnaldia* are silky and will run through your fingers
- Blanket-weeds have the coarse, gritty and interwoven texture of wet wool

Shape

- Tufts of *Stigeoclonium* and *Draparnaldia* show their fine branches when held in the palm, so does *Tolypothrix*.
- Cushion formers look like tiny green or black jellies.
- Water-net looks like a number of different sized small string bags.
- *Cladophora* and *Pithophora* can be seen to be coarsely branched in the palm.
- Many of the encrusting cyanobacteria will make crests or curls as they spread across surfaces.
- The stoneworts look like miniature conifers

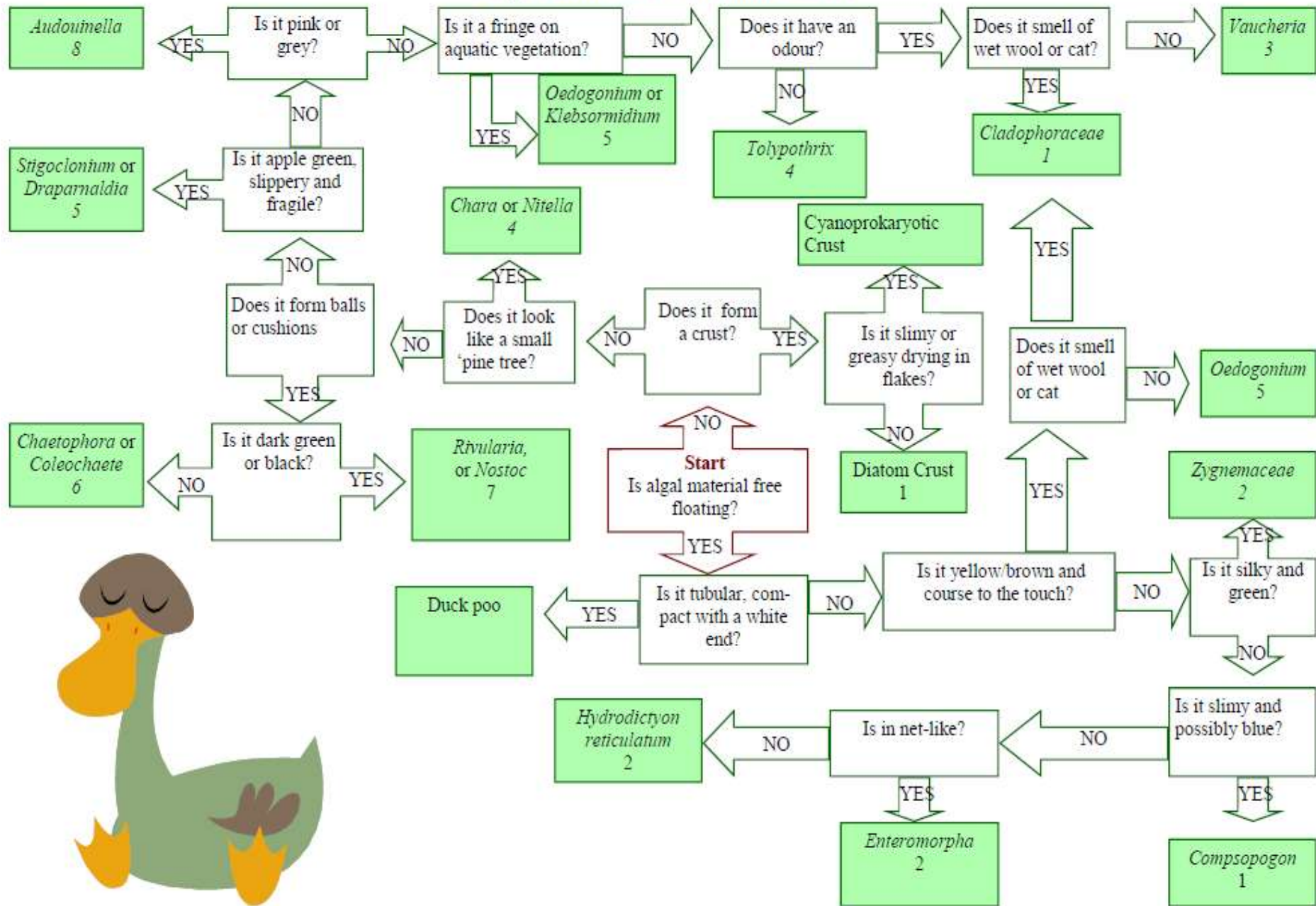
Smell

- Blanket-weeds smell damp, musty or at worst like Tom Cat.
- Velvet moss smells fishy or muddy
- Most Cyanobacteria have the geosmin smell, but share it with others
- *Microcystis* smells of dog wash
- Some stoneworts are musk-like
- *Oedogonium* and the silkweeds smell fresh.

What alga is it.

- No-one is going to expect to get this right every time! A mixed green raft, or a ratty mixture of bottom algae will never be done without a microscope.
- Look at the main alga present: colour, feel, shape, smell all help.
- The flow chart starts with fixed or floating, start there!

Algal Identification Flow Chart



Free Floating

- Tubular, compact, white end: Duck Poo!
- Yellow, green to brown, coarse to feel: smell it!
- Not much smell, not woolly: *Oedogonium* (5)
- Wet wool or tom cat smell, wet blanket feel:
Cladophoraceae (1)

Blanket-weed is usually a clear sign that there are available nutrients in the waterway.

Both *Rhizoclonium*, often responsible for the frilly garters round snags, and *Cladophora* will turn up in an unshaded nutrient rich waterway, and being perennial remain for years. **Form Score 1.**



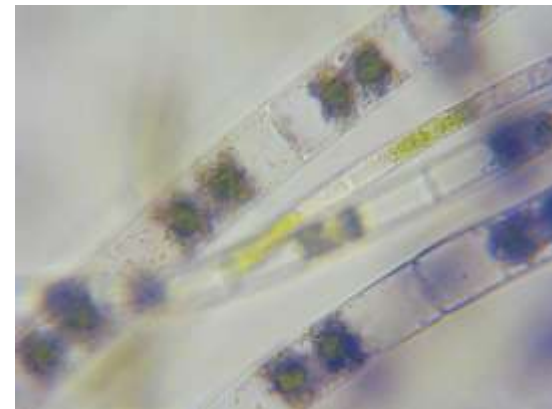
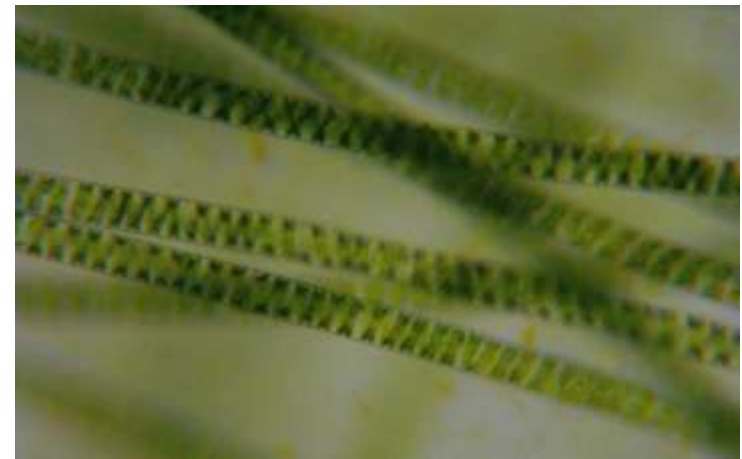
Free Floating

- Silky to feel, various shades of green: Zygnemaceae (2)
- Slimy, individual threads easily seen: look at the colour
- Pale blue or blue-green: *Compsopogon* (1)
- Green or yellow green: look at the form
- Nets or tiny string bags: *Hydrodictyon reticulatum* (1)
- Tubes: *Enteromorpha* (1)

The silkweeds, *Spirogyra*, *Zygnema* and *Mougeotia* are all common and widespread in the ACT region and elsewhere. With a few exceptions they are generally seasonal.

For silkweeds the **Form Score** is 2. While they may form thick rafts, they are generally found suspended like fine silk in the main water column.

Spirogyra is readily distinguished by its spiral chloroplasts; *Zygnema* has two stars, and *Mougeotia* has a strap. You need a microscope to see this.



The Water Net, *Hydrodictyon reticulatum*, is a spectacular looking organism. It thrives in warm, sluggish, nutrient rich water but soon disappears when conditions , especially flow, improve. **Form Score 2.**



Free floating

- Suspended in the water: check colour and smell
- Blue-green, dusty pale green, flocks: cyanobacterial phytoplankton
- Flocks clump or are lace-like, dog shampoo smell: *Microcystis* (1)
- Flocks scattered, tiny corkscrews, geosmin smell, itchy eyes: *Anabaena* (1)

Free Floating

- Skin on the surface, little smell: check colour
- Crimson, rusty brown, purplish: *Euglena* (1)
- Green: is it water repellent?
- Water repellent: *Botryococcus* (1)
- Wettable: *Pediastrum* (1)

Algal Blooms!

There are those that are **suspended** in the water column. Many of these are cyanobacterial, like *Microcystis* .

Others form **water repellent skins** on the surface, like *Euglena sanguinea*.

All have a **form score of 1**.



Free Floating

- Large floating chunks, mud coloured with coloured fringes:
- *Oscillatoria princeps* is often reddish (2)
- Other *Oscillatoria* species often green (2)
- *Phormidium* is usually bluish or purple (2)
- *Geitlerinema* is bottle green (2)

Attached

- Crust forming: feel the crust
- Fragile, rusty, chocolate or bluish and dries white: Diatoms (1)
- Robust, slimy or greasy, dries in coloured flakes: cyanobacterial crust (2)

Most Cyanobacteria are at worst unsightly, usually benign and frequently beneficial. *Nostoc* and others are *Nitrogen* fixers; *Phormidium* and its relatives are important in soil and mud stabilisation.

Phormidium is important in dry periods and in the winter in ACT waterways. The motile filaments, looking like tiny rulers under the microscope, creep across damp areas, hold moisture for a time and bind the grains of soil to reduce soil loss. **Form Score 2.**

The bottle green tufts of *Tolypothrix* that form a major part of the 'bath tub ring' on emergent aquatic plants in our lakes and weirs are often overlooked. **Form Score 2.**



In the Murray-Darling Basin two of the most widespread and frequently encountered conspicuous algal forms are the Blanket Weeds, in the Cladophoraceae, and the diatom *Melosira varians*.

Melosira, and other diatoms become visible in the spring as rusty or chocolate streamers in water. On drying they leave a dusty white stain. **Form Score 1.**

Under the microscope *Melosira* shows off its silicon pillbox cells and its golden chloroplasts



Attached

- Looking like a miniature conifer forest: *Chara* or *Nitella* (4)
- Tufts, cushions or streamers: look and feel

The stoneworts, *Chara* and *Nitella*, are structurally very like aquatic plants.

Stoneworts are not uncommon in farm dams, urban wetlands and the larger still or slow flowing water bodies in the ACT Region. There are species that do well in some of the river systems also. Stoneworts are often responsible for stabilising soft bottom sediments and helping to clarify water. They can compete with other algae and aquatic plants but do not respond well to persistent mechanical disturbance, and so may not appear at causeways and in eroding waterways.

The **Form Score** for stoneworts is **4**.



Attached

- Cushions or balls: colour and feel
- Dark colours, tough and rubbery: *Nostoc* or *Rivularia* (7)
- Green, softer and squashy: *Chaetophora* or *Coleochaete* (6)

The epiphytic or epilithic cushion formers, like *Nostoc* (Algal Form 7) and *Chaetophora* (Algal Form 6) can be very prominent when not outcompeted for space or light. *Chaetophora* appears on aquatics in both upland and lowland waterways.



Attached

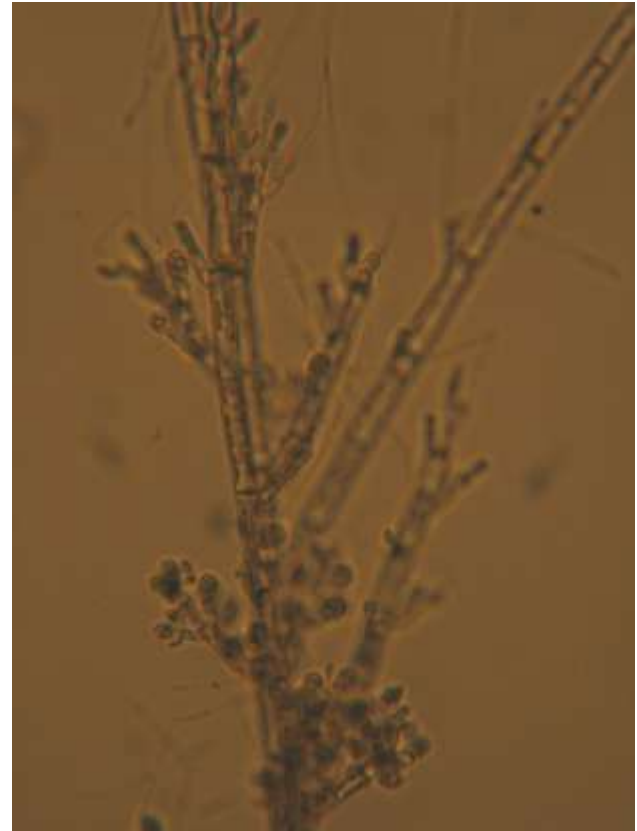
- Tufts or streamers: colour and feel
- Pink or dirty grey/brown tuft: *Audouinella* (8)
- Apple green, very slippery and fragile tuft: *Stigeoclonium* (3) or *Draparnaldia* (5)
- Bottle green to bluish, coarse tuft: *Tolypothrix* (4)
- Streamers or periphyton fringe: colour, feel and smell

Less common algae in the ACT and Region

Audouinella is a red alga, widespread but rarely becoming conspicuous, unlike here on the Water Milfoil in the Cotter River. As a rarity, it has a **Form Score of 8**.



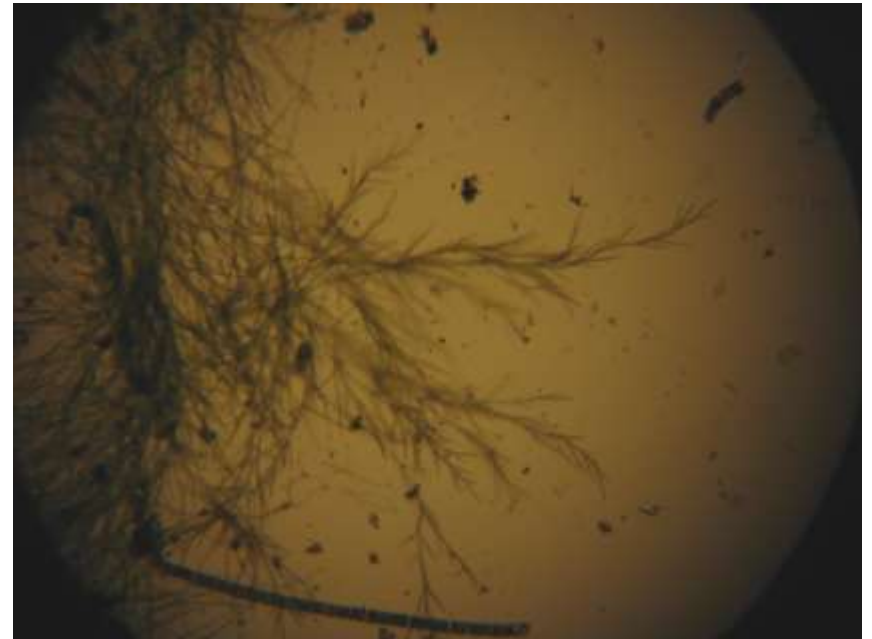
The brownish pink tufts produce masses of monospores. In tropical areas this organism forms bands in swimming pools and would score 1.



Common but harmless algal forms

The apple green tufts of *Stigeoclonium* and its relatives are common in spring.

Only *S. tenue* is found in turbid water; the rest flourish in light. **Form Score 5**



Attached

- Clean smell, often a fringe: *Oedogonium* or *Klebsormidium* (5)
- Fishy smell, fox tails or carpet, gritty feel: *Vaucheria* (3)
- Wet wool or tom cat smell, blanket feel: Cladophoraceae (1)

The periphyton fringe contains many kinds of algae, including numerous diatom, *Oedogonium* and *Bulbochaete* and the fine threads of *Klebsormidium* that attach by pads.

Algal fringes become prominent when submerged and emergent aquatic plants are little affected by shading. As most fringes are short lived, their **Form Score is 5.**



Vaucheria or velvet moss grows in the water, often as fox tails, or the air to carpet the bank.

Velvet moss can dominate the floor of an upland waterway, and act as a sponge to hold moisture between rain flushes, so it maintains moisture even when flow drops to a trickle.

In lowland waterways the velvet moss may be more likely to be encountered as a carpet on gritty sediments or recently undercut banks, rather than in the waterway.

Vaucheria has a **Form Score** of **3**.



Calculating the CHiP Algal Ranking

- The Algal Ranking is obtained by dividing the Algal Abundance score by the Algal Form score.
- For instance, in the ACT region, a thin layer of *Stigeoclonium* tufts would be Abundance 2/Form 5, $2/5 = 0.40$.
- As this Algal Score is <0.45 , then it indicates the site shows Excellent health (for Algae) at the time of that sampling.



Then what?

- If all you or your organisation wants are indications of Catchment Health, you have another one.
- You should now know which algal group is making a contribution to the economy of the ecosystem, and when. Now you can move to study the physiology of the alga, and learn of its contribution for good or bad! **It ain't just scum!**

References

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