Factsheet

Bryozoans in Freshwater: Science and Management

Executive summary

Bryozoans are colonial animals found in oceans, lakes and streams around the world. Bryozoans are environmentally important in natural freshwater environments but can become a nuisance in water pipes and holding tanks. They are prolific growers in the right conditions, so they can block pipes and filters. Removing colonies, however, does not eradicate them, because freshwater bryozoans produce resistant life stages called statoblasts which can survive most harmful conditions. Among the ways to control bryozoan fouling in freshwater are: physical removal, filtration, chemical treatment with bleach, ultra-sonication, and ultra-violet light.

Bryozoans are colonial animals

A single bryozoan individual is called a **zooid**; each one is very small (1-2 mm across) and is capable of budding off to form new ones. Zooid clones are added like building blocks, connected together to form **colonies**, which in the case of freshwater bryozoans, appear either weedy (Family Plumatellidae and Fredericellidae) or gelatinous (Family Lophopodidae); really big ones can weigh as much as several kg. When colonies encounter difficult conditions, they produce numerous **statoblasts**, which like seeds lie dormant until the environment improves, at which point each statoblast can sprout a new colony.

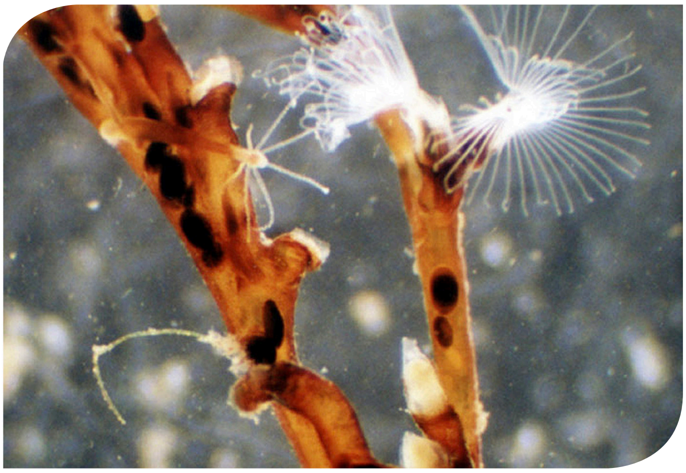

Photo 1: This close-up of Plumatella repens *underwater shows the feeding tentacles (lophophore) of several adults, and the resting 'seeds' (statoblasts) waiting to be ejected. (Photo: Peter Batson)*

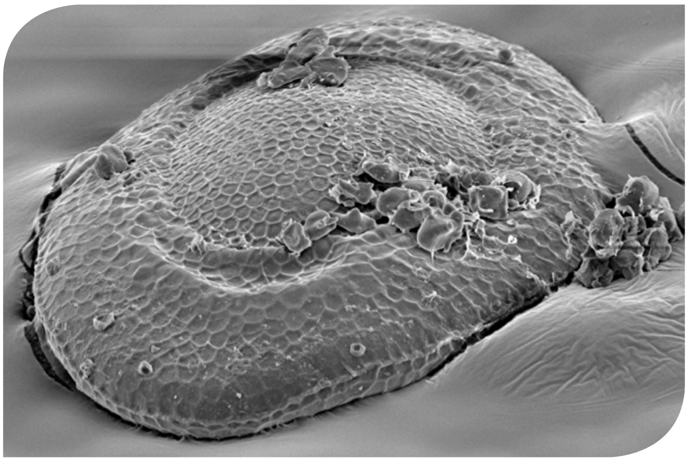

Photo 2: This is a very high-magnification image of a statoblast, the "seed" of a freshwater bryozoan. It is about 0.2 mm long. (Photo: Michelle Brunton)

Freshwater bryozoans live and reproduce in lakes and streams

Bryozoans are a normal part of healthy freshwater environments. They will grow on almost any surface in the water, from rocks and plants to glass and plastic. Colonies grow best in flowing, warm water (15-28°C), but many species will tolerate a wide range of environmental conditions. Bryozoans are often abundant in the summer. As water cools in autumn, colonies die back, but first they produce statoblasts in order to reproduce and spread to new waterways. Statoblasts are seed-like capsules that are able to tolerate dry/cold conditions that the colony could not survive. Statoblasts can float in the water (**floatoblasts**), attached to hard substrate (**sessoblasts**), or fall around the colony (**piptoblasts**). When conditions are good, statoblasts germinate and grow a new colony. Bryozoans can also regrow from broken fragments, only needing one intact zooid to regenerate an entire colony.

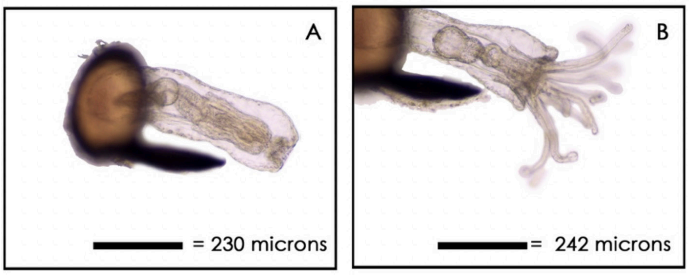

Photo 3: A new young colony of Plumatella repens *emerges from its statoblast. (Photo: Michelle Brunton)*

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Which Freshwater bryozoan is it?

Despite being ecologically important in natural environments and economically costly in irrigation and water systems, little is known about Australian bryozoans. At last count, 11 species of freshwater bryozoans have been found here, more than half of which are found exclusively in Australia.

These species are classified into three groups. The **Lophopodidae** are gelatinous, and their statoblasts have tiny hooks at each end. Tangled tubular colonies with bean-shaped statoblasts that cannot float are in the family **Fredericellidae**. Branching weedy colonies with oval statoblasts that do float are in the **Plumatellidae**. Most "nuisance" bryozoans are from this latter family.

Adults within the freshwater bryozoan families look very similar, so identification as to species is done using statoblasts, whether found in the colony itself or collected from the water or nearby surfaces. Statoblasts are usually about 1mm across, so it takes a microscope using at least 10x magnification to identify individual species; scientists sometimes need a scanning electron microscope to see all the details.

Table 1

Family	Colony form	Statoblasts	Australian species
Lophopodidae	gelatinous blob	hooks on either end	*Lophopodella carteri*
Fredericellidae	loose tangled net of tubes	bean-shaped, do not float	*Fredericella australiensis,* *F. indica, F. sultana, F. toriumii*
Plumatellidae	branching, weedy	oval, floating or attached	*Plumatella emarginata,* *P. reiki, P. repens, P. rugosa,* *P. velata, Hyalinella lendenfeldi*

Bryozoans can be a nuisance

Freshwater bryozoans have all the characteristics of persistent foulers. They can grow on all kinds of surfaces, including docks, boats, pipes and walls. As a consequence, they may become a considerable nuisance in any system that uses raw water: irrigation, wastewater treatment, industrial cooling, and aquaculture. While bryozoans are non-toxic and do not pose a health risk to humans or animals, they do grow quickly (in the right conditions they can double in size in a week) and thus can clog pipes and filters. A variety of responses have been tried and used in different settings.

Bryozoans can be helpful in their natural environment

Bryozoans are found in most freshwater environments and can be ecologically important in lakes and streams. Bryozoans feed on small particles in the water using a circle of tentacles (called a lophophore) to make water currents that carry food into the gut. Colonies can be very efficient at removing suspended particles; one species of bryozoan was estimated to remove 15 tonnes of particles from a 4.6 km^2 lake each year. From this filtered material, 8.8 tonnes of fecal pellets were deposited on the lakebed, making those nutrients available for other organisms. Feeding currents can also create important microhabitats for other small invertebrates, so bryozoans are often colonized by hydroids, micromollusks, and insect larvae.

Photo 4: Fouling bryozoans Plumatella repens *and* Paludicella articulata *cover any surface that is underwater during a big infestation.*

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Management responses to bryozoan infestation

It is functionally impossible to eradicate freshwater bryozoans from a system which they have colonised. Physical removal produces fragments, from which new colonies will grow. Most chemical and physical treatments cause the colonies to produce statoblasts which are very resistant and will germinate when conditions improve. A coordinated management response requires an understanding of what species are present, the source and extent of bryozoan infestation, its timing with the seasons, and any limits on the possible treatments available.

Who? Most foulers are plumatellids, and unfortunately they have statoblasts with varying sizes, so it may matter what species are present. If it seems that treatments that work elsewhere are not acting as expected, it would be worth examining statoblasts under a microscope to determine which families (and perhaps species) are present.

Where? If bryozoans are present, so too will be statoblasts. Looking for statoblasts in the water can identify where bryozoans are entering a system and what areas are likely to be fouled. A simple technique is to anchor pieces of polystyrene in the water throughout the system and check after several days for statoblasts on the surface. While this technique can be done at any time of year, it will be particularly useful in autumn as colonies begin to die back. If statoblasts or colony fragments are entering the system via source water, filtration before entry can reduce the likelihood of a fouling event. Once bryozoans are a nuisance, however, in-line treatments become necessary.

When? Temperature is the best indicator of bryozoan abundance; other water quality parameters are not useful for predicting a fouling event. Colonies are (usually) smallest in springtime, growing over the summer. Monitoring water temperatures in the spring can track when growing conditions will become optimal for colony growth (15-28°C). Chemical treatments may be most effective in spring when colonies are still young and developing. Monitoring water temperatures in the autumn can help estimate when colonies will begin to fragment and die. Blockages occur in autumn when colonies die off and detach from their substrate, so physical removal or flushing may be needed in autumn. Any treatment that works will have to be repeated regularly to address the influx of new bryozoans.

What? Physical removal by scouring, flushing, or manual scrubbing is simple but work-intensive. Filtration prior to entry into the system must be fine enough to restrict statoblasts (and size of statoblasts depends on species). Treating surfaces with anti-fouling paints does not appear to inhibit growth of bryozoans. Sonication, heating, desiccation, and exposure to ultraviolet light can reduce colony growth, but they do not affect statoblasts. Hydrogen peroxide is widely used to control different biofouling organisms in water treatment processes, and high enough doses could kill statoblasts (though we are not aware of any detailed research on this). Sodium hypochlorite (bleach) has been shown to effectively control bryozoan growth. Bleach treatments can be performed using 20-minute pulses of a high concentration solution (5mg/L) repeated for ten days, or 24-hour exposures to a low concentration solution (0.3 mg/L).

Why? While nobody wants bryozoan fragments in their drinking water, it may be worth considering the actual necessity for removal or limitation of bryozoan infestation in some other settings. Although the fragments and statoblasts are unsightly, they are neither toxic nor harmful, and could in fact carry nutrients. It may be that communication with users to address their concerns could eliminate unnecessary treatment costs and effects.

References

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Authors: *H. L. Mello & A. M. Smith, University of Otago*