Status: Common Native Residents

BRYOZOANS

Moss Animals

Description

Although inconspicuous and poorly known to most people, bryozoans are a major animal groups, having nearly 4,000 known species. Most bryozoans are marine, but a few dozen species live in freshwater habitats and a number these are known in South Dakota. They take the name Bryozoa (Latin for "moss animals") from their colonial and often 'furry' growth habit. Most colonies have a gelatinous matrix and form encrusting growths or branching colonies. They may grow on any submerged object, such as rocks, roots, and branches.

The individual animals of a bryozoan colony are tiny, typically only 2 to 3 millimeters in length. Their most conspicuous feature is a retractable crown of hollow, *ciliated* tentacles, called the lophophore. The lophophore serves in filter-feeding. Bryozoans feed on protozoans, bacteria, and organic matter from the water. In the center of the lophophore is the mouth, which marks the beginning of a U-shaped gut. The anus opens just outside the lophophore. The Bryozoa are sometimes classified as the Ectoprocta ('outer anus') to emphasize this feature.

Bryozoan taxonomy is complex and depends largely on microscopic details. Identification is made easier because most freshwater species produce resistant bodies called statoblasts. These form in response to adverse environmental conditions. They contain a mass of cells enclosed in a bi-valved, hardened shell.

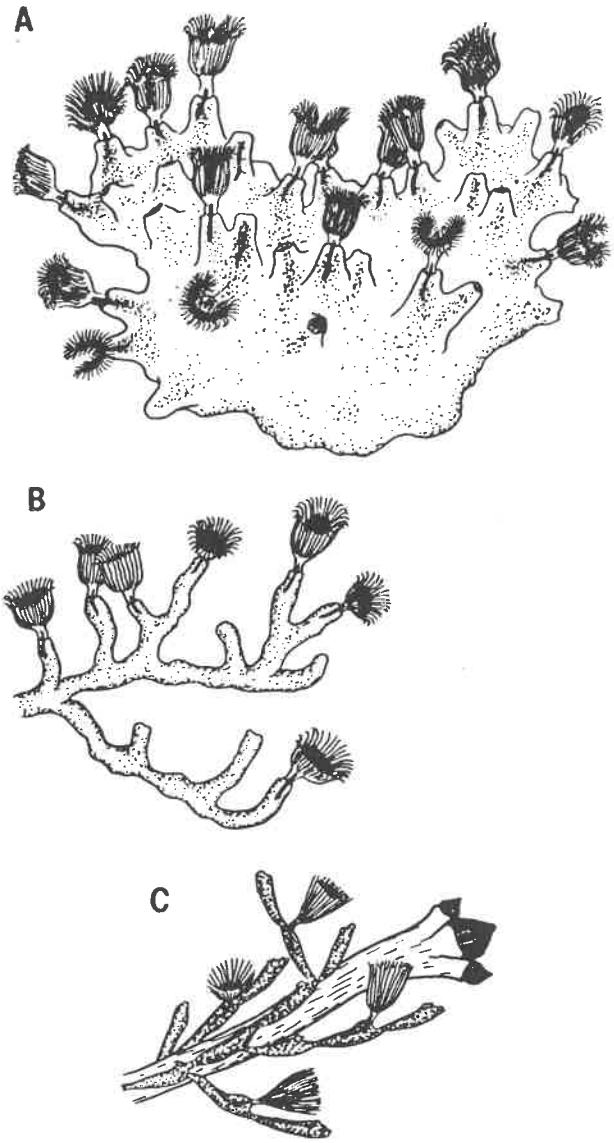

Figure 1. Representative Bryozoan Colonies: A. *Hyalinella punctata*; B. *Fredericella sultana*; C. *Paludicella articulata.*

Surface features of the statoblasts, visible with a compound microscope, allow the major genera to be identified. For detailed identification of statoblasts see Pennak (1978) and Wood (1991). At least five genera probably occur in the state: *Plumatella; Hyalinella; Fredericella; Cristatella;* and *Paludicella.* (see Table 1).

Other genera which may be recorded in South Dakota are: *Pectinatella; Lophopus; Lophopodella;* and *Stolella.* All but *Paludicella* produce statoblasts. *Paludicella* develop overwintering structures that are small, irregular in shape and difficult to identify

Table 1. The Five Bryozoan Genera Likely to be Found in South Dakota.

Genus	Description
Plumatella	A common genus, occurring primarily in still or slow-flowing waters. Colonies may be encrusting growths or branched colonies and may reach many centimeters in breadth. The surface colony forms a thin, horn-colored covering. The most common species, *P. repens* and *P. casmiana* form pale, sparsely branching growths. Statoblasts are oval, approximately 0.4 mm in length, with a pale outer ring and dark central capsule. The lophophore is horseshoe-shaped.
Hyalinella	Similar to *Plumatella* in most aspects, including the shape and form of the statoblasts (Figure 2). The gelatinous, encrusting colonies are frequently yellowish, and horseshoe-shaped lophophores are larger than those of other genera. *H. punctata* is known in S.D.
Fredericella	*Fredericella* is a genus forming amber-colored colonies with frequent, short branches. Lophophores are circular and urn-shaped. Statoblasts are paler and flatter than those of *Plumatella* and *Hyalinella*, often kidney-shaped, and lack an outer ring. *F. indica*, is probably common in most parts of the state. The lophophore is circular.
Cristatella	The only genus with colonies that form compact oval mats, usually 2 to 5 cm in length. These are similar in appearance to the egg-masses of *Lymnaea* snails and are capable of coordinated creeping, often moving several centimeters in a day. Statoblasts are large, approximately 1.0 mm in diameter, with distinctive marginal hooks. The lophophore is horseshoe-shaped
Paludicella	Branching colonies usually grow on submerged twigs. Colonies are composed of a number of amber-colored units, each housing a single animal with a circular lophophore. The units taper at each end and interconnect irregularly. They do not form statoblasts, are inconspicuous, and probably quite common.

Distribution

Although these genera are all widely distributed in the eastern United States, and have been found in northeastern South Dakota, documented records of bryozoans are scant. *Plumatella repens, P. casmiana,* and *Hyalinella punctata* appear abundant and are likely to be found in creeks and larger waterways throughout the state. Although colonies are frequently inconspicuous and difficult to collect, statoblasts may be recovered in huge numbers from driftline debris if bryozoans are locally present. Please send collection information and unidentified specimens to me at the Northern State University.

Natural History

Bryozoans are most common in still or slow-flowing waters with high densities of *phytoplankton* and suspended organic matter. These creatures are delicate and would be torn apart by high currents and turbulence. In flowing waters most species assume a flatter growth habit, so the lophophores are near the substrate where the reduced water flow provides protection. The lophophore may have from 12 to over 50 tentacles. Long lateral cilia circulate water through the lophophore. Frontal cilia intercept suspended matter and convey it in mucous strings to the mouth.

The main body lies below the lophophore and secretes the gelatinous matrix. Between the gut and the outer epidermis is an extensive *coelomic* cavity, crossed by the large lophophore retractor muscle. Because of their small size, and the large surface area of the lophophore, bryozoans require no specialized respiratory or circulatory systems. A single ganglion or 'brain' at the base of the lophophore integrates a superficial nervous system. There is no nervous coordination between separate animals within a colony. Although they lack obvious receptors, the

lophophores are sensitive to light and movement and retract promptly when disturbed. Neither the gut nor the *coelomic* cavity is continuous between individual animals, but nutrients are exchanged via the gelatinous matrix, making the entire colony *mutualistic.*

All bryozoans are *hermaphroditic.* The gonads form from the lining of the *coelom* and the ovary produces single eggs which are apparently self-fertilized. The embryo develops into a short-lived *ciliated* larva, which metamorphoses after a few hours to form a new individual. This subsequently gives rise to further animals by *asexual budding.*

In contrast to other filter-feeders such as sponges, bryozoans display considerable tolerance of pollution. They can live downstream of sewage contamination and heavy agricultural run-off. The major environmental threat of such excessive nitrate and phosphate levels, is *eutrophication.* These added fertilizers increase the growth of algae, which can cause algal blooms that blanket the water surface, shading and killing bottom-dwelling vegetation. The rapid population turnover of the algal cells adds large amounts of organic matter to the bottom sediments. Populations of bacteria, the major decomposers, then explode and rapidly exhaust oxygen from the water. This may eliminate some species directly, but others die due to the production of toxic ions and heavy metals that become soluble when oxygen levels are low. The frequent occurrence of bryozoans in eutrophic waters indicates a high tolerance of both low oxygen and increased levels of toxic ions. They do, however, appear sensitive to several organic pesticides.

Statoblasts may be formed at any time of year, but peak production occurs in the late summer and fall. In South Dakota's harsh winters, bryozoan colonies die off and the statoblasts provide a means of overwintering. Two main types of statoblast are formed: floatoblasts with a central capsule surrounded by a ring of air-filled cells serving in floatation; and sessoblasts that lack floatation cells and remain cemented to the living tissue or attached to solid objects. *Fredericella* only produces sessoblasts, but other statoblast-producing genera form floatoblasts. Statoblasts produced in the fall have a fixed period of dormancy, after which temperature provides the main trigger for germination. Statoblasts are remarkably tolerant of physical extremes including cooling to temperatures of -30 to -50 °C and prolonged dehydration.

Studying Bryozoans In The Laboratory

The best way to see if bryozoans are present waterways is to collect samples of the floating debris stranded during high waters and storms. Transfer a small piece of debris to water in a petri-dish. Low-power observation with a microscope will frequently reveal abundant statoblasts floating on the surface. These can be collected with a pipette and transferred to a slide for high-power observation.

Collection of living colonies should be attempted in late spring or summer during peak growth. No species overwinter as colonies in South Dakota. Use a large bucket to gather submerged twigs and rocks. Searching for colonies in the habitat can be aided with a mask and snorkel or a glass-bottomed bucket.

A white enameled dish is ideal for studying pieces of debris. Immerse these in shallow water and leave the colonies to acclimate. After a few minutes, search for the transparent or amber-colored colonies. Many species are sensitive to disturbance and may remain retracted for long periods before *lophophores* emerge and resume feeding. Smaller colonies are best searched for using a low-lower binocular microscope. Bryozoans may thrive in large aquaria provided adequate levels of suspended organic matter are maintained; this can be assisted by using little or no filtration. Colonies should be arranged on elevated or inverted objects to protect them from being smothered by settling debris. Use freshly collected water from the original site since bryozoans are sensitive to chlorine and to abrupt changes of temperature and pH.

Statoblasts can be *germinated* in water in glass petri-dishes with lids to minimize evaporation. Germination may occur in as little as 5 to 10 days. Germinating statoblasts sink and the emerging animal cements itself to the substrate. Once the valves of the statoblast fall away, the young colonies can be transferred into large aquaria. Samples of statoblasts revealing a high incidence of germination can be used for controlled experiments to explore viability following exposure to environmental extremes of water pollutants, low oxygen tensions (or an atmosphere of pure nitrogen), temperature extremes, and low relative humidities. To maintain precisely controlled humidities see Lide (1996).

Bryozoans make beautiful slide-mounts but must be *narcotized* prior to fixation to insure that the *lophophores* are preserved in an extended state. Details of preparation are listed in Pennak (1978).

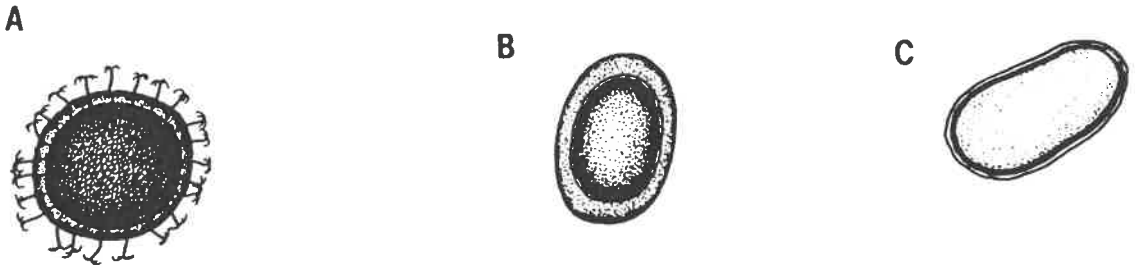

Figure 2. Bryozoan statoblasts: A. *Cristatella mucedo*, floatoblast; B. *Hyalinella punctata* floatoblast; C. *Fredericella sultana* sessoblast.

Glossary

Asexual budding - the reproductive process through which one individual gives rise to another through growth of a bud that eventually separates from the parent to become an independent animal, genetically identical to that parent.

Ciliated - having cilia, the thread-like organelles that are found on the surface of cells.

Coelom - any fluid-filled cavity formed within the mesodermal tissues, usually functioning as a hydrostatic skeleton and for storage of gametes and excretory wastes.

Eutrophication - the process resulting from an increase in nutrients (phosphorus and nitrogen) in water resulting in excessive bacterial growth, oxygen depletion, and a build-up of toxins.

Hermaphroditic - having both male and female sex organs in the same individual.

Mutualistic - conferring mutual benefit on the individual organisms involved. Mutualistic associations may exist within species, for example in colonial animals sharing food, or between species, the symbiotic gut fauna in ruminants, such as cows.

Narcotized - treated with chemicals to depress neuromuscular function, creating a state of relaxation.

Phytoplankton -microscopic plant life that floats in or on bodies of water.

References

Pennak, R.W. (1978). Freshwater Invertebrates of the United States (2nd Edition). John Wiley and Sons, NY. Chapter 12: 254-274.

Lide, D.R. (1996). Handbook of Chemistry and Physics (77th Ed.). CRC Press, Boca Raton, FL.

Wood. T.S. (1991) Bryozoans. Chapter 14 in Ecology and Classification of North American Freshwater Invertebrates (Thorp, J.H., and Covich, A.P., eds.), pp. 481-499. (A useful source for more detailed references).

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