FASCINATING FRESHWATER PHENOMENA:

JELLYFISH AND BRYOZOANS

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Freshwater Bryozoans: Origins and Composition

Freshwater bryozoans are an excellent example of an aquatic entity that consists of multiple individual animals that comprise a colony and together they perform life functions for the benefit of the entire colony. While the majority of bryozoans are considered marine, there are a few freshwater forms. *Pectinatella magnifica* (Figure 1) is a member of the animal phylum Ectoprocta (also known as moss animals), a group with a fossil record extending back to the upper Cambrian period (500,000,000 years ago). The class Phylactolaemata is found exclusively in fresh water (Wood 1989) and some species even pre-date the dinosaurs. The majority of the colony is water, but Morse (1930) determined that Pectinatella sp., was comprised also of protein amino acids such as tyrosin, tryptohane, and cystin, as well as sodium chloride (salt), glucosamine chitin, and large quantities of calcium.

Freshwater bryozoans are far less diverse than their marine cousins, with only about 50 species worldwide, but what they lack in numbers they make up for in size. Some colonies grow to be 4-foot "blobs" such as the colony found floating in Newport News, VA. When the individual animals extend their tentacles to feed, the colony takes on a fuzzy appearance, hence the bryozoans' common name of moss animal (Science Daily 2010). Colonies of *Pectinatella magnifica* feature a surface layer of adjoining rosettes each with 12-18 animals or zooids around a central jelly-like mass that is 99% water. The colonies can be free-floating or attached to a piling or other submerged object such as woody debris. In the winter, the bryozoans form statoblasts which offer protection against harsh elements and allow for spring colony formation. One study even showed that young colonies of *P. magnifica* can actually move on their own by coordinated pulsing of the individual animals (Science Daily 2010).

Figure 1. A photo of a bryozoan found in Magician Lake, Van Buren County, MI (Restorative Lake Sciences, 2013).

Each bryozoan has an outer layer that protects a digestive tract. Bryozoans are filter feeders that feed on algae and organic matter and may substantially reduce algal abundance in some lakes, thereby resulting in clearer water. The zooids feed by using ciliated (hairy) lophophores (tentacles) to direct food to them via self-created water currents. These bryozoans, despite their appearance in nature, are not a sign of bad water quality and they are not harmful to fish or other vertebrates. They may be however, indicative of nutrient-rich waters (Dendy, 1963). The bryozoans are usually found in slow-moving waters since currents tend to break up the colony.

Freshwater Bryozoans: The Need for More Information

Other common freshwater species include *Plumatella emarginata, P. repens, P. longigemmis, Stolella indica, Fredericella sultana*, and *Gelatinella toanensis*. Dispersal has been shown to be linked by waterfowl across continents, but human activities may also be a factor. Much is still not known about freshwater bryozoans (Wood 2001). Protection against known species may be needed since little is known about their total distribution. The presence of the zebra mussel (*Dreissena polymorpha*) in the Great Lakes has focused new attention on the sessile benthic communities, as significant changes in benthic (bottom) community structure are expected with the introduction of this exotic species. Without knowing the historical and current distribution of native invertebrates, such has the bryozoans, it is not possible to identify changes in community composition over time (Barnes 2003). Natural predators of the bryozoans include fish and wildlife such as raccoons.

Figure 2. A freshwater jellyfish in medusa form found in Dewey Lake, Cass County, Michigan
(Photo courtesy of Doug Pearson, Dewey Lake).

Freshwater Jellyfish: Origin, Distribution, and Morphology

Freshwater jellyfish (*Craspedacusta sowerbyi*; Figure 2) was first noted in England in 1880 by Lankester and originated from the Yangtze River system (Parent, 1981). Although the majority of the phylum Cnidaria (taxonomic rank) is found in marine or salt water habitats, a few species are also present in freshwaters. Freshwater jellyfish have been found in Asia, Europe, North and South America, and Australia. They can be found in lakes, reservoirs, man-made impoundments, rivers, and water-filled gravel pits or quarries. In the United States, they have been seen in large river systems such as the Allegheny River, the Ohio River, and the Tennessee River and thus are able to tolerate moving waters although they prefer slower moving waters. In the Great

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Lakes Region, freshwater jellyfish were first discovered in the Huron River near Ann Arbor, MI, in 1933, and in Lake Erie shortly thereafter (Mills et al. 1993). It has since been recorded in Lake Huron and Lake St. Clair, as well as dozens of inland lakes and streams throughout the region, in the states of IL, IN, MI, MN, NY, OH, PA, and WI (McKercher et al. 2013). The appearance of the jellyfish is described as sporadic and unpredictable. Often, jellyfish will appear in a body of water in large numbers even though they were never reported there before. The following year they may be absent and may not reappear until several years later (Ameling 2012). It is also possible for the jellyfish to appear once and never appear in that body of water again (Peard 2005). Jellyfish have been found in nearly 203 lakes in Michigan and that number may increase with time.

The jellyfish are all "polymorphic" which means that there are multiple forms for the same entity within a population. Most of the adult freshwater jellyfish range from the size of a penny up to the size of a silver dollar. During the winter, the polyps contract and become "resting bodies" that are capable of surviving the cold temperatures. Some scientists believe that the resting bodies, called podocysts, are one way in which the jellyfish are transported from lake to lake. It is believed that the podocysts may be transported on aquatic plants, by aquatic animals, or perhaps on the feet of birds. When conditions become favorable, the podocysts develop into polyps and the life cycle is continued (Peard 2005). The polyp form may be a "resting body" that is persistent in cold waters or when starvation is evident. Additionally, the polyp form persists annually while other life cycle stages (medusa, frustule, and resting bodies) occur when certain environmental conditions are present. However, polyps are usually not found in areas where sedimentation or dense algae is present because the polyp needs to find suitable substrates to conduct feeding in the water. Suitable substrates include rock, aged wood, and aquatic vegetation. Thus, polyps tend to be more plentiful in oligotrophic (nutrient-poor) water bodies than in eutrophic (nutrient-poor) waters (Acker and Muscat, 1976). Polyps may be translocated among lakes accidentally with stocked fish and aquatic plants or by waterfowl (McKercher et. al 2013). This may explain the increase in sightings over the years in inland lakes and water bodies.

The presence of the various life cycle forms varies with water temperature and thus season. In the winter, the resting body is the most prevalent form and all do not survive extreme winter conditions. Polyps are most abundant in the spring and propagate through asexual reproduction. During late spring and early summer, the frustule becomes abundant and by late summer and early fall, the medusa (large umbrella-shaped form) is common. Medusa formation is most prevalent in water temperatures between a minimum of 59°F and a maximum of 86°F (Milne, 1938).

Freshwater Jellyfish: Feeding Patterns and Predation

Freshwater jellyfish migrate to the deeper waters of a lake during the daytime and then to shallower depths at night to feed on migrating zooplankton that also follow this trend. The impact of this widespread jellyfish on surrounding ecosystems is unclear and is currently being studied. It is well known that the jellyfish feed on zooplankton in the water column, especially genera such as Bosmina sp., Cyclops sp., Ceratium sp., and Nauplius sp. (Lytle, 1959). Figure 3 shows a copepod known as Cyclops sp. that is a preferred food source found in many healthy lakes. Dodson and Cooper (1983) proposed C. sowerbyi's preference for predatory zooplankton, such as the rotifer Asplanchna, could influence relative zooplankton species structure. C. sowerbyi medusae prefer larger zooplankton (0.4–1.4 mm) and vigorous prey such as copepods (Spadinger and Maier (1999). They analyzed the stomach contents of various medusae and found that the larger zooplankton was dominant. This could be due to the morphological characteristics of tentacle spacing or that some prey cannot activate the stinging nematocysts used by the jellyfish to capture food. In fact, when the copepods and larger zooplankton feel threatened, they may increase the length of their antennule and make other bodily modifications to defend themselves against the jellyfish (Jankowski, 2004). Predation of the zooplankton by C. sowerbyi result in increased algal (phytoplankton) populations (Jankowski and Ratte, 2001). It is unlikely that the medusa could consume zooplankton quickly enough to compete with the fish for food (Dodson and Cooper, 1983) and do not pose an immediate threat to fishery structure. It was further noted that freshwater jellyfish are generally not considered an important predator of eggs or small fish but larger fish will feed on them if other food sources are not abundant (Davis, 1955). Crayfish are considered the only important predator of the medusa phase (McKercher et. al 2013).

It is unknown whether freshwater jellyfish can harm humans. Like marine jellyfish, they do have stinging cells (cnidocytes). This mechanism is designed for feeding, as the cnidocytes are utilized to paralyze macroinvertebrates and even small fish. However, we have no "hard" evidence that these organisms can penetrate human skin (though some have claimed otherwise).

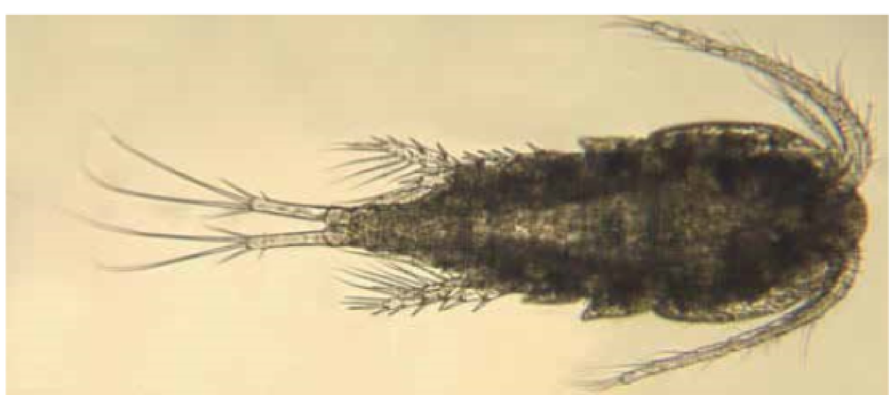

Figure 3. The copepod, Cyclops sp. (photo courtesy of the USGS, 2012).

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