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A Report of Freshwater Sponge (Porifera: Spongillidae) In Central Nebraska

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Little has been reported about the occurrence of freshwater sponges in Nebraska and no publications have previously recorded from central Nebraska waters. A large colony of freshwater sponges was discovered on the steel interior walls of a sunken (3.5 meters) delivery truck in a sand/rock quarry of the Platte River Valley near Kearney, Nebraska. Samples were collected and characteristics of the sponge were examined under magnification. Morphology indicates the sponge is a member of the genus Ephydatia. Although the species was not conclusively determined, it shares the most characteristics with *E. muelleri*. This is the first confirmed record of sponges from the Platte River drainage and central Nebraska.

**Introduction**

Sponges are filter-feeding animals that use large networks of internal channels to filter food and are thus exposed to waterborne pollutants. Thus sponges are potentially sensitive indicators of water quality and have been shown to be susceptible to changing pH, dissolved oxygen, nitrates, and other potential environmental contaminants (Kahlert and Neumann 1997, Hill and Hill 2002).

Several thousand species of sponges have been identified, of which the vast majority are marine. Spongillidae is the only identified family of sponges found in North American fresh waters. In the United States, approximately 30 species of freshwater sponges have been identified with most found in the Northern Rocky Mountains, the Great Lakes, and the New England States (Desanto and Fell 1996, Lauer et al. 2001, Peterson and Addis 2000, Ricciardi et al. 1995).

There is limited information on sponges in Nebraska. To date, only a single publication has recorded the presence of sponges in Nebraska. Dawson (1966) identified species associated with a fish hatchery in the northern Nebraska sandhills as *Meyenia mulleri*, *Spongilla fragilis*, and *Carteria tubispermis*. The taxonomy of sponges is currently undergoing substantial changes and Van Soest, et al. (2010) designate these species as *Ephydatia muelleri*, *Eunapis fragilis*, and *Heteromeyenia tubisperma*, respectively. This paper represents the first record of sponges in the Platte River Valley of central Nebraska.

**Materials and Methods**

Samples were collected from a sandpit lake approximately 1 km east of the Archway Monument along Interstate Highway 80 in Kearney, Nebraska. Collection occurred in late August 2006. Sponges were first observed approximately 5 years earlier and had continued to expand in surface area over that time. The lake is bordered by private homes and is used for regular recreational sports including self-contained underwater breathing apparatus (SCUBA) diving, water skiing, and fishing.

The sponges were located in a sunken delivery truck at 3-4 meters depth. Patches of sponges as large as 30 cm in diameter were observed. The water temperature was 28°C with no visible thermocline. The majority of sponges were located at approximately 4 meters of depth near the bottom of the truck on the inside walls. Water visibility was 1-2 meters. The inside of the truck was dark and required a spotlight for observation. Water pH was 7.5 with moderate to high levels of total alkalinity. Total water hardness was 250 ppm. Iron, copper, nitrate, and nitrite levels were low to undetectable through water quality tests.

Three samples were collected via SCUBA by cutting from an inside wall above the wheel well and near the bottom of the truck. Samples were placed in 50% isopropyl alcohol for preservation. Processing and identification were completed as described by Pennak (Smith 2001).

Freshwater sponges are identified and categorized based upon morphology, location, and environment. Final determination of genus depends upon microscopic visualization of megascleres, microscleres, gemmules, and gemmoscleres. The method presented by Pennak (Smith 2001) was used to identify the genus in this study with secondary confirmation using Penney and Racek (1968).

Spicules serve as the structural framework for sponges. They may be subdivided into megascleres and microscleres based on size and shape. Spicules in freshwater sponges are made of silicates and provide rigidity. In order to observe spicules, the tissue of a sample is dissolved with acid (Smith 2001). Nitric acid was brought to boil on a hot plate and a one-cm² sample was placed in the nitric acid. The sample was boiled until the majority of tissues dissolved and was then allowed to cool while visible white spicules settled to the bottom. A pipette was used to transfer the spicules to a test tube and samples were washed with distilled water to remove
remaining tissue. Spicules were then transferred to a glass slide and heated on a hotplate until all liquid evaporated. The sample was observed under a compound microscope under low and high power.

**Results and Discussion**

Freshwater sponges actively grow during warmer months of the late spring and summer. In the fall and winter months, the larger framework of the sponge deteriorates and gemmules form. Gemmules are small conglomerates that serve as a mode for survival over winter months. They are small and similar appearance to a period following a sentence. When temperature increases in the spring, gemmules develop into a sponge (Barbeau, et al. 1989). Gemmules also contain supportive spicules known as gemmoscleres.

In August when the sponges were sampled, they were 0.5-0.75 cm thick and were beige (flesh) in color with identifiable surface osculum (Figure 1, top). Gemmules were lightly visible throughout the sample and were brown to black in color (Figure 1, left).

Low power field view of processed samples demonstrated uniform megascleres and gemmoscleres. High power showed pointed megascleres that were either smooth or weakly spined (Figure 2). Megascleres were straight or with a slight bend. Gemmoscleres were frequent with rotule patterns that were without curved hooks. Only one form of gemmosclere was identified and was always less than 75 um in length. There were no observed differences between individual samples. Based upon Pennak’s guide (Smith 2001), the most likely genus is *Ephydatia*.

*Ephydatia* are cosmopolitan and one of the most commonly reported freshwater sponges in North America. The samples at this central Nebraska site meet criteria for this genus. The environmental factors also follow similarly reported characteristics of *Ephydatia*. These include favorable pH (slightly basic) and water hardness (adequate calcium) (Smith 2001). Additionally there were low levels of nitrates/nitrites.

Identification of the exact species in this study was not possible using the techniques used in this study. Further evaluation may require use of electron microscope to identify subtle characteristics. The specimens have a similarity to other reports of *Ephydatia muelleri* (Penney & Racek 1968 and Smith 1994) and this is the most likely species.
The one aberration noted through evaluation is a large spine perpendicular to the shaft of the gemmoscleres (Figure 3). This is not noted in other publications on *E. muelleri*. This could be a local variation of this species but may require further evaluation and categorization.

This is the first published report of freshwater sponges in central Nebraska. Further evaluation is required to determine species. Other studies should include characterization of environmental conditions and water quality along with seeking more specimens from other interstate sandpit lakes.

**Literature Cited**


