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SPECIFIC GRAVITY AND FRESHWATER MUSSELS. John J. Jenkinson, 305 Revere Avenue, Clinton, TN 37716, jjjenkinson@hotmail.com

Specific gravity (SG) can be defined as the relationship between the mass of an object and its volume. This physical characteristic is calculated by dividing the weight of an object by its displacement in water. By definition in the metric system, one gram of water occupies one milliliter of volume and, therefore, has an SG of 1.0. With regard to freshwater mussels and their habitats, SG is a quantitative way to compare the tendency of an animal to float higher or lower in the substrate than objects around it. I have not found any previous examination of SG in freshwater mussel literature.

During this exploratory study, I used a battery-powered postal scale (1g increments) to determine the weight of objects and a 100-ml graduated cylinder (1 ml increments) to determine their volume. Objects that would not fit into the graduated cylinder were put in a water-filled container, the overflow was collected, and the volume of that water was measured. All substrate materials were tested wet: either as they came from a waterbody or after soaking in water for at least 24 hours. All mussels were tested alive and prodded to ensure their shells had closed under water (without air in the mantle cavity).

So far, I have calculated SG values for 24 native mussel species, *Corbicula fluminea*, and examples of 15 actual or potential substrate materials (numerical results on reverse). SG values for substrate materials range from 1.2 (some coal rocks) to 11.9 (some lead weights). Most typical [= sedimentary] substrate materials have SG values between 2.0 and 2.5.

With regard to native mussels, SG values calculated so far range between 1.1 (*Alasmidonta arcula*) and 2.4 (*Obliquaria reflexa*). When several representatives of a species were tested, they strongly suggested that SG does not vary with size: small and large individuals (at least within the same population) yielded very similar SG values. I have not yet compared SG values among different populations of the same species.

As might be expected, representatives of the two (classic) Anodontine species that have been tested yielded low SG values, *most* of the eight Lampsiline species yielded mid-range values, and *most* of the 14 Unionine species yielded higher SG values. More interestingly, however, almost all of the species yielded SG values comparable to the SG values of the substrates where they are found in large numbers, regardless of their phylogenetic relationships. Coastal Plain and sand-dwelling species have low SG values (1.3 – 1.7, comparable to sand and clay) while big-river shoal-dwelling species have relatively high SG values (1.9 – 2.0, comparable to mixed [sedimentary] rocks).

These initial results suggest that native mussels maintain their position in the substrate, in part at least, because of the physical similarity of their SG to the SG of the surrounding particles. Changes in the SG of the substrate (e.g., after the introduction of much lighter coal particles) could create strictly physical conditions in which some species would be unable to maintain their normal position in the bottom.

Specific gravity appears to be an informative but, until now, overlooked physical characteristic of native mussel species. When evaluated more fully, SG probably will help explain the presence or absence of mussel species in various types of habitats, may point out unexpected variations in mussel behavior, and could help identify the principles controlling the range and apparent convergences in mussel shell shapes and ornamentation.

Specific Gravity Values for Some Freshwater Bivalves and Substrate Materials

Bivalve Species	N*	Specific Gravity Value	95% Confidence Interval
Alasmidonta arcula	12/4	1.15	± 0.07
Pyganodon grandis	8/4	1.19	± 0.01
Hamiota (= Lampsilis) altilis	15/5	1.34	± 0.06
Potamilus alatus	3/3	1.37	± 0.03
Cantheria spinosa	12/4	1.49	± 0.17
Lampsilis fasciola	3/2	1.55	± 0.10
Villosa iris	2/2	1.56	± 0.41
Elliptio icterina	8/4	1.64	± 0.10
Lampsilis teres	1/1	1.70	--
Corbicula fluminea	4/4	1.71	± 0.18
Megalonaias nervosa	3/3	1.76	± 0.04
Lampsilis claibornensis	1/1	1.88	--
Fusconaia subrotunda ?	2/2	1.91	± 0.03
Elliptio dilatata	1/1	1.91	--
Amblema plicata	3/3	1.94	± 0.08
Tritogonia verrucosa	5/5	1.94	± 0.26
Quadrula metanevra	2/2	1.97	± 0.06
Elliptio crassidens	15/13	1.97	± 0.05
Cyclonaias tuberculata	10/9	1.98	± 0.05
Plethobasus cooperianus	14/14	1.99	± 0.04
Ellipsaria lineolata	8/6	1.99	± 0.08
Quadrula pustulosa	13/8	2.03	± 0.08
Fusconaia ebena	10/6	2.03	± 0.10
Pleurobema cordatum	4/4	2.05	± 0.05
Obliquaria reflexa	2/2	2.43	± 0.04

Substrate Materials	N*	Specific Gravity Value	95% Confidence Interval
Coal - Stream Rocks	12/4	1.24	± 0.04
Coal - Stream Rocks	10/2	1.39	± 0.02
Clay Hardpan	9/3	1.43	± 0.02
Clay Hardpan	9/3	1.48	± 0.02
Fine Creek Sediment	10/2	1.68	± 0.04
Sand - Emory River, TN	15/3	1.80	± 0.02
Sand - Padre Island, TX	15/5	1.86	± 0.01
Creek Gravel	9/3	2.08	± 0.03
Limestone Riprap	3/1	2.24	± 0.07
Rocks - Emory River, TN	20/5	2.28	± 0.08
Stained Glass Pieces	10/1	2.40	± 0.03
Limestone Riprap	12/4	2.56	± 0.05
Quartz Gravel	9/3	2.58	± 0.04
Vermont Marble	10/2	2.59	± 0.06
Steel/Iron	8/2	7.29	± 0.22
Brass	4/1	7.53	± 0.50
Copper	4/1	8.28	± 0.33
Lead Fishing Weights	6/2	10.78	± 0.08
Lead Fishing Weights	6/2	11.97	± 0.06

* Number of Observations / Number of different animals or samples.

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