INVERTEBRATES

Status: Common, Native Residents

POND SKATERS

Description

Pond skaters are insects that inhabit the surface of fresh water where they feed primarily on other, usually dead or drowning, insects. Although the name pond skater is frequently used to refer specifically to the largest members of this group, belonging to the family Gerridae, here we will use it to refer to all surface-dwelling insects of the order **Hemiptera**.

The Hemiptera or *true bugs* all share highly modified mouthparts that form a jointed, sucking beak, or *rostrum*, enclosing the slender *mandibles* and *maxillae*. The *rostrum* is used to pierce plant or animal tissues and suck out fluids. In one group of hemipterans, the wings are symmetrical and are folded, roof-like, over the back. These are in the sub-order **Homoptera** and include many sap-feeding insects such as aphids, leafhoppers and cicadas. In the other sub-order, the **Heteroptera**, the wings are folded at a slant across the back and the overlapping portions of the forewings are thin membranes. From this derives the Latin name Heteroptera or 'different wings.'

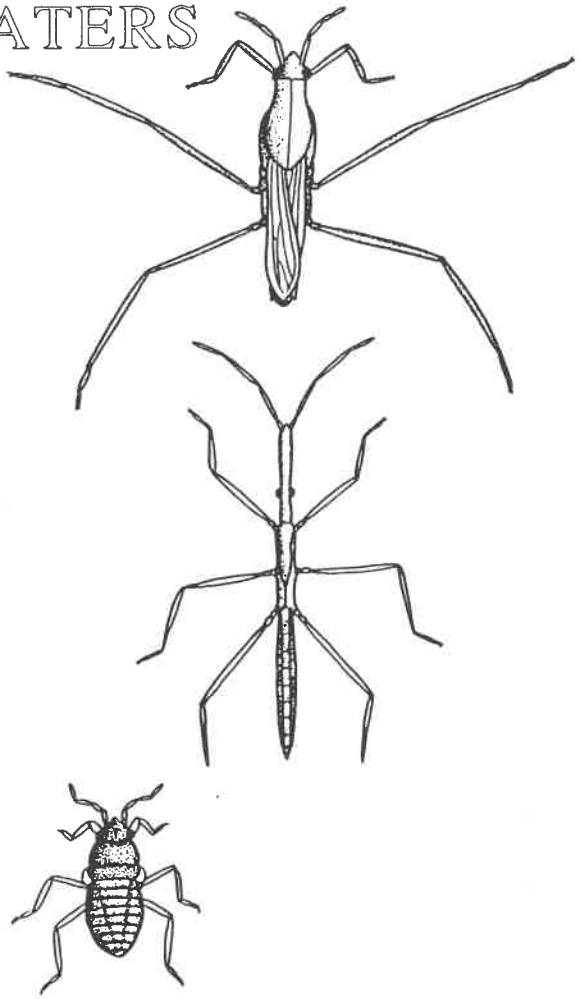

Figure 1. Three of The Most Common Species of Pond Skaters in South Dakota: *Gerris* sp., *Hydrometra martini*, and *Microvelia* sp. (top to bottom).

Within South Dakota, 7 genera of pond skaters are common:

Gerris - Twenty species occur in North America, at least 6 of which are found in the state, although they are difficult to distinguish from one another. They jump rapidly over the surface using rowing movements of the long second pair of legs. The hind legs trail behind and are used for steering, while the shorter forelegs serve to grasp prey. Winged and wingless adults occur. They range in length from 0.3 to 0.6 inches (8 - 16 mm). *Gerris* are usually found in groups.

Hydrometra - The 'water measurer' is a very slender insect with stilt-like legs. Its name comes from its habit of walking slowly in a 'measured' way. The very long head, with terminal antennae, and eyes placed laterally about 2/3 of the way back, are distinctive. *Hydrometra martini*, the only common species, is 0.3 to 0.5 inches (8-12 mm) in length. This species is usually solitary.

Velia and *Rhagiovelia* - These are small insects, usually 0.1 to 0.2 inches (4-6 mm) in length, and are found typically in small groups in the marginal reaches of flowing waters where they run actively against the current. The 10 or so species of *Velia* are mostly dark, frequently with a orange and white checkered pattern on the abdominal margins. *Rhagiovelia* species have a tuft of hairs on the tarsus of the second pair of legs which is *hydrophilic* and penetrates the water surface, serving as a paddle.

Mesovelia - There is one fairly common species of this genus in South Dakota, *Mesovelia mulsanti*, which is usually wingless as an adult. This species is leaf-green in color and mostly is found among floating debris and on the floating leaves of duckweeds. They range from 0.1 - 0.2 inches (4-5 mm)in length.

Microvelia - This group includes some of the smallest of the pond skaters, with species ranging from 0.06 to 0.16 inches (1.5-4.0 mm) in length. There are many species, most being broad-bodied, dark and short-legged. They run rapidly on still waters and may also penetrate the surface film and swim among submerged vegetation.

Hebrus - These minute (0.06 - 0.1 inch; 1.5-2.5 mm) insects are easily mistaken for *Microvelia*, but possess a distinctive pile of velvet hairs. Several species live in the state. Unlike *Microvelia*, the antennae have 5 (not 4) segments.

Distribution

The genera above all appear to be widespread in the state, although there is a shortage of records for many areas. It is likely that species of *Gerris*, *Microvelia*, *Hebrus* and *Mesovelia* are common. *Gerris* frequently collect in large groups, particularly in flowing waters beneath overhanging trees and in other partially shaded areas. *Hydrometra* is less common though it is easily missed owing to its slow movements and very slender form; it is usually found among *emergent vegetation* and floating debris in stagnant waters. *Velia* and *Rhagiovelia* species are more frequent where there is flowing water and therefore are common in rapids and creeks in the Black Hills. However, they may be encountered in other regions, particularly near the shores of larger lakes.

Natural History

Perhaps the most curious feature of pond skaters is how they are able to walk on the water surface! This feat is possible because of two factors. The first is their water-repellent or *hydrophobic cuticle*. The *cuticle* of a pond skater, like that of most insects, is coated with wax to make it waterproof. This prevents the insect from losing water, but also provides protection against drowning, since water runs off the *cuticle* surface. Because of the strongly *hydrophobic cuticle*, the legs of a pond skater repel water, pushing it down rather than sinking into it.

Water can only be pushed down a certain extent, however, before the surface film

breaks. The force required to break the surface film is known as *surface tension* and is a result of the degree of attraction of the water molecules for one another. Because water remains a liquid up to 100°C, the force of attraction is obviously quite high.

A pond skater, although denser than water, is able to stand on the surface because a sufficiently large amount of its surface area is in contact with the water. The heavier the object, the more surface area is necessary to maintain floatation. It becomes progressively more difficult for larger animals to walk on the surface. (*A technical explanation for this phenomenon is provided below.) The basilisk lizard (*Basilicus plumifrons*) is able to run over the water surface with the aid of extremely long toes, but these are probably the largest 'surface walkers.' If I were to be able to walk on water, the perimeter of my feet would need to measure over 10,667 yards (10,000 m), or in other words, my feet would need to be about 1.5 miles (2.5 km) long!!

Pond skaters have keen eyesight and are visual hunters. When a dead or drowning insect is spotted, the pond skater swings down its long, sharp *rostrum* and pierces the victim. Saliva is injected and *proteolytic enzymes* begin digesting the tissues. The partially digested broth is then sucked up.

Pond skaters have incomplete metamorphosis and mature through 4 *nymph* stages. The *nymphs* are basically smaller versions of the adults, but never possess wings. Eggs are laid on the stalks of *emergent vegetation* or, in the case of many of the smaller genera, among debris. Development is rapid. Most species grow from hatching to maturity in 2 to 3 weeks. There may be 4 to 6 broods per year. Fully winged forms disperse by flight, but wingless forms are common in most species.

In South Dakota and other northern states, pond skaters over-winter in shoreline debris beneath bark, in hollow plant stems, or in other secluded retreats. As with most other insects of our area, they survive the winters by virtue of remarkable antifreezes that protect the tissues against ice formation.

Collecting And Keeping Pond Skaters

Most pond skaters, and *Gerris* spp. in particular, are wary and difficult to catch. When disturbed, they scatter in random directions. *Gerris* and *Velia* species can quickly move out of reach. They are best collected by sweeping a wide net rapidly over the surface to collect floating vegetation and debris. This collection should be transferred to a small volume of water in a deep bucket where pond skaters can be identified. For species identification, specialist keys are required. Species should be examined under a low-power dissecting microscope (10x40 magnification) after killing and preserving in 80% ethanol.

Less active genera, such as *Microvelia*, *Mesovelia* and *Hydrometra*, may be kept in a freshwater aquarium. Add some floating vegetation on which the insects can rest, clean themselves, and lay eggs. They may be fed live insects placed on the water surface - adults and larvae of fruit flies are ideal. *Gerris* species jump around frantically in any enclosed space and usually become injured and drown within a short period. Unlike the other pond skaters, which may venture onto shoreline debris when foraging, *Gerris* spp. are helpless on land.

Conservation Measures

There are no restrictions concerning the collecting and keeping of aquatic insects. For this reason, and because they are so easy to keep, they make ideal creatures for classroom study.

*The surface tension of water at 20°C is approximately 0.07 N m^{-1} (Newtons per meter - or millinewtons per millimeter). The downward force exerted by an object is the product of its mass (in kg) and the gravitational acceleration (10 ms^{-2}). The force exerted by my feet on the ground is therefore my mass (78 kg) multiplied by 10 = 780 N. If a large *hydrophobic* object such as a wax candle is placed on water, the surface film will break (and the surface tension will therefore 'fail') at the edges where the curvature of the surface film is greatest. The surface tension of water, 0.07 N m^{-1}, tells us that a *hydrophobic* object weighing 0.07 Newtons (7 g) could rest on the surface film if the length of the edge contacting the surface were at least 1 m. Similarly, if the object weighed one thousandth of this (7 mg) the length of the contacting edge would have to be 1 mm. A large *Gerris* would have four feet contacting the surface, each with a contact perimeter of about 5 mm. Surface tension acting along the total length of 20 mm must therefore resist the animal's weight. A large *Gerris* has a mass of about 0.02 g or 0.20 mN (millinewtons, or thousandths of a Newton). The force per length is thus 0.20 mN per 20 mm or 0.01 mN mm^{-1}. This is only one seventh of the force that the surface tension can withstand, so the pond skater easily avoids the danger of breaking through the surface film.

Glossary

Cuticle - the hardened, wax-coated body covering of insects.
Emergent vegetation - plants that grow with roots submerged, but with leaves and flowers extending above the water surface. Examples are cattails *Typha* spp. and bulrushes *Scirpus* spp.
Hydrophilic - water-loving, attracts water.
Hydrophobic - water-hating, repels water.
Mandible - the anterior-most pair of appendages comprising an insect's mouthparts. The tips of the mandibles are usually hardened and adapted for biting, scraping, or piercing.
Maxilla - (pl. maxillae) the second pair of feeding appendages in an insect, usually serving to manipulate food into the gut. In hemipterans, the mandibles and maxillae are modified to form thin, piercing stylets.
Nymph - the life-stage of an insect that goes through incomplete metamorphosis.
Proteolytic enzyme - an enzyme which catalyses the reaction of proteins with water (hydrolysis) to yield smaller chains of amino acids (peptides) and/or individual amino acids.
Rostrum - modified mouthparts, characteristic of the insect order Hemiptera, which are used for sucking juices from plants and prey animals.

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Written and Illustrated by:
Dr. Jonathan Wright, Biology Department, Northern State University, Aberdeen, SD.

Reviewed by:
Nels H. Troelstrup, Jr., Ph.D., South Dakota State University, Brookings, SD 57007.

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