IN THE ZONE
The lives of water striders are characterized by epic battles of the sexes and intricate adaptations to their unique habitat.

Life on the Border

Water striders have found a habitat in the unusual zone where air and water meet. How they have adapted is a whole story of its own

By Jay Ingram

Water striders are the charming little insects that skate across the surface of ponds, edges of lakes and other sources of still water. Their many species are among the most common forms of wildlife in this country. But while their life appears to be simple, it is definitely not. For starters, striders have long waged a fierce gender vs. gender arms race, and it has played out in one of the most peculiar environments imaginable — the surface of water.

Water striders provide one of the most vivid examples of how the reproductive goals of females and males — within the same species — may clash. Males want to produce as many offspring as possible with as many females as possible; females prefer to mate exclusively with genetically superior males — that is, the best males available.

To that end, the two sides in the gender battles have elaborated sets of weirdly different body structures to ensure they accomplish their vastly different objectives. Males have intricately customized antennae that sport a variety of hooks and spikes to hold on to an unwilling female. Some females, in turn, protect their genitalia with what could best be described as chitinous, exoskeleton-like chastity belts. The intricacies of these evolutionary innovations have elevated water striders to one of evolutionary biologists' favourite characters.

In my opinion, though, the contests between males and females are a sidebar in the water striders' story. How they function in their environment is even more fascinating.

Water striders have adapted to living at the interface of air and water, and they rely on the surface tension of water to do it. Water molecules

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Mind Your Manners

Mating is an aggressive process for water striders. So are their feeding habitats. You might describe them as almost gladiatorial.

These curious insects detect their prey — usually small bugs or larvae — through their legs, which are sensitive to ripples on the surface of the water. Once a target insect has been detected, water sliders will grab on to it and puncture its body. Then it will suck out the poor creature's insides, using a method called suction feeding.

For the most part, water sliders prefer live prey, but they will also eat dead terrestrial bugs. When conditions are crowded in their own populations, they have been known to resort to cannibalism, as well.

LITTLE FELLAS
Water striders thrive on the water's surface because the ratio of their weight to their surface area keeps them from breaking the water's skin.

exert a chemical pull on each other. Below the surface — where each water molecule is surrounded by others on all sides — that pull is roughly equal in all directions. But at the surface, with only air above, the attraction is all downwards and sideways. In effect, the water behaves as if it has a thin "skin" over it.

Water striders can survive on the water because their surface area, relative to their weight, is large enough that they don't break the water's skin. Their main adaption is their long legs, which extend across the water. In addition, their legs are covered with myriad tiny hairs, which extend their surface area even further. They're also coated with a water-repellent waxy substance. All of these tricks are necessary to keep water striders from submerging.

But it's not the ability of striders to stay afloat that has been the great mystery. Rather, the central question was long focused on how they were able to speed across the water.

It began with something called Denny's paradox. Years ago, Stanford scientist Mark Denny pointed out that there was a mystery surrounding water striders' propulsion. To the naked eye, it appears as if they simply create a string of wavelets by pushing backwards with their middle legs (the hind legs are for steering, front legs for sensing ripples in the water). Scientists assumed that those backward moving mini-waves provided the "equal and opposite" reaction required by Isaac Newton to push the insect forward. Yet Denny argued that juvenile striders, which are much smaller than adults, simply can't move their legs fast enough to generate waves at all, but they do propel themselves without much trouble.

It was only when MIT scientists used high-speed video (500 frames per second) to make the movements of water visible that the mystery was solved. They revealed that the waves that trail behind a water strider actually have nothing to do with propulsion. Instead, the backward push of the legs creates underwater vortices, little whirls of water that spin away from the insect. They are U-shaped, with the free ends attached to the underside of the water's surface, like a Slinky with both ends attached to the ceiling.

Imagery of the strider as it skims across the water reveals a series of these vortices left behind, less and less defined as they spin themselves out. They are roughly equivalent to the air vortices produced by the wings of flying insects and birds, which, while a different shape, do the same thing: they move the animal forward. In the water striders' case, as in a rowboat's, the surface waves don't actually contribute to the movement.

Fascinating stuff, if you ask me. And it's made all the more so by the fact that this common insect also furnishes beautiful examples of two principles of life: one, that once life does establish itself somewhere, more often than not it plunges into the game of sex. More important though, water striders show that, on this planet, water is the thing. It provides an almost endless array of possible environments. A

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