

# Insect Waterworld

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At first thought, insects and creeks may seem ecologically incompatible. After all, creeks are flowing water, and insects have wings and fly through the air. It is true that some insects do drown in creeks, and this may be a sad end for them. However, many other insects live happily in the water—flowing or still—for much if not most of their lives.

Pondering this apparent contradiction leads to valuable insights, as is often the case in studies of ecology and evolution.

A simple explanation for the success of insects worldwide is that they were one of the first groups of animals to master the challenges of living on dry land. In fact, they may be better adapted to this environment than we are, since they have evolved gas-filled tracheal systems to transport oxygen throughout their bodies, while we still rely on liquid blood, as do our cousins the fish. So it is no surprise that most insects do not live in the water.

But just as whales and dolphins represent evolutionary lines of mammals that have re-entered the aquatic environment, some groups of insects have re-adapted to the challenges of living in water. One of the most important of these challenges is how to breathe air under water. Different groups of aquatic insects have met this challenge in different ways. The immature stages of mayflies and stoneflies have evolved delicate gills that beat along the sides of their bodies. On the other hand, mosquito larvae take in air by keeping one part of their bodies always in contact with the water surface. Some adult beetles have developed an altogether different strategy, of coming to the surface at intervals and taking bubbles of air down with them for the duration of each dive.

Both the insects adapted to terrestrial life and those adapted to the water are important in the ecology of a creek. In general, food chains of ecosystems containing flowing water have their bases on dry land, which produces leaves and insects that often fall into the creek and are carried by the current. Aquatic insects and other creek organisms feed on this fallen material and are in turn food for larger animals such as fish.

To a lesser extent, herbivorous aquatic insects such as some caddisflies may graze the algae growing on rocks in the creek and thus contribute to water-based food chains.



*Freshwater insects are featured in “Life in a Pond”, a refurbished poster to be installed in a kiosk at Remillard Park, near Larkspur Landing. The original line art is by Jennifer Dewey, poster design by Laura Lovett.*

The aquatic insects have also become useful indicators of the physical and chemical conditions of the creek water itself. Although a thermometer, a pH meter or a dissolved oxygen meter may be able to tell what the exact conditions of the water are at any one instant, the presence of certain indicator species of aquatic insects can tell what the conditions have been during their entire lifespans. This is because each indicator species can only survive in a narrow range of physical conditions; its presence is thus evidence that its limits of tolerance have not been exceeded since it began to live in a particular place.

To bring things full circle, what makes certain insects good indicator species is the type of adaptations they have evolved to get oxygen from the water. When a creek contains many mayflies and stoneflies, it is judged to have a high level of dissolved oxygen and be relatively clean. If it did not, the mayflies and stoneflies would die due to lack of oxygen and damage to their delicate gills. On the other hand, larvae of midges, often called bloodworms because they contain hemoglobin, can survive for a long time in relatively dirty, poorly-oxygenated water; their presence and the absence of other groups indicate degraded water quality.

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