



MAYFLIES — ANCIENT FLASH MOBS SEIZE THE DAY

By Pamela Eyden

When there are just a few, mayflies may resemble other flitting, flying bugs near the river in the summer. These big-eyed, winged insects seem to wobble and careen through the air more than they fly. They perch on fishing caps, tree trunks, dock pilings and lotus flowers, and will even sit like a pet in the palm of your hand.

En masse, though, mayflies can't be ignored or mistaken for anything else. For a couple of days each summer the river belongs to these delicate bugs. They rise up and fly in such numbers that they darken the sky, jam up tow-boats' radar, cover storefronts and turn bridges into slippery slides. These mass hatches are a legendary and memorable part of summer on the Upper Mississippi River.

Mayflies have many names up and down the river — fishflies, riverbugs, willowbugs, sandbarflies, shadflies, Mormonflies and 24-hour bugs. It may be more appropriate to call them "Julyflies" or "dayflies." The late river biologist Calvin Fremling, who was a professor at Winona State University who studied them for most of his professional life, recalled another name. "Probably the most colorful, as well as descriptive, term is the one used by the crews of the river boats — 'those big, black bastards.'"

The black ones would be *Hexagenia bilineata*, a species that is common on the Mississippi and its tributaries. The other species here, *Hexagenia limbata*,

is pale yellow or green and tends to live on the big river's tributaries. Both have about a one-year life cycle, although most people don't notice them until their final 24 hours.

Mud Nymphs

Mayfly life begins when fertilized eggs hatch into nymphs less than 1 mm long, which then dig U-shaped burrows in the mud and silt. They rest in one arm of the U, facing upward, fanning the water with gills to feed on

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organic matter that floats in and out. They grow and develop through several molts as long as the water is at least 50° F (10.1° C). During winter they stop growing. If the oxygen in the water is depleted or the pools freeze solid, they die.

Because they burrow into the mud and stay there for much of their lives, mayfly nymphs are vulnerable to toxic substances that settle on the bottom.

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Top: Immature mayflies (*Hexagenia bilineata*) cluster on riverside vegetation. (FWS)

Below: Dr. Calvin Fremling takes notes on the mayfly hatch of July 1957. (courtesy of Arlayne Fremling)



Immature subimago mayflies have opaque wings, like this little female *Hexagenia limbata*. When mayflies molt for the second time, their wings are transparent. (Brian Ickes, USGS)

During the first half of the 1900s, mayflies seemed to be disappearing — poisoned in their burrows by sludge from factories and sewage treatment systems that deposited pcbs, cadmium, mercury and other heavy metals and chemicals in the river. After the Clean Water Act was passed in 1972, water quality improved and mayflies gradually returned. Today, mayflies are regarded as a sign of a healthy river.

After about a year in the mud, nymphs undergo a radical change: their internal organs dissolve and are replaced by air bladders. This propels them to the surface, where, in about one minute, they split their exoskeletons and emerge as winged adults.

Wings but no Sex

These fragile “subimagos” don’t fly well. Breezes blow them to nearby trees and shrubs, where they rest and get ready for their next phase of life. Because they all tend to come out at about the same time, subimago mayflies can cluster so densely that they break tree branches. At night they are

attracted to lights. Passing towboats may end up covered from bow to stern, carrying huge loads of subimago mayflies. As Fremling noted, experienced towboat captains sometimes turn off their lights as they go through a lock, so when they exit the lock the subimagos stay with the bright lights on shore for the lockmaster to deal with.

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Sex & Death

Mayflies are the only insect that molts into one set of wings, and then molts again, shedding the first wings and flying off with a brand new set about eight to 18 hours after subimagos come out of the water. By 4 p.m. most have molted into the final “imago” phase.

As Fremling described them, “The imago is noticeably more delicate than the subimago, but its powers of flight are greater. Its wings are gossamer

and transparent, the eyes are larger, the legs are longer and more slender, and ... the somber body color is replaced by delicate shades of brown and cream.”

Three long filaments extend from their tail.

Mating begins at dusk. Small swarms hover about six feet above the water. Larger swarms hover higher. If you are nearby, you might be able to tell a swarm of *Hexagenia limbata* from one of *Hexagenia bilineata*: limbata males repeatedly fly upward in the swarm and plane downward, while bilineata males keep a fixed position. Females fly directly into the swarm, attracting males’ attention. They mate in flight and the females move away to drop their eggs onto the surface of the water — as many as 4,000 to 8,000 eggs per female mayfly, according to Fremling. The females then die as their eggs drift to the bottom. Males also die soon after mating. Nymphs hatch after 11 to 26 days, depending on water temperature.

Mass Hatches

A mass mayfly hatch provides a feast for fish, birds, dragonflies and other insects, but mayflies are a plentiful and valuable source of food all year. Snails and caddisflies eat the eggs. Fish eat the nymphs. One researcher

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near Keokuk, Iowa, found that mayfly nymphs made up more than half of the food eaten by channel catfish, freshwater drum, mooneyes, goldeyes and white bass, as well as more than 40 percent of the food found in the stomachs of paddlefish, shovelnose sturgeon and white crappies. Bluegills, black crappies and black bullheads also eat them in uncounted numbers. Fish, birds and



Left: Immature mayflies (called subimagos) rest under leaves. (L. Rettig)

Right: *Hexagenia limbata* are pale yellow. (USFWS)



Observers Wanted!

To track mayfly hatches up and down the river, biologist Mark Steingraeber, of the U.S. Fish and Wildlife Service, has recruited a network of observers extending from the Twin Cities to Muscatine, Iowa. He needs more. Boaters, river rats, fishermen and others who are interested in participating should email him.

(Mark_Steingraeber@fws.gov).

To find out more, go to the website. By 2014 observers will be able to record mayfly hatches with a new app for their smartphones. 📱

other insects will dine on the subimagos as they go through their water-to-air transition.

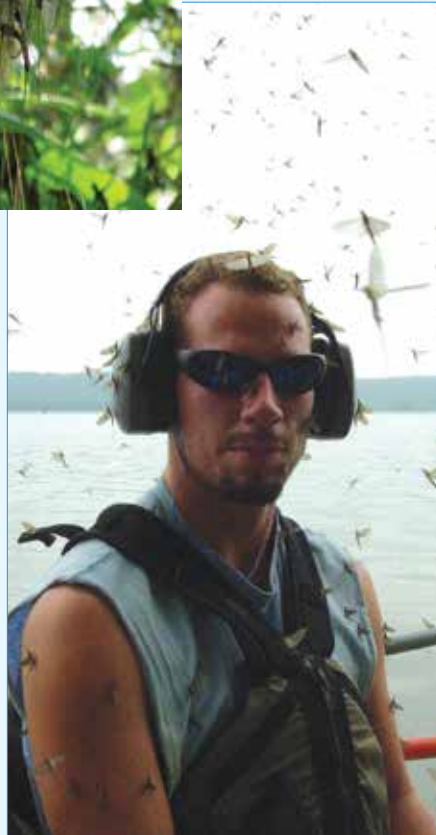
The primary hatch is usually plus or minus two weeks of July 4, but researchers cannot predict the day. They can't figure out how masses of mayflies manage to emerge at the same time over hundreds of miles of the river. If the timing were determined by water temperature alone, mayflies would hatch in Muscatine, Iowa, earlier than in the Twin Cities, but this is not the case.

"Temperature isn't the whole thing," said U.S. Fish and Wildlife biologist Mark Steingraeber, who has been following these emergences for many years. "We haven't figured out what it is, although the mayflies have."

In 2012, Steingraeber said, the primary hatch was on the weekend of June 22 and 23, with secondary hatches in some pools 10 to 14 days later. There were three emergences throughout the Upper Mississippi River in 2012. Water temperature is a factor in secondary hatches, but not the primary hatch.

"Last year was very warm from March through September, so they [nymphs] got a good lead on development. But this year has been cool, so we expect development is normal now and [the hatch] will even out." 🌊

Pamela Eyden is the news and photo editor. Her last story was "Crayfish — Feisty Floodplain Engineers," May-June 2013.



Above: Eric Sonnentag was out sampling fish when he ran into a storm of mayflies. (Wis. DNR)

Below: Biologist James Krysan scooped mayflies off the Wagon Bridge near Winona, Minn., in 1957. (courtesy of Arlayne Fremling)

