Aquatic food web tied to land: Some fish are made out of maple leaves

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This shows water sampling on Paul Lake. Credit: Steve Carpenter

A distant relative of shrimp, zooplankton are an important food source for fish and other aquatic animals. Long characterized as algae feeders, a new study published this week in the *Proceedings of the National Academy of Sciences* reports that nearly a third of zooplankton diets are supported by material that originates on land in lake watersheds.

The study brings scientists one step closer to clarifying the role that watershed inputs play in aquatic food webs. While it has been recognized that animals living at the bottom of lakes and streams rely, in part, on inputs from the land, there has been controversy about whether open water animals, such as zooplankton, consume this material.

Lead author and Cary Institute of Ecosystem Studies limnologist Dr. Jonathan J. Cole comments, "Our work changes the paradigm for how we describe the environment that supports fish. Zooplankton are one of the pillars of the aquatic food web. And while they do feed on algae, they also rely on materials derived from maple leaves, pine needles, and whatever else comes in from the surrounding watershed."

When algae are scarce, Daphnia will feed on bits of leaves that wash in from the watershed. Credit: Paul Hebert

Using ambient stable isotopes of carbon, hydrogen, and nitrogen, Cole and colleagues traced the diets of three zooplankton species commonly found in freshwater lakes: Daphnia, Holopedium, and Leptodiaptomus. Animal samples were taken from two Wisconsin lakes with distinct profiles—Paul Lake, a small lake with moderate nutrient levels, and Crampton Lake, a larger nutrient-poor lake.

While it has been assumed that the zooplankton feed almost exclusively on algae, biomass analyses revealed a different story. In both lakes, organic matter that originated on land made up approximately a third of zooplankton biomass. When edible algae were scarce, zooplankton derived a higher percentage of their diet from terrestrial material.

Once seen as closed ecosystems, research now indicates that lake food chains rely on food resources that originate on land. Credit: Steve Carpenter

Cole notes, "Historically, lake ecosystems have been studied in isolation. Yet we know lakes are connected to their watersheds and organic matter from land enters lakes in the form of run-off or ground water." Adding, "Our study adds to the growing body of evidence that aquatic food webs are subsidized by these inputs."

This is the most recent of several Cary Institute-led studies investigating watershed inputs to aquatic food webs; all of them have resulted in findings that indicate zooplankton feed on land-generated organic matter.

More information: To access the paper, visit: www.pnas.org/content/early/201 … 807108.full.pdf+html