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Effects of Fish on Aquatic Insects

Tyler Seidel
University of South Dakota

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By: Tyler Seidel

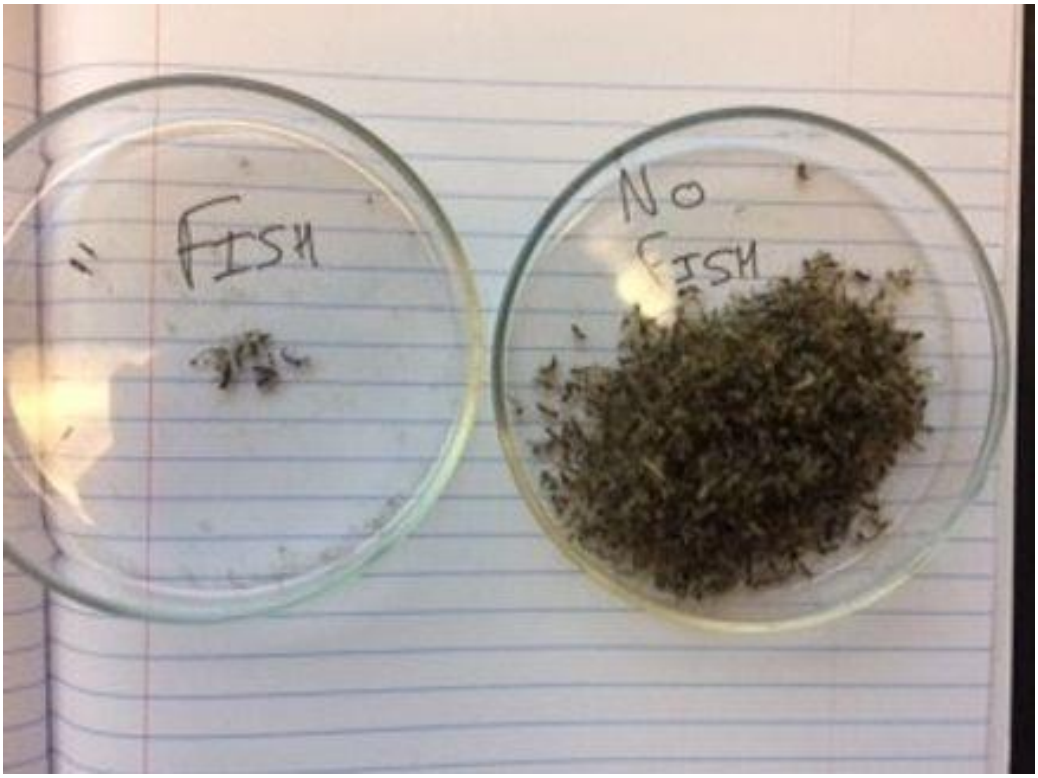
Aquatic insects are an important source of energy for freshwater fishes and an important source of energy in linked aquatic-terrestrial food webs. However, the consumption of aquatic insects by fishes may reduce the energy available to aquatic and terrestrial food webs. Our research predicted that fishes would alter local food webs and affect ecosystem productivity. Emergence traps and fish exclusion cages were used to collect emerged aquatic insects from treatments with and without fish to determine the reduction of insect emergence by fishes to terrestrial ecosystems. Furthermore, fish and benthic communities were sampled and recorded, fish diets were sampled, and terrestrial insectivorous spider abundances were recorded. Research took place above and below an abandoned beaver dammed stream on the Missouri National Recreation River at Bow Creek Recreation Area in Cedar County, Nebraska, which contains both native fish and introduced fish.

Data suggests that the fish sampled at Bow Creek Recreation Area were primarily water column feeding fish and that the stage of aquatic insects consumed varied across species. Moreover, fish exclusion cages yielded higher emergent insect biomass above the former beaver dam, and that the terrestrial spider densities were higher above cages without fish than with fish. Results from our research will help to determine the direct and indirect effects of fishes on ecosystems, allow for the testing of new theory in ecology about the role of size-structured prey, introduce the potential role of fish species loss or introduction in linked aquatic-terrestrial food webs, and help to guide the conservation and management of the Missouri River.

Our results demonstrate that freshwater fishes can reduce aquatic insect emergence by 80%. The reduction of aquatic insect emergence biomass has direct effects on adjacent terrestrial ecosystems. Since aquatic insects support a variety of terrestrial consumers, one notable effect is the reduced abundance of aquatic prey consumers such as insectivorous terrestrial spiders. This trend may be translatable to higher order terrestrial consumers such as amphibians, reptiles, birds, and small mammals. Therefore, it is important to understand how fish communities are influencing the quantity of a resource that is utilized across ecosystems. For example, the consumption of aquatic insects by fish varied according to species. The variation in consumption patterns may promote disproportionate reductions in aquatic insect biomass in aquatic and terrestrial ecosystems.

Competitive pressures among freshwater fishes influences the respective predatory behaviors of fishes in order to reduce competition. The partition of foraging habitat among fishes prompts species-specific consumption rates that are dependent on the fish community present. Therefore, the abundance of aquatic insects consumed, including the life history stage of the aquatic insect, is dependent on which fish species are present. Our results may be of particular importance to consider for recreational or sports fishing. Conservation and management decisions should consider what fish species are present, what they are eating, and how supporting artificial populations of fish species influences the other covariates. In addition, the species-specific consumption rates of aquatic insects may influence riparian zone organisms through differential habitat use patterns. This trend is supported by the colonization and persistence rates of insectivorous terrestrial spiders. However, it is unclear how fish community composition indirectly influences other terrestrial species that are dependent on aquatic insects.

Tyler checking an emergence trap at Bow Creek Recreation Area



An image reflecting the effect of fish on emerging insects. Mesocosoms with fish reduced aquatic insect emergence.

For more information, check out the following links:
https://thewesnerlab.com/
https://twitter.com/wesnerlab

Supplemental Readings

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