

PREDATOR STONEFLIES: ROLE IN FRESHWATER STREAM COMMUNITIES

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ABSTRACT

Stonefly nymphs (*Acroneuria*) were observed feeding on immature Shovel-nosed Salamanders (*Leurognathus marmoratus*) during holding periods in aquaria. Although this predation did not occur in a natural stream environment (where the predator and its prey occupy overlapping habitats), it did occur independently in 9 of 14 different aquaria. The occurrence of this relationship in stream communities may be important and should be researched further in natural stream systems.

INTRODUCTION

The role of predators in organizing freshwater communities has been reviewed by MaCan (1977). Amphibians are very susceptible to certain types of predators (e.g., fishes) and have evolved a number of antipredator devices (Dodd 1976, Ward and Sexton 1981). This paper describes a possible invertebrate predator/vertebrate prey role in montane stream systems.

MATERIALS AND METHODS

Larvae (12-35 mm snout-vent length) and subadult (30-36 mm snout-vent length) Shovel-nosed Salamanders (*Leurognathus marmoratus*) were captured from streams of Great Smoky Mountains National Park and placed in 10-gallon aquaria with continuous flow apparatus. Aquatic insects served as food organisms for the salamanders. A continuous flow system at 14°C provided an aquatic environment similar to the stream habitat from which the salamanders and stoneflies were removed.

RESULTS

Within hours, many of the salamanders were found dead. Initially, no reason for salamander mortality was evident; however, closer inspection indicated that the legs of several salamanders were severed. Further observation showed that nymphs of the stonefly *Acroneuria* (14-23 mm total length) were first killing these salamanders and then eating their limbs. This phenomenon was observed independently in 9 of 14 test aquaria where both organisms were present. The stoneflies first pierced the gular region of the salamanders' necks with their mandibles (Fig. 1). The salamanders attempted to throw off the insect predators by vigorously twisting their bodies. Eventually, the salamanders would lie motionless, apparently dead. After a few moments, stoneflies would shear the legs from the salamanders and eat them (Fig. 2).

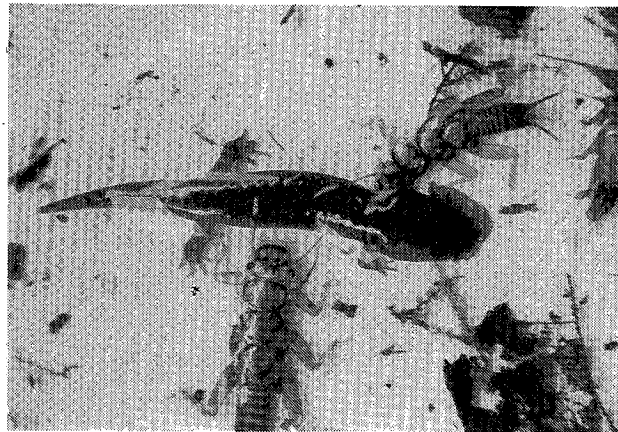


FIG. 1. Stoneflies (aquatic insects) of the genus *Acroneuria*, common in clear, fast-flowing mountain streams of Great Smoky Mountains National Park, attack the Shovel-nosed Salamander, *Leurognathus marmoratus*, from both sides. The stoneflies were supposed to serve as a food resource for the salamanders being acclimated for a bioassay test. Their anticipated roles in this circumstance, however, were reserved.

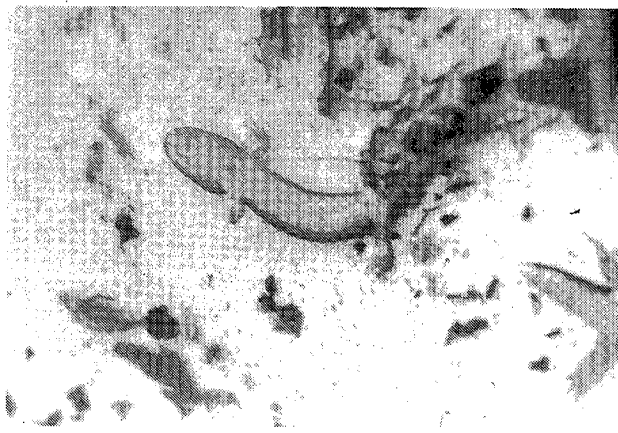


FIG. 2. The hind leg of a *Leurognathus* being sheared off by *Acroneuria*.

DISCUSSION

During a survey of stream-dwelling salamanders in Great Smoky Mountains National Park, adult *Leurognathus* (70-130 mm snout-vent length) were frequently observed feeding on *Acroneuria*, usually from a position where eddy currents between stones would pass insect drift within their grasp. Larval and subadult *Leurognathus* usually occupied habitats ranging from sand/gravel flats to positions under small stones where *Acroneuria* are less frequent. Generally, larger stones attracted larger salamanders and insects.

Although the predaceous action observed occurred in aquaria, the stoneflies appeared well adjusted to this feeding strategy, though I was unable to find reports of this phenomenon occurring in stream habitats from entomological literature. Invertebrate predators on vertebrate prey in streams, however, have been infrequently observed. Fisher Spiders (*Dolomedes triton*), for instance, are predaceous on stream fishes (Bond 1980), and Water Tigers (*Dytiscus* sp.; predaceous diving beetles) feed on tadpoles and small fish (Klots 1966). Predator-prey roles may be reversed as well during different phases of life cycles in stream organisms. Two-lined Salamanders (*Eurycea bislineata*) serve as food for adult Rainbow Trout (*Salmo gairdneri*), though adults of this salamander species have been observed feeding on emerging Rainbow Trout fry and submerged intergravel trout embryos (Harshbarger, Coweeta Hydrologic Station, personal communication).

CONCLUSIONS

The importance of salamanders within watershed populations is poorly known. At Hubbard Brook Experimental

Forest in New Hampshire, the biomass of salamanders was about twice that of birds during the birds' peak breeding season and about equal to the biomass of small mammals (Burton and Likens 1975). Aquatic insects are almost universally thought of as food organisms, and little consideration is given to predaceous and other functional roles they perform in stream ecosystems (Cummins 1974). Two conclusions seem evident from the observations presented here: (1) Our knowledge of some predator-prey relationships in streams is limited, yet their role may be important in consideration of overall stream population dynamics; and (2) some of these findings have occurred by accident in cases where predator feeding opportunity was optimized.

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DISPERSAL OF AUTUMN OLIVE SEEDS BY FOXES ON COAL SURFACE MINES IN EAST TENNESSEE

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ABSTRACTS

Monthly scat collections and seed germination tests suggested that foxes may be important in the dispersal of autumn olive (*Elaeagnus umbellata*) seeds on reclaimed coal surface mines. Analysis of 117 fox scats collected once monthly from November to April on a Campbell County, Tennessee, minesite indicated that the average number of autumn olive seeds per scat ranged from 0.3 seed in April to 218.0 seeds in November. The highest number of seeds recorded in a scat was 622. Germination tests of seeds removed from fox scats and a control seed lot from the same site resulted in germination percentages of all seed groups increasing with longer lengths of stratification. The highest percentage germination occurred at 12 weeks in the fox group and at 16 weeks in the control

group. Although germination of seeds from fox scats averaged 17 percent lower than the control group, percentage germination in the fox seed lot was sufficiently high (up to 75 percent) to allow dissemination of large quantities of viable seeds by foxes.

INTRODUCTION

Autumn olive (*Elaeagnus umbellata*), originally introduced into the United States from Asia in 1830 (Allan and Steiner, 1959), is widely used to improve wildlife habitat on reclaimed coal surface mines (Fowler and Adkisson, 1980). This hardy shrub is adaptable to a wide range of spoil conditions and produces berries in the second or third year after planting. The berries, leaves, and twigs of au-