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Predatory behavior of larval *Ambystoma tigrinum nebulosum* on *Limnephilus* (Trichoptera) larvae

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PREDATORY BEHAVIOR OF LARVAL *AMBYSTOMA TIGRINUM NEBULOSUM* ON *LIMNEPHILUS* (TRICHOPTERA) LARVAE

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ABSTRACT.— Examination of stomach contents indicated that second-year *Ambystoma tigrinum nebulosum* larvae consumed *Limnephilus* sp. larvae but rarely ingested the case. Feeding observations of captive salamanders on caddisfly larvae supported this finding. Extraction of caddisfly larvae from their case was accomplished only when larval salamanders quickly seized the anterior portion of ambulatory *Limnephilus* sp. extended from their case and vigorously shook the trichopteran from side to side.

Interest in the predatory behavior of *Ambystoma tigrinum nebulosum* on *Limnephilus* sp. was prompted by the examination of stomach contents of 29 second-year larvae (~13 mos. old) from east central Arizona. Fourteen salamanders had eaten a total of 71 *Limnephilus* sp. larvae, yet remains of only 7 cases were evident. This indicated that *A. tigrinum* were extracting caddisfly larvae from their case. Such feeding behavior apparently contrasts with some *A. tigrinum* in Utah where individuals ingested caddisfly larvae with cases (Tanner 1931). Moreover, extraction of larva from the case is discordant with the notion that larval *A. tigrinum* exploit aquatic resources in a manner nearly identical to freshwater fish (Zaret 1980), since fish typically consume both caddisfly case and larva (Elliot 1967, Tippets and Moyle 1978, W. L. Minckley, pers. comm.). This paper describes the ability of captive *A. tigrinum nebulosum* larvae to extract *Limnephilus* sp. larvae from their cases.

Salamanders used for feeding observations and stomach analyses were collected in June 1981 from Big Meadows Tank 1, a permanent pond located 1.0 km NNW of the western edge of Sunrise Lake, Apache Co., Arizona (elev. 2,774 m). Eight second-year larvae varying from 78 to 98 mm from tip of snout to posterior margin of vent were individually kept in 36 × 22 × 26 cm aquaria partially filled with 50 percent Holtfreter's solution. Animals were acclimated for 24 hours before feeding observations were initiated. *Limnephilus* sp. collected from Big Meadows Tank 1 also were kept in 50 percent Holtfreter's solution. Each salamander was provided six caddisflies during feeding runs. The number of strikes and successful captures were counted in each 1–3 hour run. Salamanders were not fed between observations.

Movement by *Limnephilus* sp. seemed to provide a visual stimulus for a strike response by these salamanders. Previous studies also noted *A. tigrinum* larvae typically striking moving prey (Dodson and Dodson 1971, Rose and Armentrout 1976). My observations, however, suggest tactility may also play a role in stimulating an attack on prey. Attraction of a salamander to a caddisfly case was apparently frequently caused by any movement of the case. The salamander usually halted and placed its snout or chin against a case that had moved. Further movement by the caddisfly stimulated a strike. Salamanders withdrew from the case if cessation of movement was protracted.

During 26 hours of observations, only 2 (3.4 percent) *Limnephilus* sp. larvae were eaten in 58 strikes. Unsuccessful attempts at prey capture consisted of a salamander taking the entire case into its mouth. The animal then manipulated the case and discarded it after about 14 seconds (N = 12, range: 3–85 seconds). On no occasion was the case consumed. Caddisfly larvae were successfully attacked and eaten only when a salamander slowly approached an ambulatory *Limnephilus* sp. extended from its case and quickly seized the anterior portion of the larva. The salamander then vigorously shook the trichopteran from side to side until extracted.

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Similar head-whipping behavior by metamorphosed *A. trigrinum* on elongate prey was described by Larsen and Guthrie (1975) and Lindquist and Bachmann (1980). This method of *Limnephilus* sp. capture seemed to be supported by the stomach analyses, in which 10 of 71 consumed larvae were severed 0–2 mm behind the metanotum.

The relatively poor capture success by salamanders in the laboratory may also be characteristic of the natural habitat. For example, Dodson and Dodson (1971) found relatively few tichopteran larvae in the diet of *A. tigrinum* larvae from Colorado, even though the insects were abundant in the samled pond. *Limnephilus* sp., however, comprised about 16 percent of the total volume of prey in the diet of larvae in June from Big Meadows Tank 1. This suggests salamander larvae of this population frequently attacked trichopterans.

In sum, stomach contents showed that *A. tigrinum* larvae from this population infrequently ingested caddisfly cases. Absence of case consumption in the laboratory supported the finding. Successful attacks on *Limnephilus* sp. were few and occurred only when *A. tigrinum* quickly seized the anterior portion of a caddisfly extended from its case. These observations suggest caddisfly cases are an effective means of deterring predation by larval salamanders of this population.

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