

On the Biology and Rarity of the Owlfly *Ululodes arizonensis* in California (Neuroptera: Ascalaphidae)

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Abstract.—The first observations on flight behavior, daily activity, seasonality, habitat use, and prey are reported for adult *Ululodes arizonensis* Banks.

Six genera and 14 species of owlflies occur in the Nearctic region (Shetlar, 1977) of which two genera and six species occur in America north of Mexico (Arnett, 1985). *Ululodes arizonensis* Banks is the only owlfly known from California (Penny, pers. comm.; Shetlar, 1977). *Ululodes* are bizarre looking, fast flying insects; they are about 20–40 mm in length and resemble dragonflies (Odonata) but have shorter wings like common lacewings (Neuroptera: Chrysopidae) and capitate antennae and an abdomen like butterflies (Lepidoptera). Most large collections have a few owlflies; however, they are rarely collected. Many of these owlflies were collected at lights (Shetlar, 1977; Arnett, 1985).

Biological information on adult *Ululodes* is scarce. *Ululodes mexicana* (McLachlan) and *Ululodes* sp. were observed flying 10 m or more above untraveled sandy roads, meadow clearings, and sandy beaches along streams for 15–20 min after sunset in Arizona (MacNeill, 1965; Henry, 1977; Shetlar, 1977). As daylight decreased, the owlflies flew lower until shortly before darkness, they were within 15 cm of the ground (MacNeill, 1965; Henry, 1977). Owlfly flights also occur at morning twilight (Shetlar, 1977). Flight activity resembled that of dragonflies (Odonata), cruising repeatedly over an area and darting to capture prey or to interact with conspecifics (MacNeill, 1965; Henry, 1977; Shetlar, 1977). Henry (1977) observed male territorial behavior and males chasing females. MacNeill (1965) captured a mating pair in flight.

Weekly from May 1986 to March 1987 I camped at a Blue Oak Savannah/riparian ecotone along the Main Fork of the Kings River (T12S, R27E, S30), Fresno County, California where next to my camp, I observed and collected *U. arizonensis* adults at a sandy beach (40 × 60 m). This site is in the Sierra Nevada foothills at 360 m elevation. My observations are the first biological information for *U. arizonensis* and are presented to improve the knowledge of owlfly seasonality, habitat utilization, and prey.

Ululodes arizonensis were first observed the fourth week of July and last seen in August, a flight period of about 5 wk. From about 15 min after sunset to darkness, the owlflies cruised and darted (horizontally) at a height of 15–30 cm above the beach. They occasionally darted vertically up to 3 m, presumably to capture prey. Commonly, from two to four owlflies cruised the beach concurrently; however, fewer and up to seven were observed. Twenty owlflies (11 ♀, 9 ♂) were collected and deposited in the California Academy of Sciences, San Francisco.

Six owlflies were collected in a 3-min period and still others cruised the beach, showing that many owlflies were using the beach. Male-male chasing and in-air clashes, and males chasing females (like MacNeill, 1965; Henry, 1977) were observed. No owlflies were seen during cursory morning twilight observations.

On 13 August 1988, I revisited the above site and collected all owlflies I could (9 ♂, 1 ♀) during their 17-min flight period (2000–2017). No owlflies were observed before or after this period. Visibility was possible for about 5 min after 2017 but precluded by darkness. The barren, sandy beach of 1986 was now scattered with grass (20 cm tall) and leaf litter along its upper edge, making owlfly detection and pursuit difficult. To catch these owlflies, I knelt at one spot and swept cruising individuals. Most owlflies used the grassy beach area near the ecotone (within 5 m) rather than the large, barren beach area.

To determine owlfly prey, I examined the gut contents of the 10 owlflies. All guts were packed but contents were so masticated that I could determine only that all contained parts of caddisfly adults (Trichoptera) and one contained part of a mayfly (Ephemeroptera) wing. Shetlar (1977) examined the gut of an unreported number of *Ululodes* and contents included small Coleoptera, Diptera, and Lepidoptera. In 1986, I collected two owlflies in flight that were carrying a caddisfly [*Hydropsyche occidentalis* Banks and *Oecitis avara* (Banks), both about 12 mm in length].

Owlflies were not observed during cursory surveys of other microhabitats, thus it appears they may use a specific microhabitat for foraging and mating activities. Attempts to collect owlflies using ultraviolet and white lights were unsuccessful; MacNeill (1965) also used lights unsuccessfully.

The brief daily activity, the short seasonal occurrence, fast flight, unattraction to lights, and possible use of a specific microhabitat makes *U. arizonensis* an uncommonly collected species. I hope this information enables and encourages further owlfly studies.

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