Delaware's wetland fireflies in the genus *Photuris* (Coleoptera: Lampyridae)

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Abstract

Although fireflies have captured the imagination of children and adults alike for centuries, surprisingly little is known about the habitat associations of most species. Eleven species of fireflies in the genus *Photuris* have been reported from Delaware. Recent research in Delaware has revealed that eight of these species are dependent on wetlands (both tidal and non-tidal) and some are associated with specific wetland ecosystem types. Seven of the eight wetland species are considered uncommon or rare including five that are considered state imperiled: *Photuris bethaniensis, P. cinctipennis*, *P. BBB, P. SPH* and *P. salina*. Most *Photuris* species can be identified by their distinctive flash patterns and their presence or absence at certain wetland sites could be considered by managers and conservationists as a partial indicator of the ecological integrity of local wetlands.

Introduction

Fireflies are among the most easily recognized insect groups yet surprisingly little is known about their habitat associations. Two genera are common in Delaware: *Photinus* and *Photuris* (Fig. 1). In particular, fireflies in the genus Photuris are difficult to identify to species based on morphological characteristics and there are few reliable keys to facilitate identification. Eleven species of *Photuris* fireflies have been documented from Delaware (Heckscher 2010). Barber (1951) and McDermott (1967) gave only vague habitat associations for some of these species. Recent inventory in Delaware has enabled the habitat associations of several species to be more clearly defined (Heckscher 2010).

Eight Delaware species (72 %, *n*=11) are now known to be dependent on wetlands. Six wetland species (75%, *n*=8) are considered state rare or imperiled. Approximately 2000 acres of vegetated wetlands are destroyed in Delaware every ten years (e.g., Kennedy 2010). Therefore, understanding the association of specific firefly species with wetland types is critically important for the preservation of biodiversity and, consequently, proper ecosystem function. Because of the high rate of wetland loss and other forms of alteration and degradation (e.g., invasive plants, contaminants, climate change) wetland scientists in Delaware should be gravely concerned about the persistence of specialized wetland species in the state including some firefly species.

Below, I focus on Delaware *Photuris* fireflies that are associated with specific Delaware wetland types. The species are presented in the order of state rarity. The species identification, conservation status, and associated wetland types are noted. In addition, flash patterns and photographs of habitat occupied by Delaware species are presented. Two Photuris firefly species known to be extant in Delaware – P. BBB and P. SPH -- are not included because these species are not yet scientifically described. The information presented below should aid in future identification by land managers and conservationists interested in identifying Delaware species.

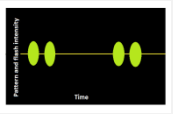
Figure 1. *Photinus* (L) and *Photuris* (R) fireflies. Note the pink pronotal spots on the *Photinus* head and the dorsal stripes on the *Photuris* elytra – two distinguishing features of each genera.

Rare & Imperiled wetland species

Photuris bethaniensis -- Delaware's only recognized endemic animal species, *P. bethaniensis* inhabits interdunal swales along Delaware's ocean coast from Cape Henlopen State Park to Fenwick Island (Heckscher and Bartlett 2004). The occurrence of this species is sporadic in suitable habitat. For example, of 18 swales surveyed along 25 km of Delaware's Atlantic coast from 1998 through 2000, seven were occupied by *P. bethaniensis*. Interdunal swales are highly threatened by sea-level rise, invasive plant species, the depletion of freshwater aquifers via development, and the disruption of the natural functioning of the dynamic coastal dune ecosystem.

Flash pattern: *Photuris bethaniensis* emits a bright double green flash (McDermott 1967). It is our only *Photuris* that consistently emits a double flash; therefore, it can be simple to recognize in suitable habitat (however, some *Photinus* species also emit a double flash).

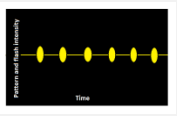
Wetland habitat (interdunal swale) and flash pattern of *P. bethaniensis*:



P. salina - *Photuris salina* occurs in the drier portions of salt and brackish marshes along the Delaware Bay (McDermott 1958). This species has apparently declined in Delaware since the 1960's (Heckscher 2010). It is known to be extant only at Woodland Beach Wildlife Area. The ecological functioning of high salt and brackish marshes have been affected by sea-level rise, invasive plants, and the application of broad spectrum adulticides often used to control mosquitoes.

Flash pattern: *Photuris salina* emits a rapid, single yellow flash of medium brilliance (Barber 1951). The flash pattern can be confused with *P. hebes* but *P. salina* inhabits salt and brackish marsh areas often with shrubs while *P. hebes* is most likely to be found in freshwater emergent marshes.

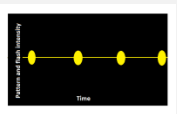
Wetland habitat (high brackish/saltmarsh) and flash pattern of *P. salina*:



P. cinctipennis: This species is associated with forested floodplains. It is known from only three sites in Delaware (Heckscher 2010; H. Bass, pers. comm.). This species was not found during Frank McDermott's extensive survey of the state last century (e.g., McDermott 1958).

Flash pattern: This species emits a single rapid flash of medium brilliance (Heckscher pers. obs.).

Wetland habitat (forested floodplain) and flash pattern of *P. cinctipennis*:

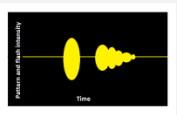


Uncommon wetland species

P. pensylvanica - *Photuris pensylvanica* inhabits freshwater emergent, shrub, and forested peatlands such as Atlantic white cedar floodplains, tidal marshes, and emergent fens (Heckscher 2010). This species is an excellent ecological indicator of high quality wetlands (Heckscher 2010) and is likely sensitive to ecological disturbance.

Flash pattern: *Photuris pensylvanica* emits a brilliant two-part flash: a single rather rapid flash followed by a second slower flash that fades. This diagnostic flash pattern is easy to recognize in the field even at a great distance. It is often given while the insect is falling through vegetation.

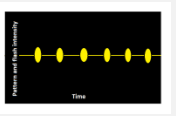
Typical wetland habitat (freshwater emergent, shrub, and forested peatlands) and flash pattern of *P. pensylvanica:*



P. hebes - This species tends to inhabit undisturbed freshwater emergent wetlands, moist meadows, roadside depressions, and sometimes forested floodplains (Heckscher 2010). Thus, it is not restricted to high quality peatlands as is *P. pensylvanica*. It often colonizes wetlands several years after disturbance such as wetland mitigation sites. *Photuris pensylvanica* is more typical of wetlands of high ecological quality; however, *P. hebes* can indicate a wetland in moderate to high ecological conditions that may be recovering from degradation.

Flash pattern: Rapid, single yellow flash that can sometimes appear orange through poor environmental conditions (e.g., haze).

Wetland habitat (undisturbed freshwater wetlands, moist meadows, depressions, and floodplains) and flash pattern of *P. hebes:*

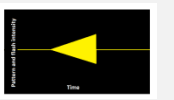


Locally common wetland species

P. lucicrescens - *Photuris lucicrescens* is widespread and can be locally common or absent from vast areas. The species occurs in floodplains that are usually forested but always of at least fair ecological quality. It often patrols adjacent uplands.

Flash pattern: The flash pattern of this species is easy to identify and is a brilliant yellow flash that increases in intensity with an abrupt termination.

Wetland habitat (forested floodplains) and flash pattern of *P. lucicrescens*:



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