Snake Assemblages Inhabiting Four Man-Made Wetlands in Letterkenny Army Depot, Franklin County, South-central Pennsylvania: Implications for Wetland Management and Conservation

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Northern Water Snake (*Nerodia sipedon*)

ABSTRACT

There is a dearth of information on the status of snake assemblages in Pennsylvania. The characterization of snake species assemblages and their population status are necessary to enact conservation and management policies. We have chosen Letterkenny Army Depot (LEAD), a federally owned 7,000 ha facility, as the study site where to examine the snake community inhabiting man-made lakes in south-central Pennsylvania. In this study, we will use cover boards and opportunistic transect searches to determine the species composition, relative population size, sex ratios, morphometrics, and activity patterns of the snake assemblages around four man-made lakes in LEAD. Monthly surveys will start in April until October of 2012. Findings from this study will provide the base line to the better to understanding of the critical role that man-made wetlands play in snake community dynamics.

Introduction

The north-eastern United States has a large diversity of biomes and Pennsylvania exhibits many of them. The Ridge Valley Region of Pennsylvania is characterized by low elevations, forested ridges and extensively farmed valleys. The Appalachian Mountains to the west, the Coastal Plains to the east, low valleys and many wetlands, are all trademarks of the Ridge Valley Region in south-central Pennsylvania. This suite of geographic and environmental features makes this a unique and diverse region. Unfortunately, little is known about the specific composition of biotic communities in most of these physiographic regions. This information is even more relevant in the light of the recent anthropogenic pressures facing the state, from urban sprawl to hydraulic fracturing.

Pennsylvania is home to approximately 39 species of reptiles, of which 20 are snakes. Many of these snakes are restricted to specific biomes throughout the state (Hulse et al. 2001). There is, however, an inherent lack of literature on the natural history of snake populations, in the state. Thus, the greatest limitation for the conservation of either populations or entire snake assemblages is the fundamental lack of biological information (Hulse et al. 2001).

Wetlands are diverse and critically important ecosystems. They prevent flooding, filter and clean water supplies, and provide critical habitat for wildlife (PGC, 2005). Some snakes depend on wetlands for food, refuge, protection, and other resources essential to their survival. Sadly, many wetlands are destroyed by human activities. In Pennsylvania, wetland losses are estimated at 30 ha a year (PGC, 2005). The destruction of wetlands forces snakes inhabiting them to relocate or threatens them with local extinction. Studies have shown that constructed wetlands are as valuable as natural wetlands in providing a habitable refuge for many aquatic and semi-aquatic species (Mazerolle, 2006).

Previous studies, conducted in south-central Pennsylvania, indicated that the area possesses a good representation of state's native herpetofauna (Delis et al. 2010). With this background, I set up to examine the natural history of the snake assemblage inhabiting constructed wetlands in an anthropogenically impacted environment. Specifically, the objectives of my study are to determine the species composition, relative abundance, sex ratios, morphometric characteristics, and reproductive and health status of snakes at four different wetlands. I will also determine the yearly activity patterns in relation to distance from the sites of peak human disturbances.

Figure 1. Study area, Franklin County (Modified from Google Earth)

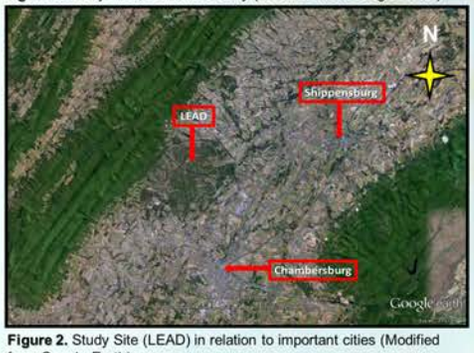

Figure 2. Study Site (LEAD) in relation to important cities (Modified from Google Earth)

Study Site

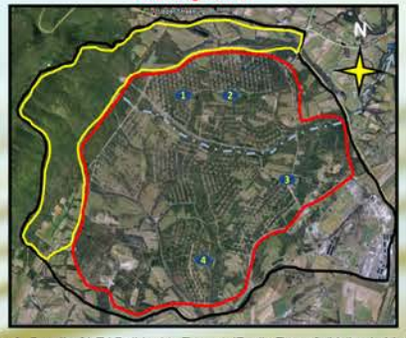

Figure 3. Detail of LEAD (black); Zone 1 (Red); Zone 2 (Yellow); Muddy Run Stream (Blue); Wetlands indicated by numbers (Modified from Google Earth)

Letterkenny Army Depot (LEAD)

- Property: Federal (DOD) ammunitions depot established in 1942
- Geographic: Southeast Ridge Valley, Chambersburg, Franklin Co.
- Coordinates: 39°58' N Lat. / 77°42' W Long.
- Surface Area: 7,000 hectares
- Altitude: 182 m - 670 m
- Habitat: Deciduous forest
- Zone I (Ammunition Area) Land Use
  - Mostly disturbed, fragmented by roads, military mission
- Zone II - (Buffer Area) Land Use
  - Mostly undisturbed, limited agricultural

Wetlands Selected

- Wetlands within Zone I selected for the study:
  1. Henry's Pond (12 boards)
  2. Cole's Pond (10 boards)
  3. Shirley's Pond (15 boards)
  4. Lake Letterkenny (17 boards)
- Man constructed and even distribution within Zone I

Figure 4. Wetlands in this study. 1. Henry's Pond; 2. Cole's Pond; 3. Shirley's Pond; 4. Lake Letterkenny. Grey rectangles are cover board locations (Modified from Google Earth)

Methodology

- Snake cover boards (54) set at ~ 50 m intervals in wetlands perimeter
- Placed in areas with direct sunlight exposure (Figure 5)
- Monthly surveys from April 2012 to October 2012 (Figure 6)

Figure 5. Example of snake cover board deployed at LEAD Zone 1

- Larger wetlands received more boards
- Opportunistic surveying using natural cover surveys
- Snakes marked with AVID Passive Integrated Transponder tags
- Data recorded on snakes:
  - Species ID
  - Sex
  - Snout-vent length
  - Tail length
  - Reproductive status
  - Health status

Figure 6. Checking cover board

Expected Results

Snake native to south-central Pennsylvania (Hulse et al. 2001).
*Observed in a previous study in Zone II of LEAD (Delis et al. 2010).

*Thamnophis sauritus** (Eastern Ribbon Snake)	*Regina septenvittata* (Queen Snake)
*Thamnophis sirtalis** (Common Garter Snake)	*Storeria dekayi* (Brown Snake)
*Nerodia sipedon** (Northern Water Snake)	*Storeria occipitomaculata* (Redbelly Snake)
*Diadophis punctatus** (Ringneck Snake)	*Thamnophis brachystoma* (Shorthead Garter Snake)
*Coluber constrictor** (Eastern Racer)	*Opheodrys vernalis* (Smooth Green Snake)
*Crotalus horridus** (Timber Rattlesnake)	*Opheodrys aestivus* (Rough Green Snake)
*Scotophis alleghaniensis** (Eastern Rat Snake)	*Clonophis kirtlandii* (Kirtland's Snake)
*Lampropeltis triangulum** (Milk Snake)	*Carphophis amoenus* (Eastern Worm Snake)
Agkistrodon contortrix (Copperhead)	*Virginia valeriae* (Smooth Earth Snake)
Sistrurus catenatus (Massasauga)	
Heterodon platirhinos (Eastern Hognose Snake)	

Figure 7. Common Garter Snake (A), Queen Snake (B)

Discussion on Expected Results

We are optimistic that this site will be a good representation of the native snake assemblage characteristic of south-central Pennsylvania. If snake abundance is found to be higher in this study in Zone I compared to the study carried out by Delis and coworkers (2010) in Zone II, this may be partially attributed to the higher diversity of wetlands (i.e. streams, ponds, vernal pools, man- made lakes, etc.) within Zone I. A low number and diversity of wetlands can impose restrictions of some aquatic and semi-aquatic snakes such as *Nerodia sipedon* and *Thamnophis* species. Additional characteristics of the structural habitat influencing snake abundance are leaf litter depth, tree density, and disturbance level. Disturbed forests seem to have a higher abundance of snake species which may be the result of increased food and microhabitat availability. The large number of wetlands and other microhabitats in Zone I at LEAD, therefore, increases the spatial heterogeneity of the site, expands and diversifies the resources available and allows larger biodiversity. The information from this study will be used to establish and enact management and conservation policies for the future of wetlands and other natural resources at LEAD.

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