Microhabitat distribution and selection among colubrid snake species of the Pierce Cedar Creek Institute

Ryan Webb, Aaron Warner and Robert Keys, PhD
Cornerstone University

Abstract

The global decline of amphibians and reptiles has resulted in an increase of studies focused on population. The Pierce Cedar Creek Institute in Hastings, MI is committed to the conservation of species, but no studies at the site have focused on population and distributions of colubrid species. The aim of this study is to assess the population, diversity, and microhabitat selection of the snake species on the Pierce Cedar Creek site. A system using drift fences, funnel traps, and an array of artificial cover areas was used to capture different snake species. PIT tags were used in order to identify snakes already captured. A total of 53 captures were recorded during the study, encompassing seven different species. The majority of captures and recaptures were *Coluber constrictor foxi.* An ANOVA analysis was used to determine habitat preferences, and habitat distribution of the species tagged. The data analysis showed that there was no significant habitat selection among the species, except for the *Coluber constrictor foxi* which preferred restored prairies with development.

Introduction

Snake species are a common element in most habitats in the Great Lakes region, yet little research has been conducted on the microhabitat preferences of snakes of the region (Busby & Parmelee, 1996; Cagle, 2008). In fact, evidence would seem to suggest that snake populations have been in decline over the past number of decades (Gibbon, et al., 2000; Brodman, Cortwright, & Resetar, 2002; Busby & Parmelee, 1996). Without the biological data, the ability

to make wise conservation management plans for the preservation and conservation of snake species is unavailable (Harding, 1997; Cagle, 2008).

In order to create conservation management plans for the preservation of snake species, the makeup of snake populations must first be understood. Most studies on snake species diversity over the last decade have focused on the ability to provide an accurate assessment of snake populations at different locales (Brodman, Cortwright, & Resetar, 2002; Busby & Parmelee, 1996; Cagle, 2008; Enge, 2001; Ryan, Philippi, Leiden, Dorcas, Wiley, & GIbbons, 2002). Without a measure by which to judge changes in snake populations, management of these key species is untenable. In fact, it would seem that the movements and behavior of various snake species can be linked closely to the specific area in which they live, hibernacula used, and the makeup of the landscape matrix at that site (Carfagno and Weatherhead, 2006; Keller and Heske, 2000; Kjoss, 2000; Brown and Parker, 1995). Current inventory listings at the Pierce Cedar Creek Institute (PCCI) show the presence of nine different snake species on site. Of these, only the Massasauga rattlesnake has been researched in any depth (Bissell, 2006). This leaves much room for the study of the other colubrid species on the site and potential conservation planning to maintain feasible management plans. Also, the hit and miss sampling of other colubrid species does not present an adequate sampling of other potential species for the possible microhabitats present on the site, especially given that Harding (1995) lists nine other potential species occurring easily within this locale.

While the general or overall habitat preference of currently listed snakes at PCCI is widely known the microhabitat is not. The currently listed species include: *Sistrurus catenatus catenatus, Thamnophis sirtalis sirtalis, Thamnophis sauritus septentrionalis, Nerodia sipedon, Storeria dekayi, Pantherophis spiloides, Heterodon platirhinos, Coluber constrictor foxi*, and

Lampropeltis triangulum triangulum. The broad habitat characteristics of these snakes (excluding *Sistrurus catenatus catenatus*) provide a starting point for the study of the finer landscape matrix requirements of the snakes on the PCCI property.

Thamnophis sirtalis sirtalis (Eastern Garter Snake) is a very versatile animal and has been found in almost every natural habitat. Habitat preference runs toward moist grassy regions, particularly near the edges of ponds, lakes, ditches, and streams. They have also been found in open woodlands, and in urban and suburban areas (Harding, 1997; Blaesing, 1979).

Thamnophis sauritus septentrionalis (Northern Ribbon Snake) occurs predominately along the edges of lakes, ponds, bogs, streams, and marshes. Especially where there are clumps of grass or sedge and other low shrubbery. Preference is generally for sunny sites over shaded areas, but they will occasionally be found near woodland ponds (Harding, 1997; Carpenter, 1952).

Neriodia sipedon (Northern Water Snake) live near most permanent bodies of water, including streams, rivers, lakes, sloughs, lakes, ponds, bogs, marshes, swamps, and impoundments. They prefer sites that are sunny and have ample cover and basking sites (Harding, 1997; Tiebout and Cary, 1987).

Storeria dekayi (Northern Brown Snake) occur in a wide variety of habitats ranging from dense woods and scrublands, open prairies, meadows, and wetland areas. They prefer moist soils, but can be found in dryer areas as well. This species has adapted well to urban sprawl and is common in urban and suburban areas (Harding, 1997, Clausen, 1936).

Pantherophis spiloides (Black Rat Snake) usually occur around woodlands, but also use adjacent open habitats such as shrubby fields, hedgerows, pastures, and marsh and bog edges. Preferences are often for the ecotone habitat at the edge of forests. They also often hunt and seek

shelter around barns, outbuildings, old foundations, trash dumps, and abandoned cars and farm machinery (Blouin-Demers and Weatherhead, 2001;Harding, 1997).

Heterodon platirhinos (Eastern Hog-nosed Snake) inhabit almost all types of terrestrial habitats such as open pine and deciduous woodlands, old fields, meadows, pastures, and occasionally along wetland edges. They prefer sandy, well drained soils, when they are not hunting or basking they remain underground or occasionally under logs or other cover (Finn, 2005; Harding, 1997).

Coluber constrictor foxi (Blue Racer) generally prefers open, dry, sunny habitats with ample cover such as old fields, prairies, hedgerows, thickets, and shrubby fence lines. They can also be found in open woodlands, woodland edges, lake borders, and marshes (Harding, 1997). *C. constrictor foxi* has also been consistently associated with old field habitat and restored prairies (Keller and Heske, 2000).

Lampropeltis triangulum triangulum (Eastern Milk Snake) can be found in a wide variety of habitats. Preference is generally for open woodlands, bogs, swamps, wood edges, marshes, lakeshores, old fields, pastures, farmyards, parks, and gardens. They also can be found near farm outbuildings, barns, sheds, piles of rocks, logs, firewood, and building materials, anything the offers cover for them and their prey (Harding, 1997; Williams, 1988).

Using this baseline habitat data, this study proposes to:

1. assess the species types, distribution, population numbers, and microhabitat selection of snake species at the Pierce Cedar Creek Institute, with special emphasis placed on the restored prairie sites.

2. to make an assessment of snake species within these microhabitats to determine whether the species are distributed individualistically or as distinguishable assemblages (groups of species found in similar abundance within the study sites).

Methods

This study was conducted at the Pierce Cedar Creek Institute, Hastings, MI during the summer of 2009. Study sites for the research were chosen on the basis of known snake species and research on the preferred habitats of those snakes (see above).

Snakes are very secretive creatures and they are often difficult to find. As such, three different methodologies were employeed in capturing snakes. The first method was the use of drift fences and a funnel trap. Row and Blouin-Demers (2006) trap and drift fence design was used as a basis for this method. Traps were constructed of plywood (ends), hardware cloth (body) and aluminum screen (outside body covering) and were 1.2m long and 30cm in diameter. Drift fences were made from commercial silt fences (Lowe's) and ranged from 60.96cm to 91.44cm high. The fence was stretched out into a Y-shape; each arm was 30.48m long. Funnel traps were placed at the ends of each arm of the drift fence (Figure 1). Traps were checked twice daily.

The second method for capturing snakes was the use of artificial cover boards placed into a similar shape as proposed by Reading (1997). The artificial covers were made from plywood 60.96cm x 121.92cm. Eighteen artificial cover boards were arrayed at each trapping site (Figure 1). Each trap day the artificial cover areas were examined for hiding snakes and then replaced.

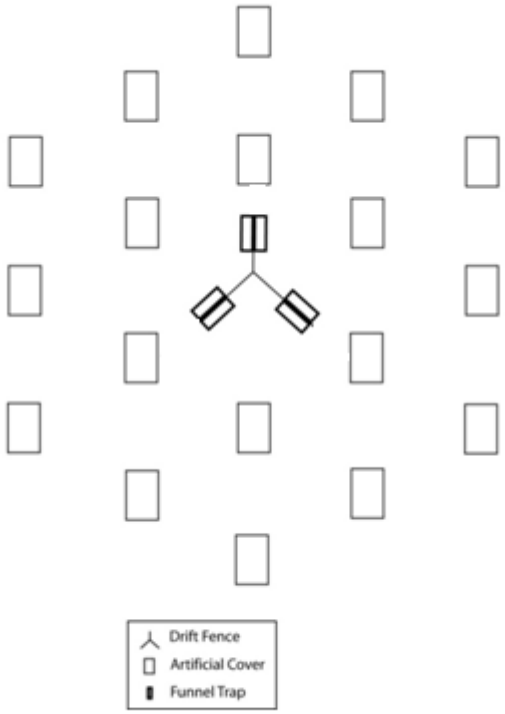

Figure 1. Drift fence, trap and artificial cover board array.

The final method for snake capture involved conducting patterned walking herp forays for one hour around each array site (Reading, 1997).

A total of four array sites were established based on habitat preferences for snake species. Each array remained in place for three weeks. Habitat preference areas were identified using habitat identifications conducted by Walker and Keys (2006). Arrays were moved to new locations at the end of the three-week period. Three, three-week trapping sessions were conducted over the summer of 2009, beginning May 14 and concluding August 1. A sand prairie site was used as a fifth study site without any cover boards or traps due to turtle nesting. All of these sites were placed on Pierce Cedar Creeks Property and are shown in Figure 2.

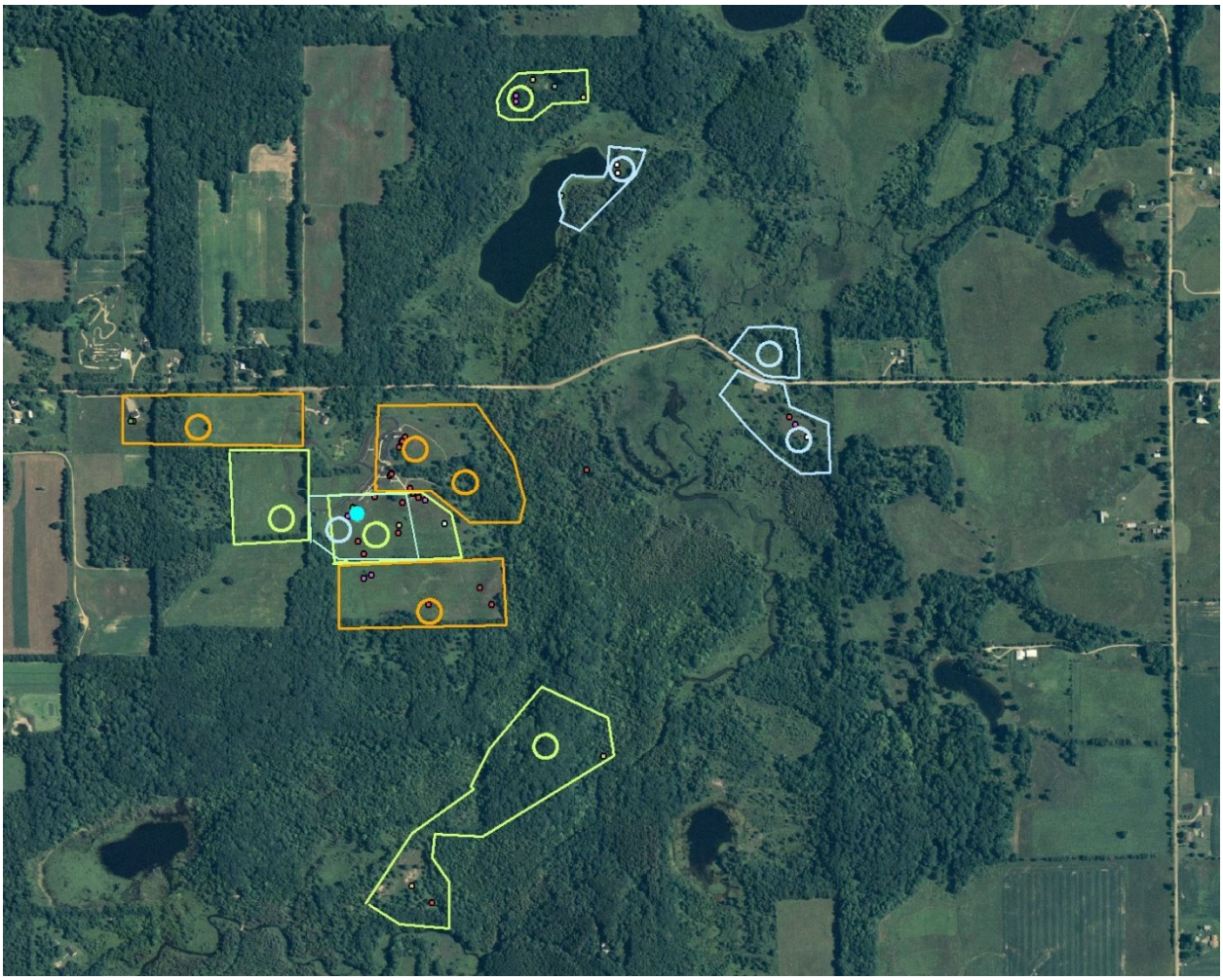

Figure 2. Array arrangement on the PCCI property. Green-1st trapping; Orange-2nd trapping; Blue-3rd trapping.

Upon capture and restraint, snakes were identified, sexed (if possible), checked for a PIT tag, weighed, measured and the GPS location was also recorded. Restraint method was dependent on the snake species and size. Restraint tubes were used for larger snakes, while most snakes were able to be handled with hand restraint. If the snake was deemed large enough (greater than 2cm diameter) and had not been tagged before, a sterile PIT tag (Biomark) was inserted under the second scale above the ventral scales on the largest part of the body after the body was swabbed with an alcohol swab. If any bleeding occurred liquid bandage was applied and the specimen was

placed in a pillow case until bleeding stopped. Snakes were released as quickly as possible at the location of capture.

After release, PIT tag number, habitat type, plant species, any other significant structures such as holes, rock walls dead logs etc that were in the immediate area, and snake behavior at time of capture were also recorded. Surface temperatures (˚C) were recorded with a temperature gun (Pro Exotics PE-1 Infrared Temp Gun) by taking three readings and averaging them. Air and precipitation readings were obtained for each day from the on-site PCCI weather station.

Hypothesis testing was run using ANOVA for single factor variance on habitat preference data for all snakes and for snake habitat preference for snakes species having greater than five total capture/recaptures. Capture data were also graphed to determine if patterns existed between temperature, precipitation and capture rates.

Results

Snake capture was sporadic throughout the summer months. There were a total of 53 captures, 11 of which were recaptures. Figure 3 shows the species which were captured and the recaptures. Only two captures can be attributed to the traps and three to artificial cover boards. The remainder of the captures were the result of herp forays around the arrays.

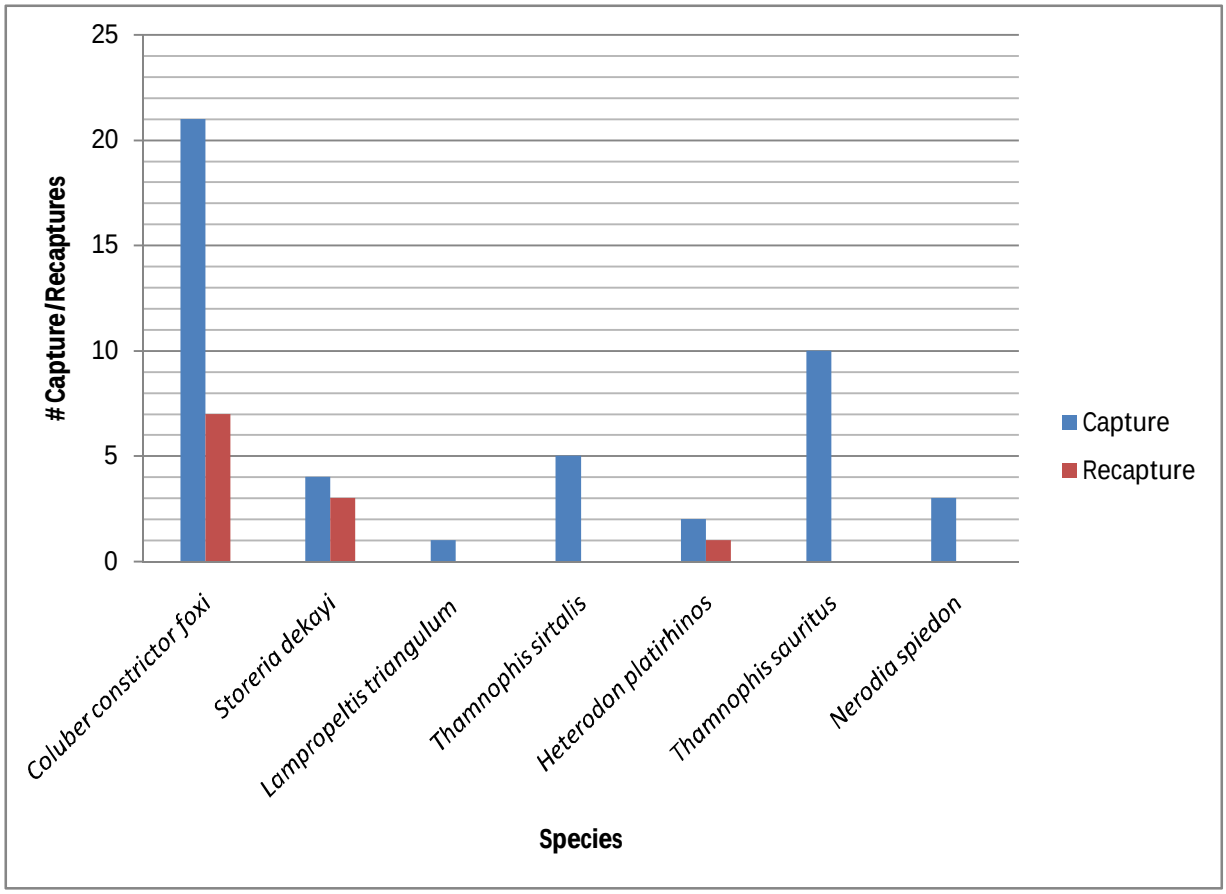

Figure 3. Capture/Recapture results.

Coluber constrictor foxi constituted the greatest number of captures (21 individuals/7 recaptures), followed by *Thamnophis sauritus* with 10 captures/0 recaptures). All other snake species had five or fewer catches, with the exception of *Storeia dekayi* with 4 captures/3 recaptures.

Given the low number of captures for various species, it was decided to only run statistical analysis on snake species for which there were greater than five total capture/recaptures. ANOVA for overall habitat preference of snakes showed that there was no significant difference in snakes preferring one habitat type more highly than another habitat type (*n=52; df between groups =4, df within groups=30; p=0.375*) (Figure 4).

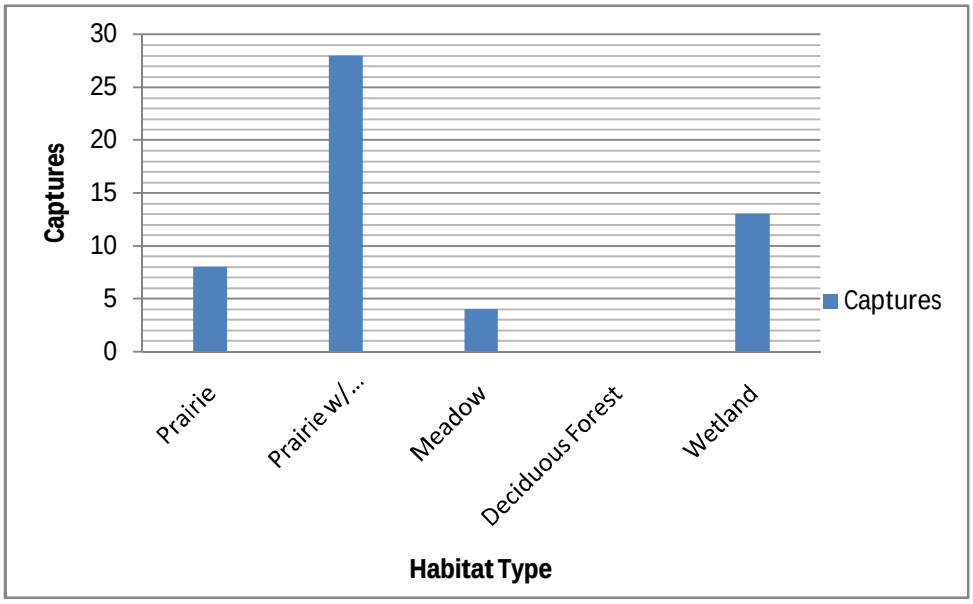

Figure 4. Capture rates by habitat type.

An ANOVA single factor analysis of habitat preference for snakes with capture rates greater than five total capture/recaptures showed that there was no significant habitat preference for *Thamnophis sauritus sauritus* (*n=10; ; df between groups =4, df within groups=8; p=0.832*) and for *Storeia dekayi* (*n=4; ; df between groups =4, df within groups=7; p=0.353*). However, the ANOVA single factor analysis for *Coluber constrictor foxi* showed a significant habitat preference for restored prairies, especially around developed areas (*n=27; df between groups =4, df within groups=8; p=0.035*) (Figure 5).

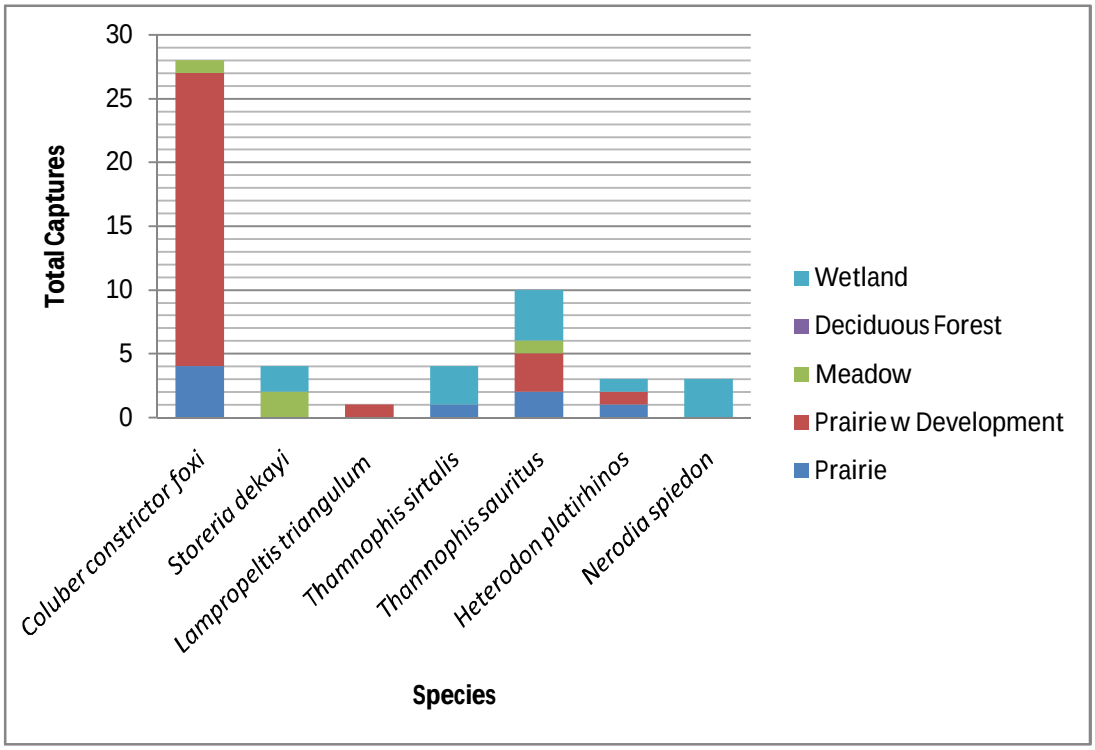

Figure 5. Snake captures by habitat type

An analysis of captures verses temperature and precipitation (Figure 6) showed an interesting relationship between precipitation and captures. On days on and surrounding precipitation events the rate of captures increased. However, in the absence of precipitation events the capture rate decreased to the point where no captures were made for 20 consecutive days.

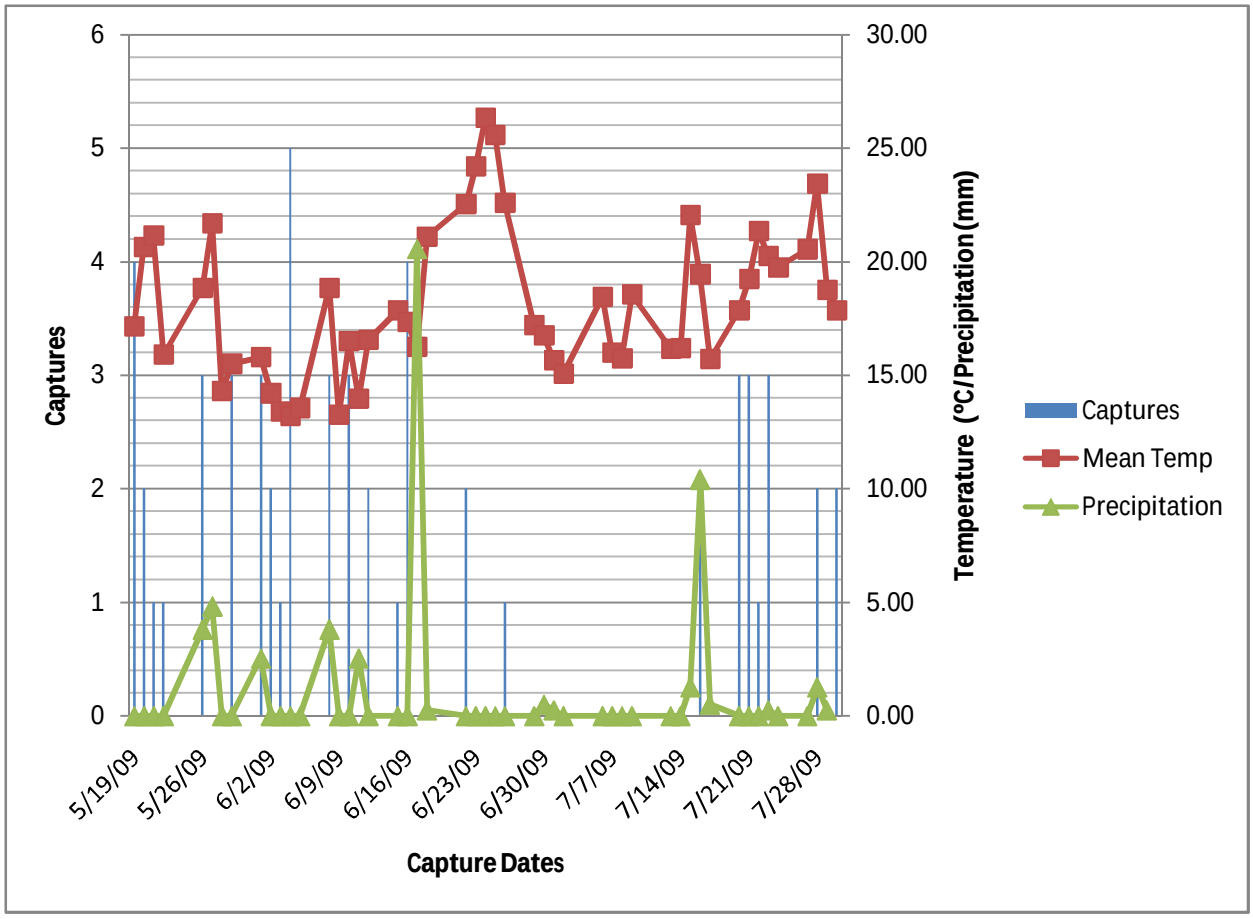

Figure 6. Capture rate in comparison to temperature and precipitation at PCCI

Discussion

The purpose of this study was to assess the microhabitat selection and population distribution of the snake species on the Pierce Cedar Creek property. Captures throughout the summer only yielded eight (including *Sistrurus catenatus*) of the known nine species which theoretically reside on the PCCI property. No additional species were discovered during this research and relatively small numbers of for most other species were discovered. However, of the eight species recorded, the population of *Coluber constrictor foxi* was shown to be both the greatest in number (23 individuals), the most clumped and significantly associated with a specific microhabitat type (restored prairie close to developed areas). This is consistent with other

research conducted by Keller and Heske (2006) which suggests a preference by *Coluber c. foxi* for restored prairies and developed areas where hiding and hibernacula are present. The number of captures during the research period did not allow for substantial determination of overall habitat preference or distribution for all other species of snakes.

The weather station located on PCCI property provided temperature and precipitation data showing no relationship between temperature and capture rate. There was however a relationship between precipitation and capture rate. When there was a lack of precipitation capture rate decreased, and in turn when there was a significant amount of rain capture rate increased. This could be related to snake preference for more humid conditions when foraging for food.

Coluber c. foxi preferred short grass sections of prairies at PCCI. This high rate of capture could be because it is easier to see and capture the snakes when in shorter grass (less cover/hide areas). *Coluber c. foxi* also seemed to prefer prairie sections near buildings or where humans influence the habitat. This is potentially due to possible hibernacula sites near the structures themselves.

While other conclusions on specific snake species cannot be supported with this research due to the low number of captures, it was found that certain snake species were generally captured in certain conditions. *Thamnophis sauritus septentionalis* were generally found on the tops of sedges and tall grasses; potentially due to basking sites near cover. Also, *Storeria dekayi* were generally a fossorial snake or found under vegetation, and they prefer damp areas with a lot of cover.

Limitations

There were a few limitations and problems within this study. Trap problems were the biggest issue in the study. Unlike other research (Row and Blouin-Demers, 2006) very few snakes were

actually captured in the traps themselves (2 individuals were captures), while small mammals, birds, and amphibians were caught in the traps. Also the drift fences used were potentially not tall enough, as larger snakes were seen easily climbing over the tallest drift fence (roughly 1 meter tall). The cover boards (Reading, 1997) also may have used too thin plywood, which caused the majority of the boards to severely warp creating very little usable cover.

Weather had a huge impact on the movement of snakes, and for research activities. During the peak summer months when temperatures are high, snakes became more crepuscular, making foray capture more difficult. Severe rain storms also cause snakes to hide and the capture rate became almost zero. During those periods of harsh weather, research wasn't able to be conducted due to safety reasons. Also, snake movement as a whole is greater during May to mid-June when they are beginning to move from the hibernacula and early September to October when they migrate back to the hibernacula. Research was conducted in the latter portion of the first migration (May to mid-June) to August 1 causing low capture rates for most of the research season.

Future Research

There exist a number of potential studies that could be done on the colubrids at PCCI. Given the large number of *Coluber c. foxi* captures, a study that radio tracks *C. c. foxi* across the PCCI property, in order to get a more defined microhabitat, home range, and distribution of this species would be of great benefit for the conservation of the species, especially considering the relative lack of studies specifically on Blue Racers.

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