Examination of home range in male purple finches (*Carpodacus purpureus)*

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The primary goal of this study was understand the home ranges of red and brown purple finch (*Carpodacus purpureus)* males. Home ranges are an important basis of study because they provide valuable information on the habitat size, distribution, and ecosystem required to sustain a species. Data amassed on the males in our study was collected using an integrated radio-tracking methodology. Various home range parameters were estimated for the red and brown males during the breeding season using a Minimum Convex Polygon estimator. Although there was not a significant difference in the home ranges of each age type, the overall area used by the brown males was generally larger in size than the red males.

Introduction

By definition, a home range is an area delimited by the spread of land that an individual confines its activities to, whereas a territory is the area of land that is actively defended by the male. Territories can include all or part of the home range. Understanding home range and territory size of vertebrates can provide vital information about intrapopulation distribution patterns (Odum & Kuenzler 1955) and give insight into the fitness of the individual or the species (Brown 1969).

One purpose of territoriality in animals is to regulate the distribution of breeding pairs so that they are far enough apart to ensure that there are sufficient resources to raise the offspring of each pair (Wilson 1975). This optimization of food abundance to the density of conspecifics may account for the significant variance in individual space use in birds (Brown 1969; Adams 2001). However, predictions based solely on optimality models do not account for variation among individuals as postulated by the ideal dominance model of habitat selection, which suggests that characteristics such as age and body size can also influence territory sizes (Adams 2001). Ideal dominance model studies generally show that older and larger males are more dominant (Marra 2000) and

have higher quality territories than younger and smaller males (Petit and Petit 1996). This dissimilarity usually correlates with level of fitness whereby younger and smaller males experience a lower level of reproductive success than the older and larger males (Petit and Petit 1996).

The purple finch *Carpodacus purpureus* is common across the northeastern United States, the west coast of North America, and central and southern Canada (Wootton 1998). Adult purple finches display sexually dimorphic coloration whereby males have a red coloration and females have a drab brown and grayish coloration (Wootton 1998). A phenomenon called delayed plumage maturation occurs in male purple finches whereby young males do not acquire their breeding plumage until they are around 2 years of age despite their capability to mate (Greij 2004). It has been shown that females prefer brightly colored mates due to sensory bias (Boughman 2002; Smith 1963), which does not explain the evolutionary purpose of delayed plumage maturation. It is speculated that young males are less experienced than older males, so their subordinate coloration allows them to intrude on other territories and achieve extra-pair copulation with females that wouldn't otherwise be possible if they were brightly colored (Greij 2004).

The goal of this study was to gain information on the typical home range size of male purple finches. Furthermore, we were interested in comparing the home range size of mature red males to the younger brown males. Because the immature males are less experienced and less appealing to female purple finches, we predicted that they will not be able to defend a territory and therefore will have considerably larger home ranges than the red males who are limited by their territories.

Materials and Methods

Study area

The study area is located at the Itasca Biological Station in Itasca State Park in northern Minnesota and is characterized by its Laurentian, Eastern Broadleaf and Old

Growth forests and boasts over 100 lakes in 32,000 acres of park (GPS location 47'13"30N, 95'11"30W).

Selection, capture and marking of purples finches

Purple finches were trapped during the breeding season (May and June 2010) using mist nets set up near feeders. The finches were sexed and then tagged with radio-transmitters (250mg, ATS) were attached to 7 males from different age classes.

Radio tracking protocol

Finches were tracked from the biological station for approximately for 2-3 weeks depending on their date of capture. The tracking team limited their data collection time to afternoon sessions in order to ensure that finches would be tracked evenly throughout the study area and also during peak foraging times when they are most likely to be moving around their home ranges (CITATION). Only one location estimate was taken per finch per day to reduce dependency among estimates and obtain an unbiased estimate of the home ranges (White and Garrott 1990). The Radio-tracking teams used receivers and antennas supplied by ATS.

Locations estimation

We recorded location points on a Universal Transverse Mercator coordinate system and entered the data into the software program ArcGIS. The home range area estimates were computed using using the minimum-convex polygon (MCP) analysis.

Statistical analysis

Sufficient data was not collected to run a Univariate Analysis of Variance (ANOVA) to compare results between different age classes. In the future the ANOVA test should be followed by post-hoc tests to pinpoint the between-age differences.

Results

Six red males and two brown males were successfully tracked in our study. The average red male home range size was 133,650 ± 138,085 m^2, and the average brown

male home range size was 1,412,438 ± 1,810,527 m^2 (Fig. 1). Figures 2-9 are home range estimates for the radio-tagged purple finches. Shapes indicate the 95% Minimum Convex Polygon for each individual.

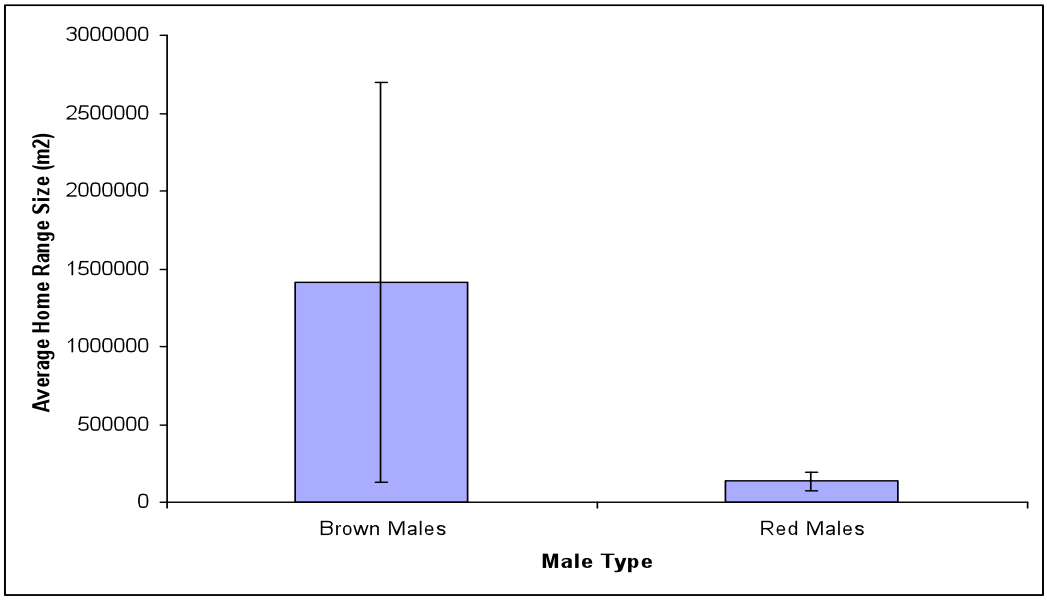

Figure 1: Mean (±SE) for average home range size in each category of male type

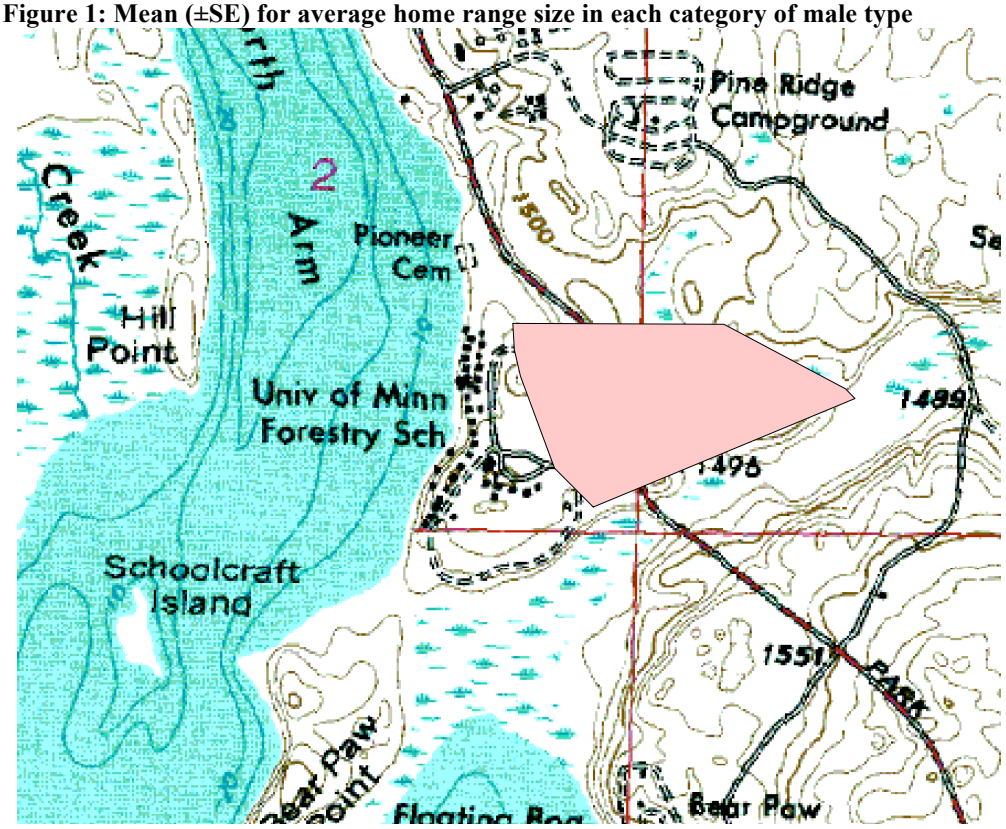

Figure 2: Red male 2009

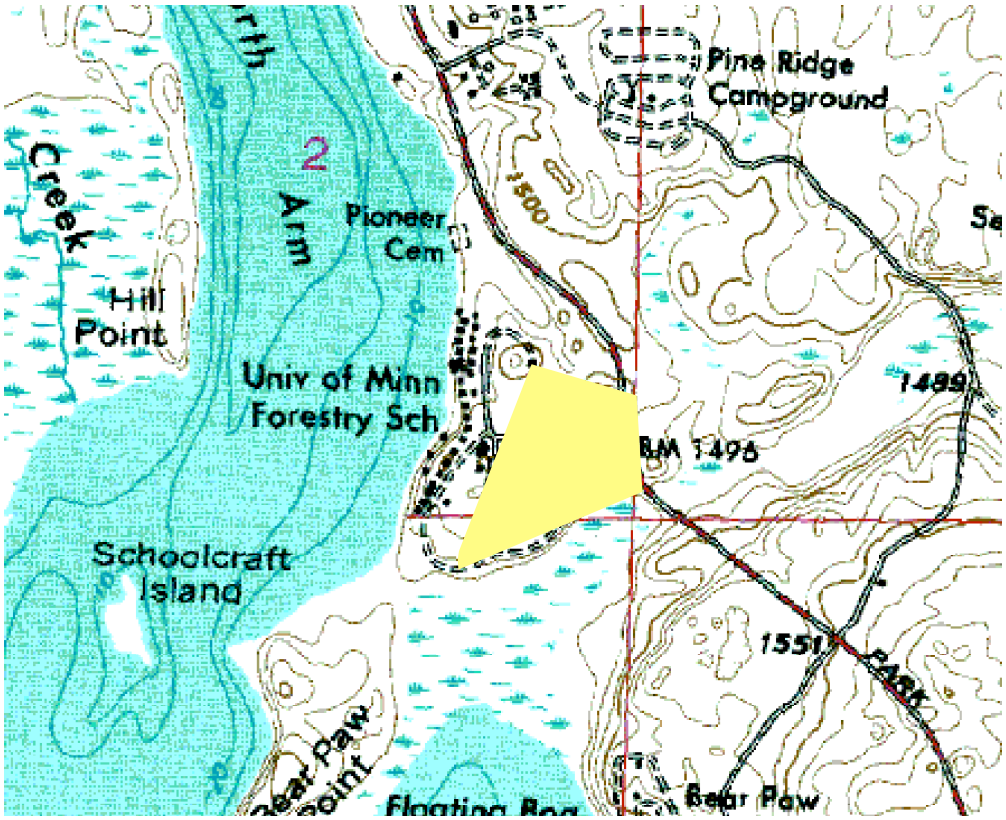

Figure 3: Red male 2009

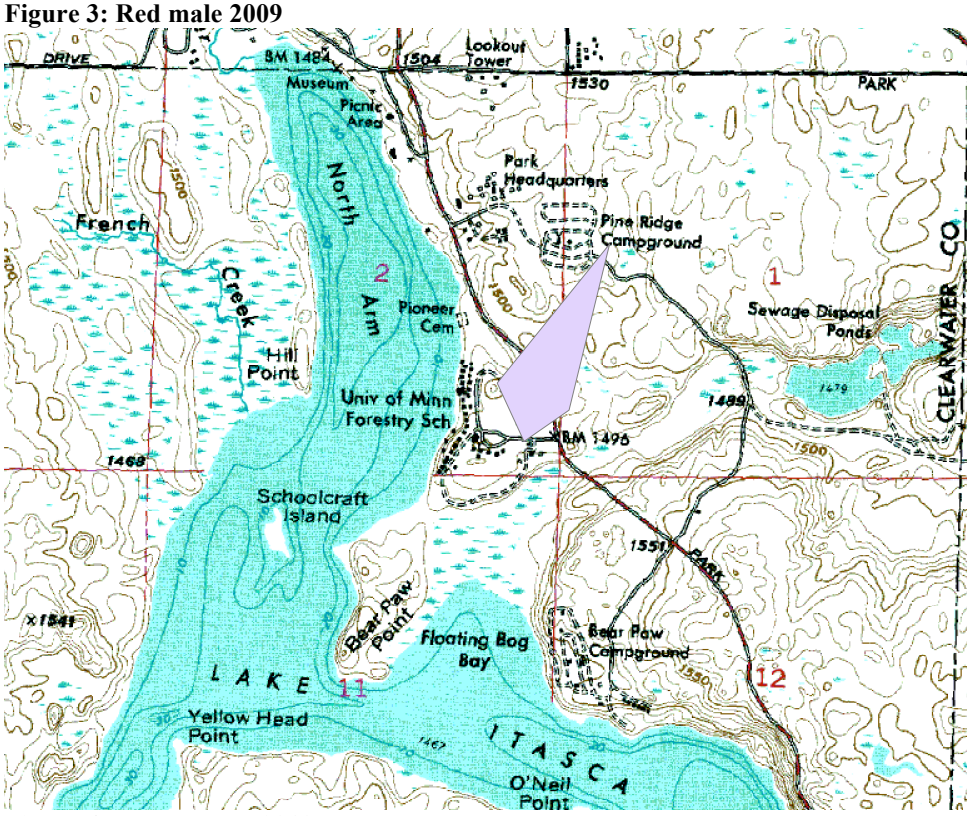

Figure 4: Brown male 2010

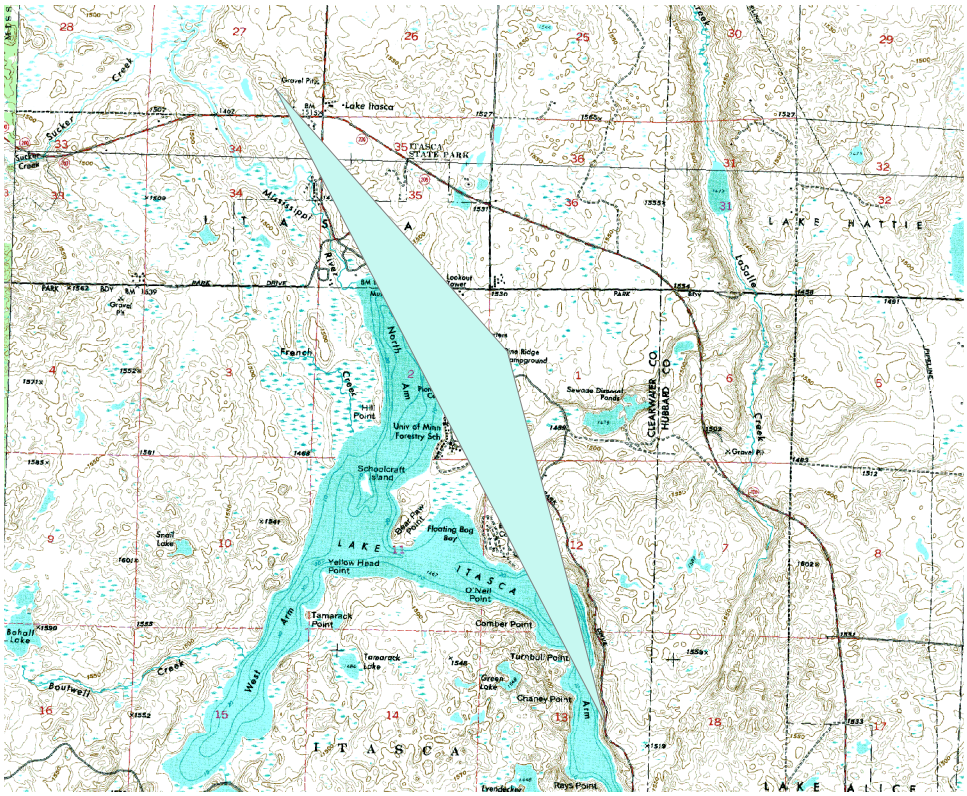

Figure 5: Brown male 2010

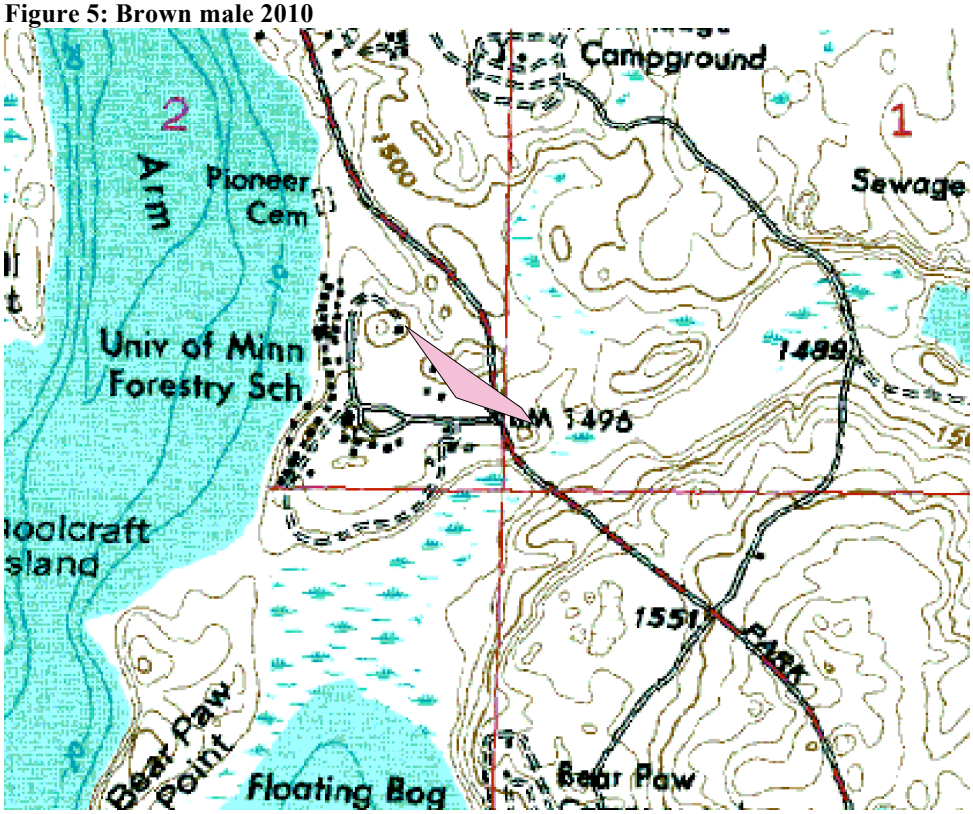

Figure 6: Red male 2010

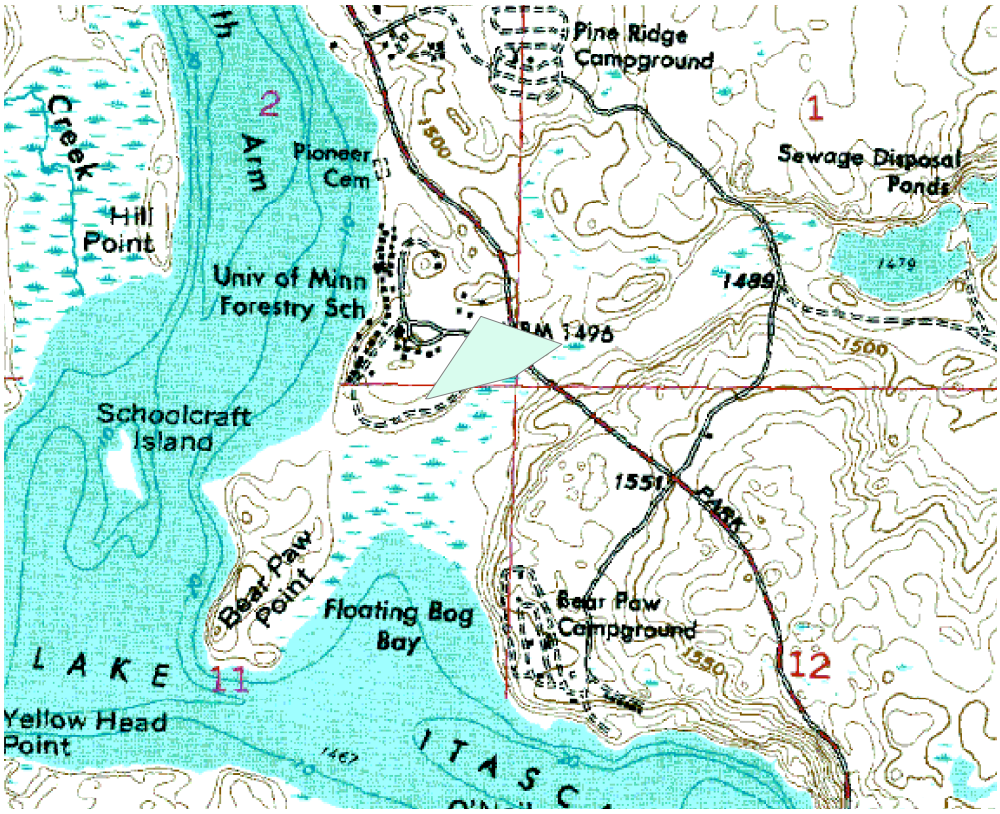

Figure 7: Red male 2010

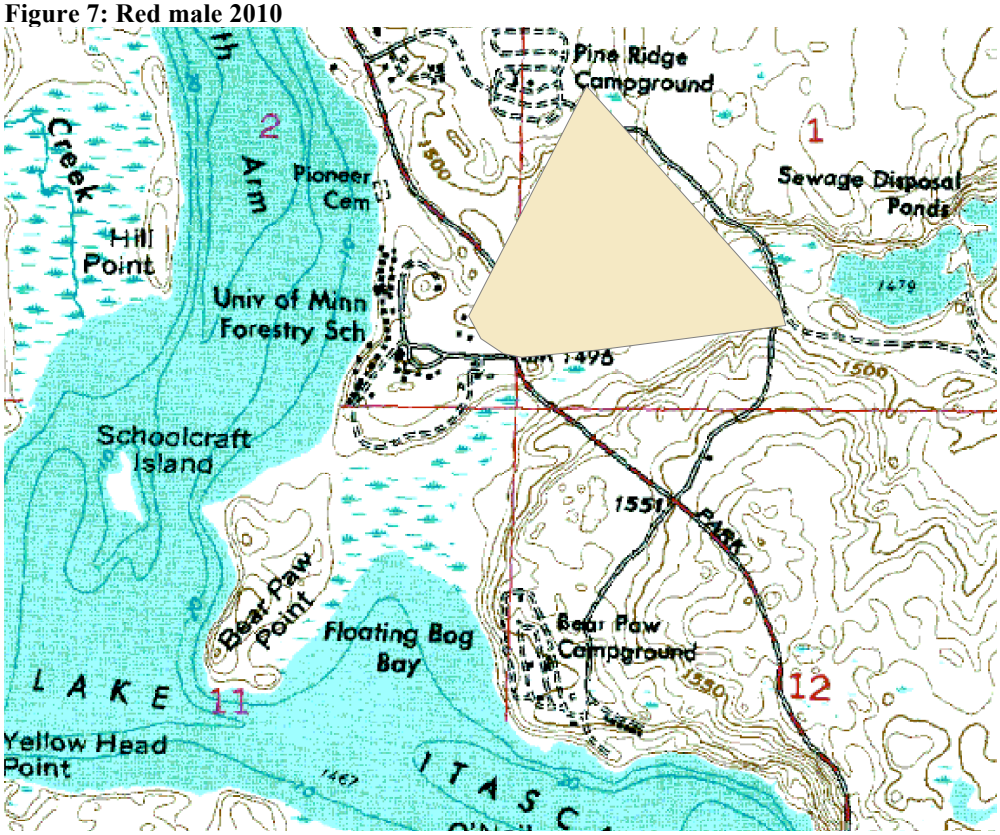

Figure 8: Red male 2010

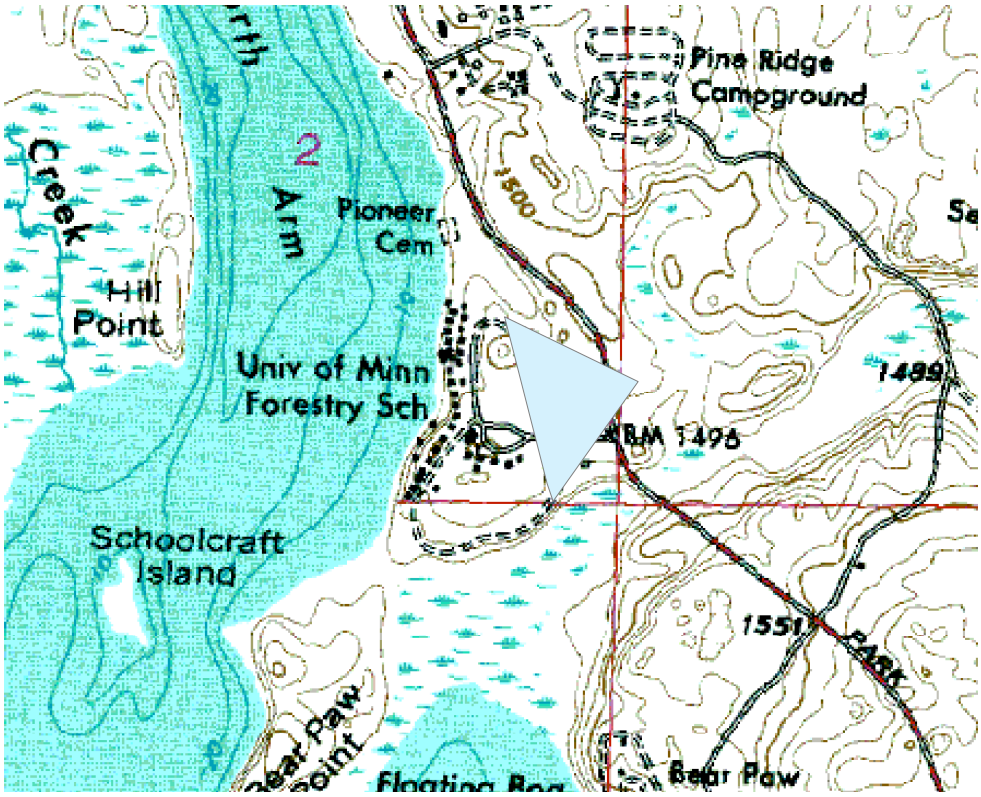

Figure 9: Red male 2009

Discussion

Range use pattern of the different individuals showed high variability within the different age classes due to small sample size, and no statistically significant differences were detected between adults and immature males. In absolute numbers, the brown males utilized smaller areas than the red males in the breeding seasons of 2009 and 2010. This difference is most likely explained by the restriction on the red males to defend a territory, meaning that they are not able to travel as far of a distance to forage, whereas the brown males are most likely too inexperienced to defend their own territories (Petit and Petit 1996) and therefore have the freedom to forage in a much larger area. It is also possible that older birds capable of defending territories have selected the best habitats, forcing the brown males to travel farther in search of quality food sources (Elchuck et al. 2003). The variance in the population of red males could be due to differences in foraging and defending abilities, meaning that more experienced birds can be effectively sustained

by smaller home ranges than younger and less experienced males (Elchuck et al. 2003; Petit and Petit 1996).

This investigation requires a more intensive study to obtain significant data for the home ranges of brown and red males. It would also be advantageous to study other aspects of purple finches such as their territory size, home range overlap, time spent foraging in red and brown males, courting and territorial behaviors in red and brown males, etc. Ultimately, tracking purple finches will lead to a better understanding of this fairly unstudied species and may provide valuable insight into bird and animal behavior in general.

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