Effects of nearby prey abundance on den tree selection of fisher (*Martes pennanti*) mothers

SARAH RASMUSSEN, *Undergraduate of Fisheries, Wildlife and Conservation Biology, University of Minnesota, St. Paul, MN 55108, USA*

Introduction

The fisher (*Martes pennanti*) is an arboreal member of the weasel family native to the boreal forests of North America (Hazard 1982; Golightly 1997; Davis 2009). Apart from being an integral part of their ecosystem, fishers are valued economically for both their fur and predation of porcupines, which can damage commercially valuable timber by eating bark and foliage (Paragi et al. 1996; Buskirk & Zielinski 2003). Fishers occur in both coniferous and deciduous forests, but have been extirpated from Minnesota south of the Great Lakes due to trapping. However, they are still present in north-eastern Minnesota (Hazard 1982).

Fishers select for their habitat based on their needs and stage of life, and are one of western North America's most habitat-specialized mammals (Aubry & Lewis 2003; Davis 2009). The type of habitat selection that female fishers exhibit while caring for their kits is particularly important because it can have serious consequences to offspring survival (Powell et al. 1997). During this time, fishers select aspen, pine, and fir trees for natal dens, which can be affected by human activities such as forestry (Paragi et al. 1996; Davis 2009). Therefore, in order to effectively manage and protect fisher populations, more information regarding suitable areas for natal dens needs to be collected. Extensive research has been conducted regarding habitat cover types and den tree species (e.g. Proulx et al. (1997) and Zielinski et al. (2006)), but more research is needed for non-cover type characteristics of surrounding den tree areas.

Fisher behavior and population dynamics are highly correlated to their prey abundance (Bowman et al. 2006; Jensen et al. 2012). Fishers tend to forage in high density prey areas, which I believe is because hunting is one of their most important energy expenditure activities (Powell 1979; Davis 2009). Because female fishers require more energy during reproduction, I predict they will choose den trees that minimize their hunting energy expenditure (Powell & Leonard 1983). Therefore, I hypothesize that prey abundance will be higher as proximity to the den tree increases.

Methods

Study Area

Study sites included the area within a 1250m radius surrounding five separate known den tree sites of fishers in northern Minnesota. Three sites were located in Camp Ripley, one site was in Hoyt Lakes, and one site was in Remer, MN. The majority of the Hoyt Lakes and Remer study areas were coniferous, and the Camp Ripley study area was mostly deciduous forest.

Data Collection and Analysis

I collected all data at the end of March and beginning of April, 2014, close to when fisher kits were born (Hazard 1982). Previously, the Minnesota DNR fitted the fishers with VHF collars and homed in on their den trees using a VHF antenna and receiver. I collected prey abundance data along north/south transects spaced 250m apart within the study area surrounding each tree, with one transect originating at the tree and continuing 250m south (Figure 1). The transect originating at the den trees in Hoyt Lakes and Remer continued 50m south. Private land and lakes were not included in the transects.

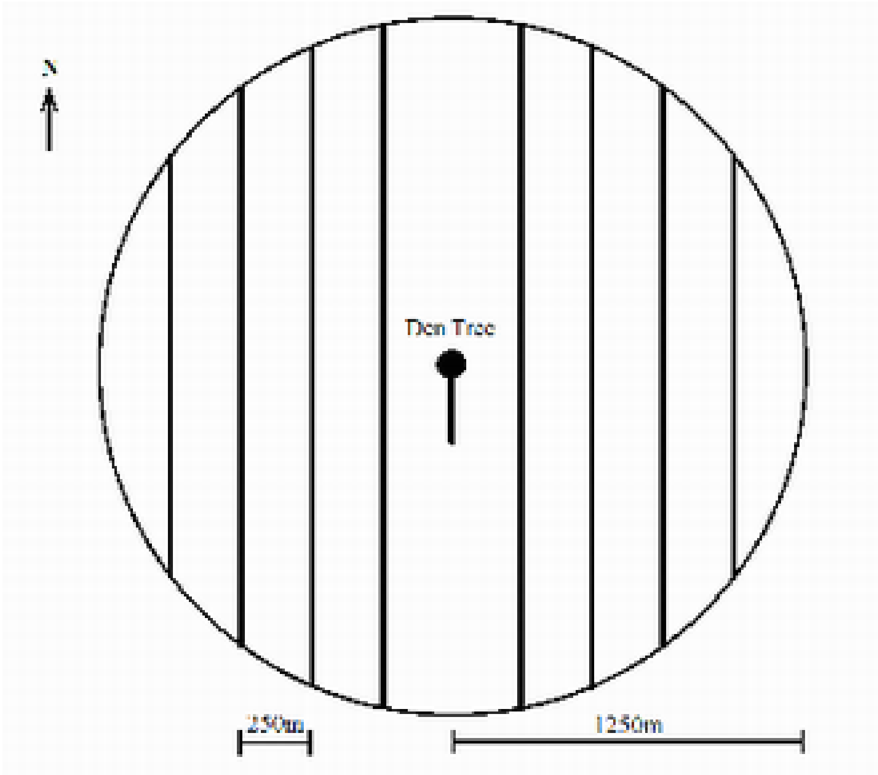

Figure 1: Study site and transect layout surrounding known fisher den trees in northern Minnesota. The study sites include transects within a 1250m radius of five known den trees. Transects run north/south at 250m intervals east and west of each den tree within the study site. One transect originates at the den tree and runs south for up to 250m south.

I focused on snowshoe hare (*Lepus americanus*), squirrel (*Sciurus spp.*), and porcupine (*Erethizon dorsatum*) populations for my measure of prey abundance, as they have been shown to be important prey species for fishers (Powell 1979; Powell et al. 1997). I collected prey abundance data using three different methods, allowing me to check for consistencies between the results. Snowshoe hare abundance was estimated using two methods. The first method was snow track counts, which were conducted by taking GPS coordinates of trails within 3-5m of the transect (O'Donoghue et al. 1997). Continuous trails that overlapped the transect multiple times were only counted once. Data were standardized by the amount of time between the most recent snowfall and track counting. Snowfall data were obtained from employees of the local DNR office. The second method, scat counts, was conducted by noting the GPS location of hare scat within 3-5m of transects. Squirrel and porcupine abundance were estimated by snow track counts, and porcupine abundance was also estimated by examining trees within 3-5m of the transects for porcupine scars (Yeaton 1988).

Linear mixed-effect models were created using R for each method and species combination (R Version 3.0.3, www.r-project.org). A model including snowshoe hare, squirrel and porcupine snow track counts was also created. Models used distance from the den tree to predict track count density, which was calculated for every 200m of transect. Fisher and transect IDs were used as random effect variables.

Results

No significant results were obtained. Only Hoyt Lakes and Remer den tree transects contained enough snow tracks to analyze, so any data gathered at Camp Ripley was disregarded. The only species and method combination that acquired enough data to be analyzed individually was track counts for snowshoe hares, and the relationship between snowshoe hare track density and distance from den tree was not significant ($p = 0.6787$). An analysis of snow track counts for snowshoe hare, squirrel and porcupine combined yielded similarly insignificant results ($p = 0.3208$; Figure 2).

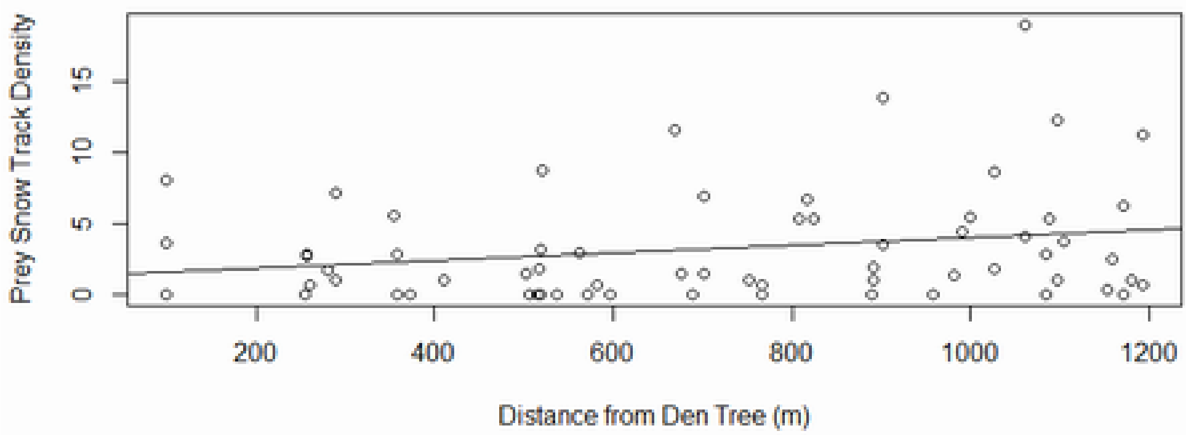

Figure 2: Plot of snow track density vs. distance from fisher den trees in Northern Minnesota. Snow track density was calculated for snowshoe hare, squirrel, and porcupine tracks for every 200m of transect. Distance from the den tree was calculated from the midpoint of every 200m segment. The relationship between prey track density and distance was insignificant ($p = 0.3208$).

Discussion

No model displayed a significant relationship between distance from den tree and prey density within the study area. This suggests that snowshoe hare, squirrel, and porcupine abundances are homogenous within at least 1250m of den trees. It is possible that areas beyond the study site had lower prey abundance, and the scope of this study was not large enough to accurately test the hypothesis. Future studies should create study sites around random points without den trees in order to compare the prey densities with known den tree study sites. Factors such as cover type should also be taken into account in future studies. Additionally, more conclusive results may be obtained by using smaller sections of transect to calculate prey density. This would create more variable distances from the den tree to analyze. Not enough data was collected in this study to use less than 200m transects and obtain meaningful results.

According to the results of this study, it is not more important to manage snowshoe hare populations in close proximity to known den trees than it is to manage populations up to 1250m away. However, this study revealed many opportunities for future research that should be conducted. Understanding the dynamics of this crucial part of the fisher life-cycle is critical for management decisions and to ensure the continued persistence of fishers across their natural range.

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