Habitat Fragmentation Changes and the Influence on Diversity of Song Sparrow (Melospiza melodia) Behavioral Aggression

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ABSTRACT:
Fragmentation of habitat is currently a major issue in wildlife sustainability & management. Fragmented habitat can manifest in numerous ways such as loss of amount of habitat, decreases in connectedness of habitat, and/or increase in edge effects due to the change in shape of remaining habitat. Avian species are highly subject to the effects of human disturbances such as fragmentation because they need to defend territories to maintain effective breeding and foraging home ranges. To understand the pressure human disturbance puts on a local avian species of songbird, we examined the effects of fragmentation on territorial aggression of the song sparrow (Melospiza melodia). Specifically, our study compared not only the degree of territorial aggression displayed between individuals living in fragmented and non-fragmented habitats, but also the suite of types of aggressive behaviors. Additionally we sought to understand the relationship between fragmentation and density of individuals in each habitat type. Overall this study demonstrates that fragmented areas contain a greater density of individuals maintaining territories and these increases in density influence certain aggression scores as well as the types of aggressive behaviors displayed.

BACKGROUND:

Avian aggression:
• Avian aggression has been well-studied in regard to different behavioral and physiological changes (Wingfield, 1985).
• Testosterone (T) and luteinizing hormones (LH) have been measured in non-migratory birds both during breeding and non-breeding season in response aggressive encounters, and more specifically simulated territorial intrusions (STI) (Meddle et al., 2001).
• It has been noted that the increases in these two specific hormones can cause physiological changes in birds, including influencing certain behaviors. Increased testosterone levels have been previously linked to increased territorial aggression (Wingfield et al., 1990; Hirschenhauer and Oliviera, 2006; Goymann et al., 2007).

Terrestrial aggressive behaviors can be affected by certain environmental factors, such as food source or possible breeding habitat (Busch, et al., 2004). Non-migratory birds are expected to defend their territory year-round from both conspecifics and non-conspecifics (Strubchtby and Morton, 2001).

Song sparrows as a model organism:
• *M. melodia* is used as a model for this experiment due to its abundance and well-studied physiology and well-defined behavioral displays (Wingfield and Hahn, 1992).
• Individuals weigh 18-24 grams and responds to conspecific playback.
• *M. melodia* is a non-migratory, seasonal breeder that defends its territory year-round, especially during breeding season.

RESULTS:

1. Behavioral Aggression:

METHODS:

- Decays were caught the day of each STI.
- A decay was caught by setting up mist nets and using an iPod and speaker playback combination set directly underneath the mist nets.
- Captured Individuals were banded and morphological measurements were taken.
- All decays were released back onto their territories at end of day.

STI’s Simulated Territorial Intrusions:
• When necessary (if individual couldn’t be sited or heard), playback was used to determine focal individuals territory.
• A net was set up (raised) within the focal bird’s territory in an area with the best chance of viewing the bird’s reaction to the addition of the decay.
• The speaker and iPod were placed next to the decay and the playback sequence was turned on.
• For ten minutes, the playback was played, with 10 different songs, each grouped into 4 sequences, divided by 30 seconds of silence.
• A variety of behaviors were observed & recorded (details, Figure 1)
• After the duration of the STI, the net was lowered to catch the focal bird in order to band and measure the individual.

RESULTS:

- Point counts/response to playback throughout 50 m segments of habitat types were done for 5 minutes each (Hamel et al., 1996), or
- Counting number of banded birds in habitat

CONCLUSIONS:
• Fragmentation influences specific aggressive behaviors such as proximity to decay and number of songs (Figure 2).
• Fragmented areas generally displayed more aggressive behaviors than Non-fragmented areas (See Table 1).
• Density was found to be higher in fragmented areas than non-fragmented areas (See Table 3)
• Overall these data demonstrate that the complexity of effects fragmentation can have on subtle behavioral changes which possibly paramount implications such as decreased fitness.

FUTURE RESEARCH:
• Exploring into greater detail the effect of density on territorial aggression, such as monitoring how far fledgeings have to go in order to find sustainable habitat.
• Measuring testosterone levels in both fragmented and non-fragmented areas to determine levels in response to behavioral changes we see.
• Measuring corticosteroids in both fragmented and non-fragmented areas.
• Catching the birds via food source to obtain baseline hormone levels during winter months and during breeding season.
• Determine the long term ecological effects of the behavioral and physiological changes due to fragmentation.

WORKS CITED:


Figure 1: Variety of Aggressive Behaviors Exhibited

Table 1: Bird densities per square meter

- Figure 2: Four Main Aggressive Behavior Comparison from STIs
- Table 2: Bird densities per square meter of area studied

- Figure 3: Lake Sullivan & surrounding area
- Figure 4: MU Ecolab
- Figure 5: Broad Ripple Canal at Butler University
- Figure 6: Indianapolis Museum of Art