

Carry-over effects of non-breeding territoriality on reproductive success
in *Troglodytes troglodytes*

Ayaka Soda

INTRODUCTION

Traditionally, research investigating the factors that drive differences in reproductive success among individuals has focused on behaviors immediately before or after copulation. However, recent studies have revealed that experiences or behaviors of individuals during the non-breeding period also affect their reproductive performance in the subsequent breeding season. To understand the mechanism underlying the variation in reproductive success, it is necessary to conduct research that investigates the natural history of animals not only during the breeding season but also during the non-breeding season and examines the reproductive success of individuals by tracking them from the non-breeding season to the breeding season.

The Eurasian Wren (*Troglodytes troglodytes*) is one of the socially polygynous species, which comprise only 2% of avian species. Because males are expected to be under strong competition for females, they may adopt specific strategies prior to the breeding season to enhance their mating success. In the present study, I identified male wrens by color rings and tracked them throughout the year. I described the detailed natural history of them both in the breeding and non-breeding seasons. I also investigated whether variations in male behavior during the non-breeding season affect their reproductive success in the subsequent breeding season.

METHODS

During the breeding season, I conducted surveys on breeding activity of wrens. I mapped each male's breeding territory by recording the location of their song posts. I then installed trail cameras in front of their nests to monitor the activity of females. I also used a fiberscope to inspect whether any young successfully fledged from the nest.

In the non-breeding season, I mapped each male's non-breeding territories by playing back their territory calls and recorded the locations where they reacted. In addition to territory mapping, I conducted a survey of food abundance. I used a Surber

sampler to collect aquatic insects, which are the primary food of wrens during the non-breeding season, from channels in the study site.

RESULTS AND DISCUSSION

Over four breeding seasons, I monitored 47 breeding attempts by 39 males. Most males were monogamous, with only six cases of bigamy. Compared to other populations of Eurasian Wrens, the degree of polygyny was low in the study population. I discriminated six types in nest sites, but there was no significant relationship between nest-site type and predation rate.

The breeding sites of Eurasian Wrens are restricted to high-elevation areas, and they have been considered to migrate to lower areas to avoid snowfall and low temperatures during the non-breeding season, from autumn to winter. However, I found that some males did not migrate but established territories at the breeding site during the non-breeding season. Some of these males maintained their territories until the subsequent breeding season and used them as breeding territories. Other males established breeding territories during the breeding season.

I compared the reproductive success of males that established territories during the non-breeding season (NB males) and those that established them during the breeding season (B males). NB males constructed more nests and attracted more females than B males. The predation rate was lower for nests constructed by NB males than for those constructed by B males. The average territory size of NB males was larger than that of B males. These results suggest that establishing territories during the non-breeding season enhances the probability of obtaining higher-quality territories, which would lead to the higher probability of being chosen by females.

In the non-breeding season, territory size was negatively correlated with food abundance in that territory. However, the qualities of the territory owners and their territories were not related with whether the owners successfully maintained their territories until the subsequent breeding season.

CONCLUSION

The present study showed that in the Eurasian Wren, males initiate competition for

breeding territories during the non-breeding season, and this competition affects reproductive success in the subsequent breeding season. The present study highlights the importance of focusing on the non-breeding season to better understand what determines differences in reproductive success among individuals.