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Research Article

Effects of Road Construction Works on Some Bird Communities in Van (Turkey)

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Abstract

Human activities represent an important threat to biodiversity. Birds are especially valuable in evaluating environmental monitoring. In this study, we investigated effects of road reconstruction and restoration activities on birds such as Sand martin (*Riparia riparia*), European bee-eater (*Merops apiaster*) and European roller (*Coracias garrulus*) nesting at roadside in Van, Turkey. To test and control for possible effects, we conducted point-count surveys along the 85 kilometers long highway in Van between years 2013-2015. Our results demonstrated that total population number of these species and nests decreased during and after the road broadening and construction efforts between years 2013-2015 ($p<0.05$). These three species failed to find alternative nest area affected by habitat destruction caused by road construction works.

Keywords: Biodiversity loss, ecological effect, roads, population size, grassland birds

1. Introduction

The ecological effects of roads and their construction processes on animal populations and biological diversity has grown recently. Road developments affect and modify the habitat conditions in several ways. First of all, the construction of new roads becomes natural habitats into highly disturbed environment (Fahrig and Rytwinski, 2009; Benitez-Lopez *et al.* 2010; Rytwinski and Fahrig, 2013; Astudillo et al., 2014; Yrjöla & Santaharju, 2015). Also, roads have many direct ecological effects on birds as habitat loss, disturbance, noise, mortality by collisions, behavioral changes, barrier effects which have been well-studied (Spellerberg & Morrison, 1998; Torres et al., 2011; Kociolek et al., 2011; Kambourova-Ivanova et al., 2012; Morelli et al., 2014.) The effects of roads on habitats are often described as being either negative or positive. For example, road kills are seen as negative and an increase in road side habitat is seen as positive. Although there are many reports on road kills, the longer term effects of road construction processes on the population dynamics of the species is rarely mentioned in the literature (Roedenbeck et al., 2007; Torres et al., 2011, Yrjöla & Santaharju, 2015).

In recent years, highway reconstruction and restoration activities have been rapidly increasing all over Turkey and in Van province. The aim of this study was to determine the impacts of these activities on bird populations in the grassland area (Van, Turkey). Observations and censuses were carried out to determine population trends of birds such as Sand martin (*Riparia riparia*), European bee-eater (*Merops apiaster*) and European roller (*Coracias garrulus*) nesting at highway roadside verges. In these surveys, population size of these species before and after the roud construction works were compared and assessed statistically.

In this manner, we provide a useful record for ecologists, road planners and other officials who are in need of reliable information to support their conservation decisions.

2. Material and Methods

The potential influences of road construction on bird populations were investigated along a road in Van, Turkey (Fig. 1). The study in which, habitat preference, reproduction activities and population densities of three bird species (*Riparia riparia, Merops apiaster* and *Coracias garrulus*) were investigated, was performed at 6 points along the 85 kilometers long highway and 4 points other localities in Van between years 2013-2015.

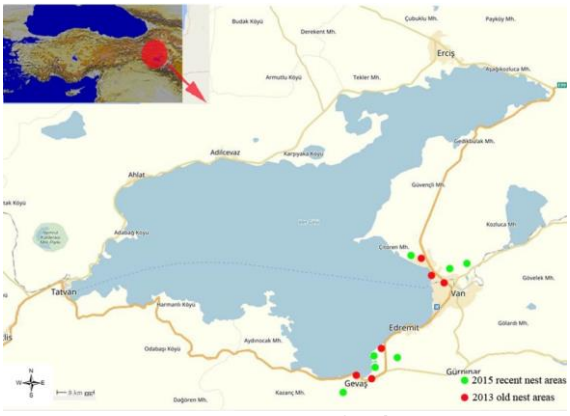

Figure 1. Location of study area

The road construction works through the grasslands was conducted in 2013-2014 and we performed bird counts

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in the area in 2012-2015. Bird populations were monitored using yearly breeding bird counts between late April and late August. The observing of bird populations continued for one year after the construction process. Population density of the species were determined by using Point Counts (Dobinson, 1976; Bibby and Burgess, 1992). To determine if there is a difference between years pertaining population sizes ANOVA method and Tukey test were used. Bird population changes were studied during construction of the new highway and the possible effects of road widening works on bird populations were investigated.

3. Results and Discussion

Our results demonstrated that road construction works significantly had reduced some bird population nesting at highway roadside verges. The total population number of three species and nests decreased during and after the road broadening and construction efforts (Fig. 2).

Figure 2. Nests of Sand martin at the roadside

Due to detriment of nests during these activities, a statistically significant decrease was determined in total populations of *Riparia riparia, Merops apiaster* and *Coracias garrulus* species in years 2013-2015 ($p<0.05$) (Fig. 3).

These three species nested frequently in burrows in sand bank along the roadside before road construction works. Therefore, they had shifted their territories further away. The result of many studies have reviewed reduced densities of birds breeding near roads (Ortega & Capen, 1999; Polak et al., 2013) and only several publications have recorded the new environment along the roadside impacts to birds positively (Pocock & Lawrence, 2005; Morelli et al., 2014). Especially, some species having alternative breeding areas showed stable densities (Seiler, 2001; Jacobson, 2005; Fahrig & Rytwinski, 2009; Yrjöla & Santaharju, 2015). However, our results showed that these three species failed to find alternative nest area affected by habitat destruction caused by road construction works.

The average distance of territories of all bird species from the road changed during the study period showing a general increase while the total number of all territories decreased. Many studies have shown that richness of breeding birds is decreased near high traffic roads (Parris and Schneider, 2008; Griffith et al., 2010).
It was claimed in various studies that the largest number of animals affected by traffic mortality and the most abundant group of killed animals are birds on roads (Orlowski, 2005; Summers et al., 2011; Kambaurova-Ivanova et al., 2012).

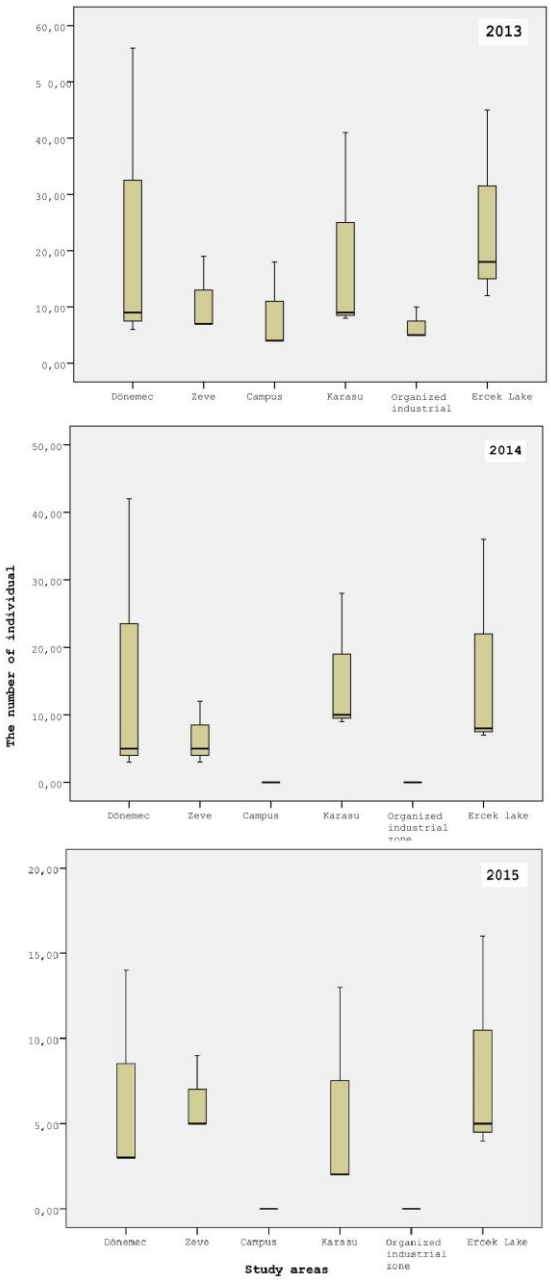

Figure 3. Quantitative assessment of Sand martin, European bee-eater and European roller populations in the study areas in 2013-2015.

During the study period any dead individuals of *Riparia riparia, Merops apiaster* and *Coracias garrulus* were observed along the 85 kilometers long highway that we research. But detailed studies are necessary to determine effects of traffic noise and mortality.

Based on our results we suggest that highway reconstruction and restoration activities affects birds

directly. Although all species aren't equally affected by roads, new environment along the roadside provide a momentary disadvantage to species whose population and number of nest decreased significantly near the new road. It is obviously that road-related threats to bird populations deserve more attention. Therefore, there is an urgent need for well-designed studies of road effects on bird populations, which can be used to support decision-making during road construction planning.

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