

Investigation of the Distribution of Two Dove Species (*Spilopelia senegalensis* and *Streptopelia decaocto*) with Similar Ecological Characteristics; The Case of Antalya, Türkiye

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Abstract: This study was conducted between 2018 and 2019 to determine the distribution and bioecology of the Eurasian Collared Dove (*Streptopelia decaocto*) and the Laughing Dove (*Spilopelia senegalensis*) in Antalya, Türkiye. All districts of Antalya were surveyed and observed over a two-year period. Observations were analysed across four regions: north, east, west, and central districts. Both dove species were found in every district of Antalya. While *S. decaocto* was more abundant in the western districts (*S. decaocto*: 46.88±48.93; *S. senegalensis*: 11.05±14.00), *S. senegalensis* had higher numbers in the central (*S. senegalensis*: 654.17±570.56; *S. decaocto*: 46.88±48.91) and eastern districts (*S. senegalensis*: 42.05±25.09; *S. decaocto*: 18.10±23.05). A comparison between the initial observations in 2018 and the final ones in 2019 (*S. senegalensis*: 74.1% → 90.3%; *S. decaocto*: 29.9% → 9.7%) suggests that the population of *S. senegalensis* is expanding more rapidly than that of *S. decaocto*. The decline of *S. decaocto*, a resident species of Antalya, in areas where *S. senegalensis* is spreading suggests possible competitive displacement between the two species.

Key words: City birds, Doves, Invasive birds, Populations dynamics, *Streptopelia decaocto*, *Spilopelia senegalensis*

1. Introduction

The laughing dove (*Spilopelia senegalensis*) is smaller than the Eurasian Collared dove (*Streptopelia decaocto*). It has a reddish-brown head and neck, a white abdomen and undertail feathers, and a distinctive, black-spotted band across the front of the neck and breast. The back is dark reddish-brown, while the upper tail is grey. The tips of the outer wing coverts are bluish grey. Additionally, its eye rings and feet are red [9], (Figure 1a). The current distribution of *S. senegalensis* extends from sub-Saharan Africa to the Middle East, Central Asia, India and Australia. In the 19th century, this species was found only in a few cities in Türkiye, such as İstanbul, and as well as in the Levant, including Gaza, Jerusalem, Jericho, Damascus, Homs, and Aleppo [8]. Historical records indicate that *S. senegalensis* was observed in İstanbul's Sultanahmet district on April 23, 1966, and in Antalya's Muratpaşa district on May 5, 1994 [6]. Today, it is present in all regions of Türkiye [9].

Eurasian Collared dove (*Streptopelia decaocto*) has a bluish, light grey in appearance. A characteristic half-moon-shaped black band is present on the nape. Its dorsal and lateral

plumage is powder brown, while the upper tail coverts are grey [9] (Figure 1b). This species is considered invasive in many regions [10], [12].



Figure 1. Appearance of the observed species a) *S. senegalensis*, b) *S. decaocto*

S. decaocto was historically found in Asia until the 16th century, with its range extending east of the Levant, to India, Sri Lanka and Myanmar, and possibly Afghanistan [4]. The first recorded observations of this species in Türkiye were in Hatay, one of the southern provinces, in 1881 (January) and in Kalkan, Kaş, and Muratpaşa districts of Antalya in 1982 (August and September). This species has even been reported in North America [11], [6].

Today, both dove species are considered native to Türkiye [9]. They are commonly observed either in pairs or in large flocks. Neither species prefers forested or densely vegetated wild areas [11]. *S. senegalensis* is highly adaptable to human settlements, whereas *S. decaocto* tends to be more cautious around humans, favouring agricultural areas, suburban environments, and roadsides [5], [2].

This study aims to determine the population sizes (number of individuals) of *S. decaocto*, first recorded in the Antalya region in 1982, and *S. senegalensis*, first recorded in 1994, over time. Based on the results, the interaction between these two species and their habitat preferences, given that they share similar environments, was analysed.

2. Material and Method

This study was conducted in Antalya province, located in southwestern Türkiye, with two dove species, *S. senegalensis* and *S. decaocto*, serving as the study material. Antalya, consisting of 19 districts (positioned between 29° 20'–32° 35' east longitude and 36° 07'–37° 29' north latitude), has mild, rainy winters and hot, dry summers. Twelve of the 19 districts are coastal, while seven are located inland at higher elevations. These districts were grouped into four regions (central, northern, eastern, and western) based on their geographic location.

Central districts: Muratpaşa, Konyaaltı, Kepez

Northern districts: Gündoğmuş, İbradı, Akseki, Döşemealtı, Korkuteli, Elmalı

Eastern districts: Aksu, Serik, Manavgat, Alanya, Gazipaşa

Western districts: Kas, Demre, Finike, Kumluca, Kemer

Each district was visited eight times over two years (2018–2019), resulting in a total of 152 visits. To determine the presence and population size of doves in the districts, two counting methods were used:

1. Point count method – Observations were conducted at 47 designated points, where counts were recorded over 15-minute periods.
2. Line transect method – Observers continued counting while walking along predefined transect lines, and photographs were taken to document the doves.

Prior to the study, a literature review and preliminary observations were conducted to identify suitable habitats for both dove species [18]. Based on this information, observation points were selected. These included areas with dense human populations, locations near food shops, backyards with poultry houses, and sites where large groups of doves were frequently observed. The species' distribution averages were calculated along with their standard errors.

The data from the initial and final observations of the species were compared to assess potential interactions between them [15]. Descriptive statistics were presented with mean, standard deviation, median, minimum, maximum, Q1, and Q3 values. The normality assumption was checked with the Shapiro-Wilk Test. Since the data did not conform to a normal distribution, the Mann-Whitney U Test was used to analyse the difference between the numerical data of the two groups. Analyses were performed with SPSS 23.0 software. $P < 0.05$ was considered statistically significant.

Furthermore, in each of the eight visits conducted in Antalya, the proportion of each species relative to the total number of individuals was calculated, allowing for a comparison of relative abundances.

During the field observations conducted in 19 different urban and rural areas at different time periods, the presence data of both dove species, as well as their food sources, habitat and nest site preferences, and interactions with other species, were also observed.

3. Results

3.1. Observations regarding the presence data of both species

According to the data obtained, both species continued to presence throughout Antalya (Figure 2). In a total of 152 visits to 19 districts in two years, *S. senegalensis* was detected more frequently (Figure 3). While *S. senegalensis* was not found in 7 districts during our first visits, it was found that this species was absent in only one district during our last visits. The average of the two years was 122.05 ± 321.9 individuals for *S. senegalensis* and 27.16 ± 33.91 individuals for *S. decaocto* in all Antalya.

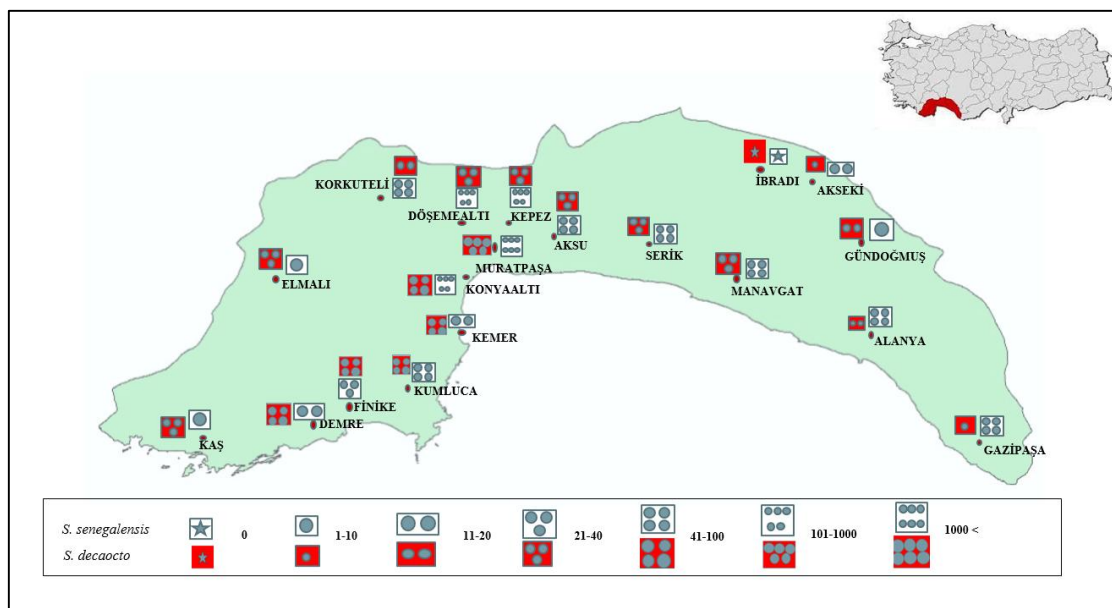


Figure 2. Distribution map of *S. senegalensis* and *S. decaocto* in Antalya

In the centre districts visited, the number of *S. senegalensis* was higher than the other (*S. senegalensis*; 654.17 ± 570.56 - *S. decaocto*; 46.88 ± 48.91) (Table 1).

In the eastern districts the average number of *S. senegalensis* was higher than other dove (*S. senegalensis*; 42.05 ± 25.09 ; *S. decaocto*: 18.10 ± 23.05) (Table 1).

There were 48 visits to the districts in the north of Antalya and *S. senegalensis* and *S. decaocto* showed similar averages (*S. senegalensis*; 15.17 ± 27.02 ; *S. decaocto*; 15.60 ± 32.98) (Table 1). However, in Döşemealtı, the number of *S. senegalensis* was higher than the other dove (*S. senegalensis*; 58.88 ± 41.13 individuals - *S. decaocto*; 28.88 ± 20.31 individuals).

In the western districts (40 visits), the averages were 46.88 ± 48.93 for *S. decaocto* and 11.05 ± 14.00 for *S. senegalensis* (Table 1).

Table 1. Average numbers of *S. senegalensis* and *S. decaocto* observed in all districts in 2018-2019

| Districts | N | <i>S. senegalensis</i> | <i>S. decaocto</i> | Population of districts* | Population of districts (%) |
|-----------|----|------------------------|--------------------|--------------------------|-----------------------------|
| Centre | 3 | 654.17 ± 570.56 | 46.88 ± 48.91 | 1.233.033 | 49,94 |
| Northern | 6 | 15.17 ± 27.02 | 15.60 ± 32.98 | 182.955 | 7,41 |
| Western | 5 | 11.05 ± 14.00 | 46.88 ± 48.93 | 247.890 | 10,04 |
| Eastern | 5 | 42.05 ± 25.09 | 18.10 ± 23.05 | 805.397 | 32,62 |
| Total | 19 | 122.05 ± 321.91 | 27.16 ± 33.91 | 2.469.028 | 100 |

N: Number of districts.

*: Average human population of districts and Antalya in 2018-2019 [1]

When Table 1 is examined, a different trend is observed only in the western region. The analysis of all visits to the districts in this region is presented in Figure 4. Accordingly, an increase in the number of *S. senegalensis* and a decrease in *S. decaocto* were observed.

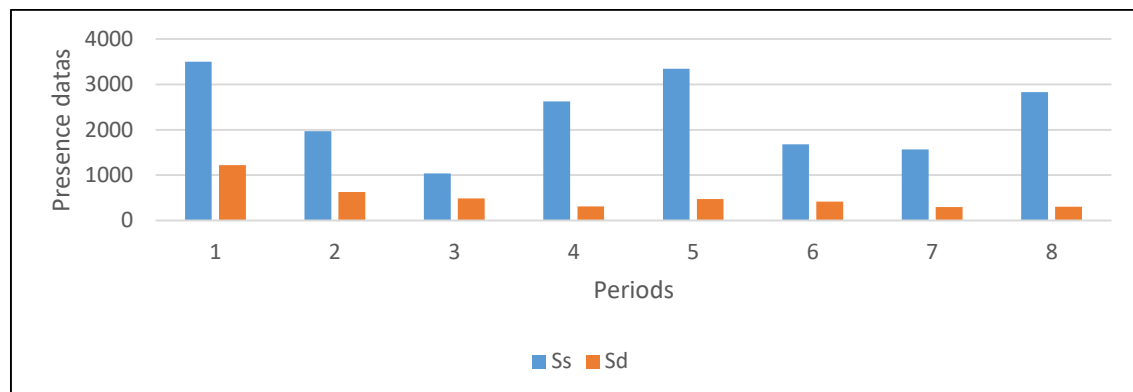


Figure 3. Observed presence data of both species across **Antalya** (blue colour: *S. senegalensis* (Ss), orange colour: *S. decaocto* (Sd))

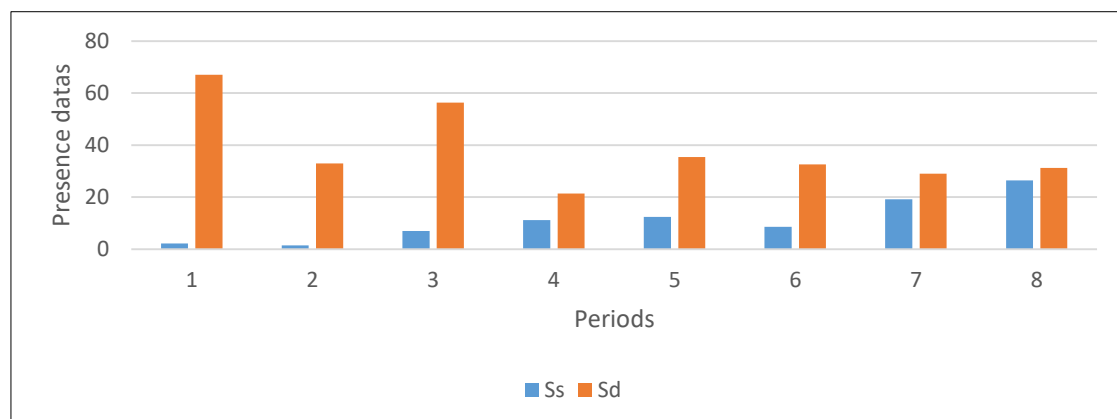


Figure 4. Observed presence data of both species in **western districts** of Antalya (blue colour: *S. senegalensis* (Ss), orange colour: *S. decaocto* (Sd))

It was observed that the number of *S. senegalensis* increased from the first visit to the last visit in the districts where it was initially present, and that it was also detected in some districts where it had not been recorded before. When the data of both species detected during the observations were compared proportionally, it was become clear whether the species affected each other or not. In some areas, the increase in the number of *S. senegalensis* negatively affected *S. decaocto* (Figure 5). A similar result was found when the presence data of *S. decaocto* and *S. senegalensis* were tested based on the first and last observations of the study for both species (Table 2) [15]. According to Table 2; when the numbers of *S. senegalensis* and *S. decaocto* were compared during the first visits in 2018, no statistical difference was found ($p>0.05$). In the last visits in 2019, a statistical difference was found between the numbers of the two species ($p<0.05$).

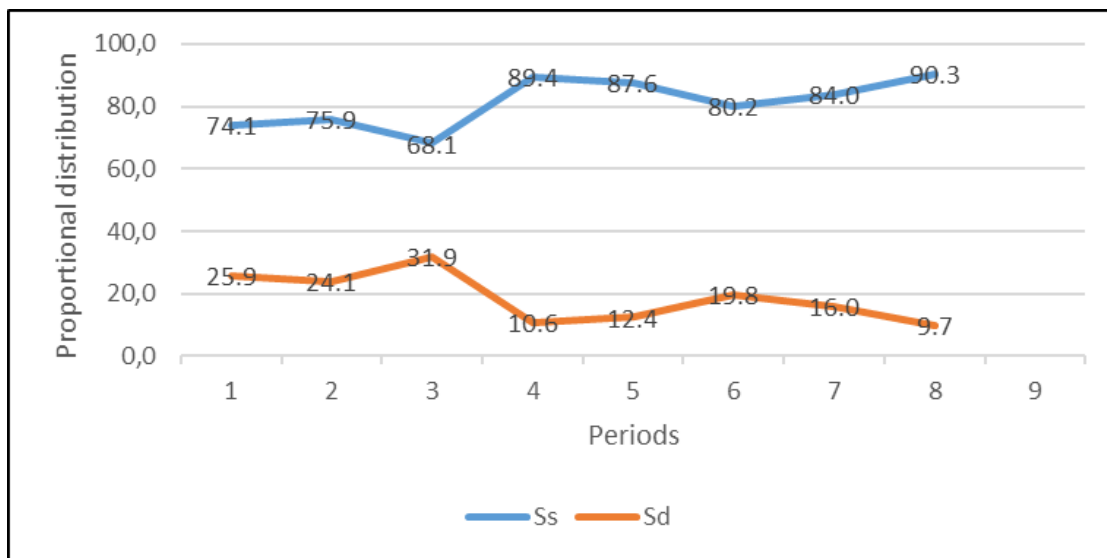


Figure 5. Proportional distribution of *S. senegalensis* (Ss) and *S. decaocto* (Sd) in two years

Table 2. Statistical comparison of presence data of *S. senegalensis* (Ss) and *S. decaocto* (Sd) dove [15]

| | Group | n | Mean + SD (Min-Max) | Median (Q1-Q3) | p |
|-------------------------|-------|----|-----------------------|----------------|-------|
| 2018, first observation | Ss | 19 | 184.32±535.62(0-2296) | 9(0-31) | 0.08 |
| | Sd | 19 | 64.37±67.30(0-218) | 45(5-108) | |
| 2019, last observation | Ss | 19 | 149.11±290.45(0-1104) | 32(8-85) | 0.032 |
| | Sd | 19 | 15.95±15.50(0-59) | 11(3-25) | |

Mann Whitney U test was used. SD: Standard Deviations, Q1: 25th percentiles and Q3:75th percentiles

3.2. Behaviours of feeding, habitat and nest site preferences:

Long-term observations conducted in the Antalya province have clearly demonstrated that *S. senegalensis* (Laughing Dove) and *S. decaocto* (Eurasian Collared Dove) prefer similar habitats. Particularly, urban areas, parks, orchards, feed depots, farms, and similar places with intense human influence have been identified as ideal habitats for both species. However, *S. decaocto* avoids living as closely with human settlements as *S.*

senegalensis. This leads *S. decaocto* to concentrate more in the peripheral areas of urban regions and in rural areas.

The dietary preferences of both species include seeds, grains, and small fruits [17]. *S. senegalensis*'s tendency to live closely with humans allows it to have easier access to human-derived food sources (garbage edges, bagel shops, bakeries, feed depots, etc.) [17]. Food sources provided intentionally or unintentionally by humans facilitate the feeding of *S. senegalensis*. It has been observed that, in addition to *S. senegalensis*, *S. decaocto* also feeds on food items left intentionally or unintentionally by humans.

A study conducted in the Muratpaşa and Konyaaltı districts examined 161 nests of *S. senegalensis*. Among these, 32% were located on lighting fixtures, 23% in wall recesses, and 11% behind air conditioners. These were followed by nesting sites behind and on top of signs, in front of windows, and under shutters. The average height of the nests of *S. senegalensis* from the ground was calculated to be 4.21 ± 1.32 m, while the nests of *S. decaocto* were observed at higher levels. [16] (Figure 6).

Additionally, human presence served as a protective shield against predators. The benefits of finding food and safety from humans, along with a more frequent breeding cycle, provide *S. senegalensis* with a significant advantage in population growth. In contrast, *S. decaocto* exhibits a more cautious approach towards humans and other competitors compared to *S. senegalensis*. This limits *S. decaocto*'s access to human-derived food sources and the benefits of safety provided by humans. *S. decaocto*'s more shy behaviour causes this species to concentrate more in the peripheral areas of urban regions rather than the city centres.



Figure 6. Two examples of places where species incubate. a) *S. decaocto*, b) *S. senegalensis*

4. Conclusion

S. senegalensis, which is observed more frequently than *S. decaocto* in Antalya province, was found more frequently in old settlements and places with dense human population [16;18]. According to the 2018-2019 census, the population of the center districts is 49.94% of the Antalya population, while the population of the eastern districts is 32.62% (Table 1) [14]. This supports our thesis that *S. senegalensis* prefer to live close to humans [7]. It also suggests that the region where the species first reached Antalya was the center and eastern districts [6]. Similarly, *S. decaocto* was observed more in the western districts and Kaş district, where it was first recorded in Antalya, is located in this region [6]. Another point to be noted is that the western districts of Finike, Demre and Kumluca are agricultural districts. Agricultural areas are one of the preferred habitats of *S. decaocto* [5; 2; 3]. The fact that Kaş and Kemer are touristic districts causes the human population to be dense in summer and sparse in winter. In all districts in the west, *S. senegalensis* was found in lower numbers than *S. decaocto*.

The northern districts of Antalya, which are higher than sea level and have a continental climate, are the districts where the numbers of *S. decaocto* and *S. senegalensis* are close to each other. A different situation was observed in Döşemealtı, one of the northern districts. It is thought to be because the Döşemealtı district is closer to the districts of Konyaaltı, Kepez, and Muratpaşa.

According to the visits made in two years, while the number of *S. senegalensis* increased throughout Antalya, the number of *S. decaocto* decreased towards the end of the second year. When the data between the two species were compared proportionally (Figure 5), it was determined that the data regarding the presence of the two species in the same environment showed an inverse graph. A decrease in the number of *S. decaocto* was observed. It can be thought that this decrease may be due to the other dove, but it can also be thought to be related to factors such as human impact. However, when the western region (especially the districts where tourism is intense) and the central districts where the human population is dense are examined, it was seen that the number of *S. decaocto* was high in areas where the number of *S. senegalensis* was low.

As a result, these two species, which have similar ecological characteristics, can be found everywhere in Antalya. The only difference between them is that *S. senegalensis* can live closer to humans than another dove. While this is a positive advantage for *S. senegalensis*, it may turn into a disadvantage for another dove and may cause *S. decaocto* to migrate from areas with high populations of *S. senegalensis*. As noted in one study, *S. decaocto* (Eurasian collared dove) is an urban resident, but *S. senegalensis* (Laughing dove) is an urban user [13].

Authorship contribution statement

N. Yapıcı: Conceptualization, Resource/Material/Instrument, Original Draft Writing, Data Curation, Review and Editing, Project Administration, Formal Analysis, Visualization; **A. Erdoğan:** Methodology, Supervision/Observation/Advice, Resource/Material/Instrument, Review and Editing

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethics Committee Approval and/or Informed Consent Information

As the authors of this study, we declare that we do not have any ethics committee approval and/or informed consent statement.

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