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Seasonal changes in the spatial distribution of feral pigeons (Columba livia) in Albany Port

Kaiwen Liu

University of Western Australia

ABSTRACT

Seasonal changes in the spatial distribution of feral pigeons (Columba livia) in Albany Port were studied, focusing on two key periods: late summer/early fall (March 15 to April 5) and winter (July 21 to August 11). Thirty-one remote time-lapse cameras deployed in eight zones were used to measure the distribution of feral pigeon activity throughout the port. The results showed that the pigeons were active in March-April and distributed in most areas of the port. In addition, feral pigeon activity in some areas increases significantly during the winter, probably due to the availability of resources and shelters during the winter in these areas. The findings partially support the hypothesis that pigeons are more active during warmer months, but also reveal that feral pigeons adapt to harsh conditions by migrating to safer habitats during the winter. Other evidence also confirms that pigeons' activity preferences are not limited to seasonal changes, but depend more on their habits and habitat conditions. The results showed that the seasonal variation of feral pigeon distribution and its preference for specific areas should be understood on the basis of field survey results, and the importance of adaptive and region-specific feral pigeon control strategies should be emphasized.

KEYWORDS

Columba livia; Control; Pigeon; Reduction; OvoControl

1 Introduction

Feral pigeons are currently one of the most common free living bird species in cities with a global population around between 165 and 330 million individuals. Associated with 100 pathogenic microorganisms and 18 ectoparasites, these pigeons pose potential hazards to human health, especially to immunocompromised people; their droppings, acidic and bacteria-ridden, can lead to the destruction of buildings; their incessant growth also threaten the survival of native species.(Burt et al., 2018, Farfán Aguilar et al., 2022). Trapping, culling and usage of repellents could temporarily reduce the pigeon number, but rebound had been quick. (Stock B et al., 2013). And these exclusion methods have raised also the issue of animal welfare. Reproductive control of feral pigeons, through the use of contraceptives such as OvoControl, is becoming a more humane and long-term means of feral pigeon control. Studies have shown that pigeons adapt their behavior mode and population density to environmental factors such as temperature, food availability, and shelter (Rose et al., 2004), so an understanding of the seasonal and spatial distribution patterns of pigeon populations will aide in selections of control strategies. To understand feral pigeon conditions in this unique port environment, this study investigated seasonal changes in the spatial distribution of feral pigeons within Albany Port. By deploying cameras at different times to capture feral pigeon movements, changes in feral pigeon activity in different areas of the port were analyzed. This information is

essential for implementing plans and developing effective control strategies.

2 Materials and methods

2.1 Study area

Figure 1 Albany Port camera location area map

The study was conducted in the Port of Albany, a large port in southern Western Australia, which is a non-major port on the Australian maritime route, mainly exporting agricultural products and having a tourism role, which provide potential habitat and activity conditions for feral pigeons. Human activities and resource conditions in different areas of the port are key factors affecting the distribution of feral pigeons. For the purposes of this study, the port was divided into several survey areas, labeled B, C, D, E, F, G, H, and I. The division of areas represents the different operating areas within the port. Green represents potential feeding sites and yellow represents hot spots where feral pigeons are distributed.

2.2 Data collection

To collect data on feral pigeon distribution in the Port of Albany, we deployed remote time-lapse cameras at eight key locations in the port area. Reported pigeon abundance "hot spots" and potential sites for future feeding stations were selected as the basis for key site selection. A total of 31 cameras were deployed to capture a more comprehensive picture of pigeon behaviour and activity in the harbour. Each camera uses a program for shooting images at 15-minute intervals. Pre-set time intervals allow continuous monitoring of flock presence on a daily basis without human intervention.

The cameras were selected for 19-21 consecutive days in two seasonal periods, from March 15 to April 5 and from July 21 to August 11. Long-term continuous data is ensured to obtain the movement patterns of wild pigeons. Data collection was manually reviewed using images taken by cameras, recording the number of pigeons appearing in each frame. Cameras that fail to capture adequate data are excluded from data analysis, and pictures that do not contain pigeons are excluded from the dataset to ensure data integrity and accuracy.

2.3 Data analysis

Analysis of the data involved assessing the spatial distribution of pigeon activity across different study sites. This was achieved by grouping data on feral pigeon populations by location and calculating the total number of pigeons in each area during the two study periods. The goal was to determine the level of pigeon activity in the study area and whether these patterns were consistent across seasons. For each site, pigeon populations were compared between March and April with those between July and August to determine if there were significant seasonal differences in pigeon activity.

A bar chart was used to show feral pigeon abundance in each key area during the two study periods, allowing a clear comparison of feral pigeon activity levels between seasons. The study data were analyzed on spatial and temporal trends, considering how pigeon behavior is affected by resource constraints and seasonal changes in environmental conditions, and integrating wild pigeon hot spots to gain insights into areas that may be more suitable for targeted pigeon control efforts.

3 Results

The results were analyzed by combining data on the number of feral pigeon activities in specific regions, taking into account the specific characteristics and functions of each region.

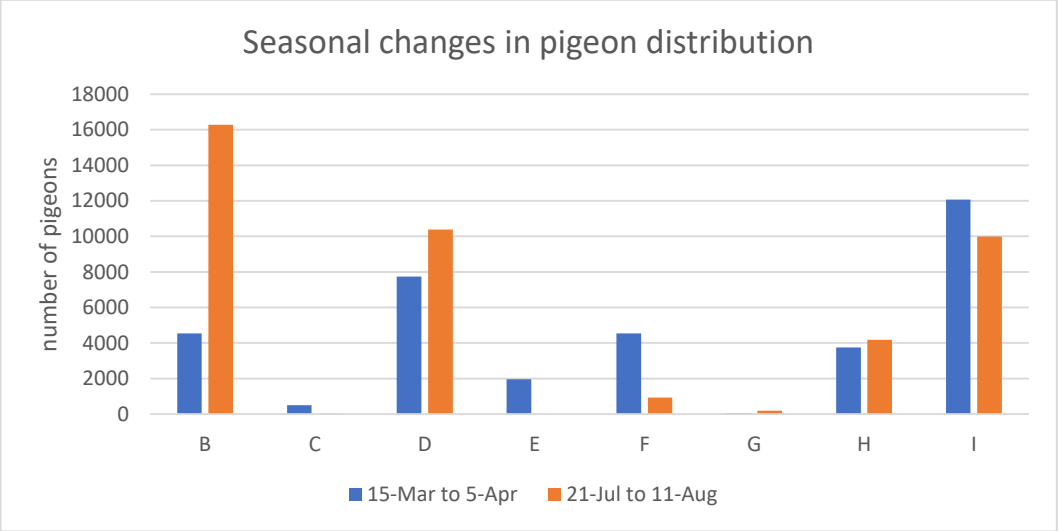

Figure 2 Seasonal changes in the regional distribution of feral pigeons at Albany Port

3.1 Seasonal pigeon distribution

Zone B: The main feral pigeon hotspot in winter, the pigeon population increases dramatically from about 5, 000 birds in March-April to nearly 16, 000 birds in July-August. This suggests that pigeons rely heavily on this area during the colder months.

Zone D: The second winter feral pigeon hot spot, with about 8,000 birds during March-April and increased activity in winter to more than 11,000 birds. The relatively stable growth indicates that the region was competitive in both seasons.

Zone F and H: These areas have high feral pigeon activity levels in March-April, followed by a significant decrease during the winter months. This decline suggests that feral pigeons avoid these

areas during the winter.

Zone I: Feral pigeon activity in Zone I is relatively stable, with numbers dropping slightly from around 12,000 birds in March-April to 10,000 birds in July-August. This pattern suggests that Zone I may not be as competitive in winter as it is in summer.

Zone C and G: These two areas have low pigeon populations throughout the year and are not the main areas for feral pigeon activity.

3.2 Key findings based on regional functionality

(1) Berths and open working Area (H, D)

In the berthing area, pigeon activity has always been high, and the number of pigeons in Zone D has increased significantly in winter, reaching more than 10,000. The increase of pigeon activity in this functional area in winter reflects adaptive behavior, because H and D are the main dock areas, and the dock area brings a lot of food resources to wild pigeons due to its high traffic volume, such as cargo leakage, garbage, artificial breeding and so on. Secondly, some port infrastructure can provide shelter for feral pigeons. Therefore, it is a key area of feral pigeon control.

(2) Grain Storage and Logistics Area (B)

The number of wild pigeons in Area B increases significantly in winter (July-August), reaching nearly 16,000, and is lower in March-April (about 5,000). This suggests that feral pigeon dependence on Zone B increases during the colder months. This trend suggests that Area B is a key area for feral pigeon activity, possibly due to the availability of Area B as a food storage transport route, which provides feral pigeons with the required food resources due to food spills or increased human activity resulting in food waste. In view of the potential for area B to become a breeding ground for feral pigeons in winter, Area B will become a key area for the control of feral pigeons in winter.

(3) Special Pigeon Colony Area (I)

The level of feral pigeon activity in Region I was relatively high and stable, and the number decreased slightly between the two seasons. There are two possibilities for this model. The first possibility is that Area I may not have provided enough food resources or shelter during the winter, but some feral pigeons remained there due to its warm season advantage. Another possibility is that Zone I is a transition zone where feral pigeons temporarily congregate as they move between zones.

(4) Processing Area (E, F)

These areas, which are associated with processing, logistics and transfer stations, have partial feral pigeon activity during the warm season and decrease to lower levels during the winter, suggesting that pigeons prefer areas with less foot traffic during the colder months. However, there are higher numbers of pigeons during warmer months, suggesting that pigeons are attracted to these areas during business hours, which may be due to resources generated by cargo leaks.

(5) Secondary Areas (C, G)

Pigeon activity levels in these areas are very low, and feral pigeons tend to avoid Spaces that provide neither adequate food nor shelter.

4 Discussion

The main hypothesis of this study is that the spatial distribution of pigeons in Albany Harbor is affected by the seasons. The distribution of feral pigeons demonstrated by the experimental data supports this hypothesis, and the regional preference of feral pigeons is indeed changed by seasonal influences. Feral pigeons showed completely different regional distribution in the warm and cold seasons, but there was no increase or decrease in the overall activity level, indicating that the seasonal effect on pigeon distribution is regional.

The seasonal variation of the spatial distribution of feral pigeons in Albany Port was studied. The results support the hypothesis that the distribution of feral pigeon activity is influenced by the seasons, with relatively average regional activity in late summer and early autumn (March to April) and a clear shift to a few specific sheltered areas in winter (July to August). According to Rose et al , pigeon activity levels increase with favorable environmental conditions, such as higher temperatures (2006). This suggests that feral pigeons are more active during the warmer months and will be active in most areas.

Interestingly, the study found that the feral pigeon population in Area B showed an anti-seasonal increase in the winter, with the pigeon population increasing by more than three times. This trend challenges the norm, suggesting that certain feral pigeons gather in certain areas during the winter. The movement of activities to Zone B may be due to the better resources and shelter that the area offers in cold weather. Thus, pigeons in Port Albany show a similar pattern of congregating in several areas to seek shelter and resources during the winter, which is consistent with the findings of Senar et al (2016), who found that pigeons in Barcelona turn to areas with better environmental coverage during the cold season, where resource constraints such as food affect the distribution of pigeons' activities. This suggests that seasons do not entirely affect feral pigeon activity, that feral pigeon distribution also depends on region, and that feral pigeons experience the same winter increase in ports (areas H, D), which is consistent with Aguilar et al (2022), who observed that pigeons would concentrate in areas of human activity. Food resources brought by high human flow will be a key factor affecting the distribution of wild pigeons.

Depending on the impact of regional environmental characteristics and resources on feral pigeon ranges, this should actually lead to a significant reduction in feral pigeon populations in warm winter hot spots. But the activity in Zone I reflects the study of pigeon navigation by Guilford and Biro (2014). Their study found that pigeons prefer familiar environments and areas, and only adjust their routes under extreme environmental stress. This suggests that pigeons tend to return to familiar places even when environmental conditions are less favorable. This explains why Area I experiences a decrease in feral pigeons during the winter but remains a major hot spot. Because these areas provide shelter and resources for feral pigeons during the warm season, and because of the habits of feral pigeons, they become year-round gathering places. This situation demonstrates the importance of ongoing management interventions in key areas where resource availability management or concentrated population control can simplify the complex behaviour of feral pigeons and lead to targeted management strategies.

While the study provided data on the spatial distribution of feral pigeons, it also had some limitations. For one thing, weather can affect the sharpness of photos, reducing the accuracy of pigeon counts. Second, the study only documented two distinct periods, limiting our ability to capture seasonal changes in feral pigeon distribution throughout the year. Future studies could consider adding monitoring periods, such as spring and early summer, to get a more complete picture of pigeon activity levels throughout the year. In addition, feral pigeon activity may be influenced by factors other than seasonal variations, such as possible pigeon migration and changes in infrastructure function, which were not investigated and controlled for in this study. Aguilar et al (2022) suggest that feral pigeon management efforts should be coordinated with surrounding areas to reduce possible pigeon migration and ensure long-term success. Future research should explore the role of extreme weather patterns, limited food supply, and human behavior to develop more scientific and adaptable strategies for feral pigeon management.

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