

STRIKING A BALANCE BETWEEN EFFORT AND BENEFIT FOR BIRD DAMAGE CONTROL: CROW MANAGEMENT IN TOKYO, JAPAN

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Abstract Optimizing the efforts required for countermeasures against animal damage is an important issue in wildlife management. In Tokyo, the increase in the abundance of crows has led to many complaints from residents. As a result, in 2001, the Tokyo Metropolitan Government implemented a crow control project. This study aimed to analyze the number of crows and complaints associated with crows in Tokyo over a 20-year period, and to determine the relationship between control efforts and effectiveness in bird damage control. Although several thousand more crows were trapped each year after the start of the project, the number of trapped crows had only a small impact on population decline. In addition, as the project progressed, the impact of the decline in the crow population on the reduction in complaints became smaller. This analysis suggests that the benefits of bird damage control measures change over time. Further, it is important to evaluate and revise control methods that require a large effort or lack effectiveness.

Key words *Corvus macrorhynchos*, *Corvus corone*, urban landscape, human–wildlife conflict.

INTRODUCTION

As the world becomes increasingly urbanized, the urban environment creates novel challenges for wildlife owing to habitat loss, food scarcity, and increased human disturbance (e.g., pedestrian traffic, vehicular traffic, industrial noise) (Fernandez-Juricic and Jokimäki, 2001; Seress and Liker, 2015). As a result, the urban environment has excluded many wildlife species while providing favorable habitats for others, leading to their expansion into urban areas.

Because wild birds in urban areas often cause conflicts with humans, various countermeasures have been implemented to mitigate this. For example, there are methods to control populations by trapping and removal, and physically preventing intrusion and foraging by means of nets and lines (Blackwell et al., 2003; Honda, 2012). In addition, sound and visual stimuli have been used to deter wild birds and their effectiveness has been scientifically evaluated (Gorenzel et al., 2002; Mahjoub et al., 2015). These measures require human labor in their implementation, although digitalization is being promoted. To implement sustainable countermeasures against wild birds, it is necessary to evaluate the human effort involved in these control methods; however, this information is currently very limited.

Crows are one of the most common urban birds in Japan. The jungle crow *Corvus macrorhynchos* and carrion crow *C. corone* (hereafter referred to as crows), which breed in Japan, inhabit not only rural and suburban areas but are also observed in many urban areas (Higuchi 1979; Ueta et al., 2003). As with other urban birds, conflicts between crows and humans are often seen as problematic. For example, the scattering of garbage by crows at collection sites is common (Figure 1A), resulting in local governments receiving many complaints from residents (Kurosawa et al., 2003). In addition, crows cause damage to the human environment by nesting in power distribution poles and transmission towers causing electrical power outages (Figure 1B; McIvor et al. 2012; Shirai et al., 2020), attacking people during the breeding season (Kurosawa et al., 2003), and causing bird-dropping nuisance (Shirai and Sasano, 2020). These have become social problems in many parts of Japan.

The number of crows in Tokyo has rapidly increased since the 1980s, and garbage damage caused by these birds has been a social problem since the late 1990s (Ueta et al., 2003). As the number of complaints about crows reached 3,753 in 2001, the Tokyo Metropolitan Government established a team to start a crow control project (Okuyama, 2003). The project designed countermeasures to control the crow population, which are still being implemented, with a focus on crow population monitoring and trapping, and improved garbage management. The

purpose of this study was to investigate the relationship between the effort and benefits of bird management based on 20 years of data obtained from the Tokyo Metropolitan Government's crow control project.

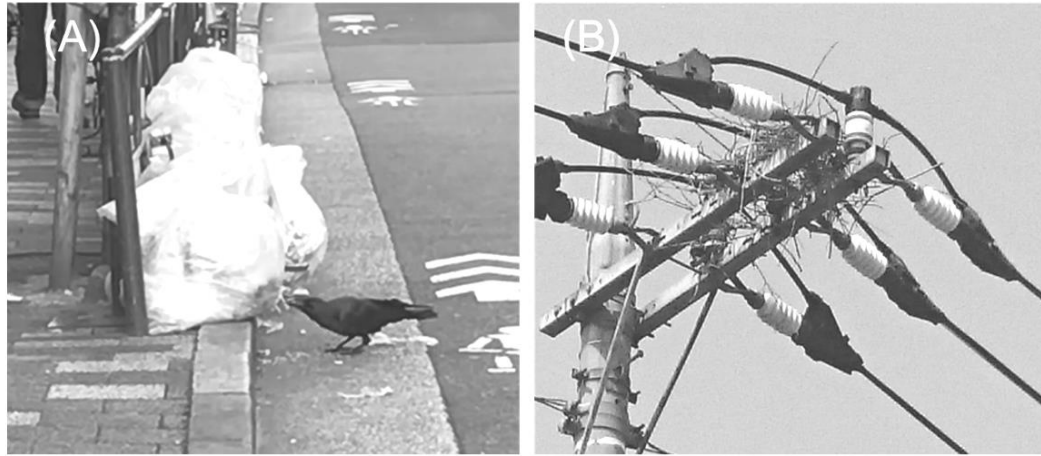


Figure 1 (A) Crows scattering garbage and (B) a crow's nest on a utility pole

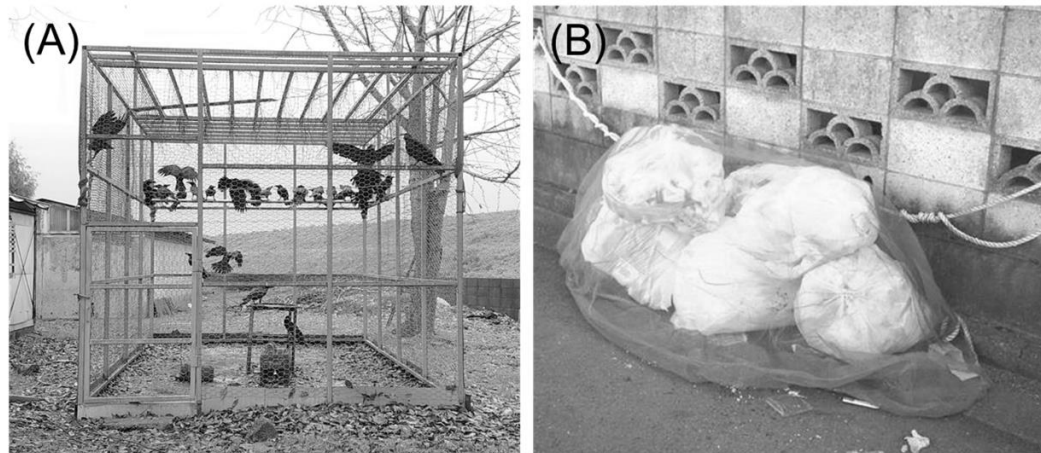


Figure 2 (A) Box trap used for capturing crows and (B) net covering used for garbage management

MATERIALS AND METHODS

Crow control project in Tokyo. In Tokyo, the main measures taken against crows are: (1) trapping and nest removal; and (2) waste management. Box traps, a safe and effective method of capturing crows, are set up in parks and other public facilities near crow roosting sites, and food is placed inside the traps to attract crows (Figure 2A). In addition, nests are removed during the breeding season (April–June) to prevent reproduction by crows.

Local governments in Tokyo have improved the management of waste, which is a food resource for crows. There are approximately 270,000 garbage disposal spots in central Tokyo and 100,000 in suburban areas. Nylon and wire nets, and other similar items, have been used as tools to prevent crows causing damage at garbage disposal spots (Figure 2B). Announcements are being made to local residents regarding food waste reduction.

Data collected by the crow control project. The Tokyo Metropolitan Government has published data on the crow population, number of crows trapped, and number of complaints related to crows every year since the start of the crow control project (Tokyo Metropolitan Government 2021). The crow population size is calculated by counting the number of individuals at approximately 40 locations, such as their roosts in Tokyo during winter. The number of crows trapped in Tokyo can be determined from the permission paperwork needed to trap crows. In addition, the Tokyo Metropolitan Government receives complaints about crows damaging plastic garbage bags and scattering the contents, and the occurrence of bird-dropping nuisance. The annual number of complaints is also available as part of the monitoring data.

Data Analysis. I analyzed the monitoring data of the crow population, number of trapped crows, and annual number of crow-related complaints from residents published by the Tokyo Metropolitan Government (Tokyo Metropolitan Government, 2021) (Figure 3). In addition, the increase or decrease in the crow population were calculated by subtracting the population of the current year from the population of the following year. The datasets for the first (2001–2010) and second (2011–2020) decades of the crow control project were analyzed separately.

Multiple linear regression analyses were used to examine the relationships between: (1) the abundance of crows and the number of trapped crows; (2) the number of trapped crows and the increase or decrease in the population; and (3) the crow population and the number of complaints received from residents. The first and second decades of the project were treated as categorical variables and were included in the multiple linear regression analyses. An interaction term was included in all analyses.

RESULTS AND DISCUSSION

There was a significant correlation between the crow population and the number of crows trapped ($t = 5.98$, $P < 0.001$), except for the first two years of the project, where the slope was equal to 0.83 (95CI: 0.53–1.12) (Figure 4). Thus, the annual number of trapped crows corresponded to 83% of the population. However, the number of trapped crows in the current year did not significantly influence the increase or decrease of the population in the following year ($t = -0.76$, $P = 0.46$), although the slope was negative (-0.13 , 95CI: -0.52 – 0.24) (Figure 5).

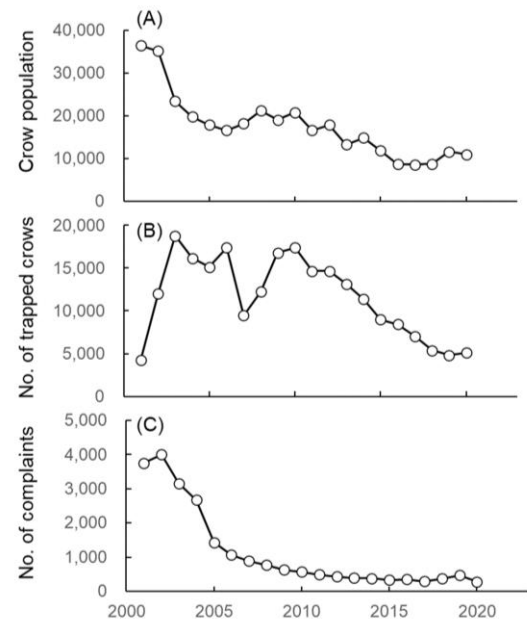


Figure 3. Annual changes in (A) the abundance of crows, (B) the number of trapped crows, and (C) the number of complaints in relation to crows in Tokyo

the increase or decrease of the population in the following year ($t = -0.76$, $P = 0.46$), although the slope was negative (-0.13 , 95CI: -0.52 – 0.24) (Figure 5).

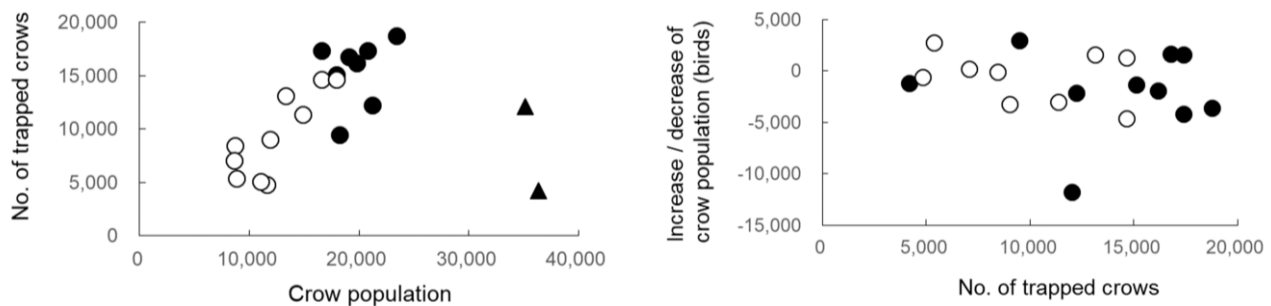


Figure 4. Number of trapped crows in relation to the crow population in Tokyo. Solid and open circles represent the data of the first (2001–2010) and the second decades (2011–2020) of the crow control project, respectively. Data for the first two years (2001 and 2002; triangles) were removed from linear regression analysis because they were insignificant outliers.

Figure 5. Change in the crow population in relation to the number of trapped crows in Tokyo. Solid and open circles represent the data of the first (2001–2010) and the second decades (2011–2020) of the crow control project, respectively.

The extermination of crows using traps is commonly used as a population control measure; however, it is known that many of the individuals captured by this method are inexperienced young birds (Tamada and Fukamatsu, 1992). Of the crows captured in Tokyo, 56% from the suburban area and 79% from the city center were juveniles captured mainly during autumn, immediately after fledging (Yoshihara et al., 2015). Relatively large numbers of crows

die of natural causes during the poor food availability seasons of winter and early spring (Matsuda, 2005), and it can be assumed that the capture of juvenile crows involves individuals that are likely to die. This may explain the relationship between the number of trapped crows and the increase or decrease in the population in this study. Therefore, I suggest that the direct approach of trapping contributes only slightly to the reduction of the crow population, which implies that indirect approaches, such as the management of food resources, are the main contributors to the decline in the crow population of Tokyo.

Although the decrease in the crow population of Tokyo was significantly correlated with a decrease in the number of complaints ($t = 5.69$, $P < 0.001$), the relationship changed between the first and subsequent phases of the project (interaction: $t = 2.21$, $P = 0.042$). This indicates the rate of decline in the number of complaints decreased in relation to the change in the crow population (Figure 6). The number of complaints has remained stable since 2011, fluctuating between 288 and 491 per year. Crows generally use roosts in groups, and their range of activity extends around these roosts (Morishita et al., 2003). Although the number of crows using roosts has decreased, roosting sites such as the Meiji Shrine, Toshimagaoka Cemetery are still maintained (Karasawa et al., 2016). Considering that the crow population of Tokyo numbers more than 10,000 birds (Figure 3A), it is possible that the trouble near the roosts continues.

The results of this study highlight the importance of evaluating and revising the methods used for continuous bird damage control. Population control of birds by trapping, which was only marginally effective in this study, generally requires specialized knowledge and experience. However, garbage management is easier to implement, and the difficulties differ greatly from those of trapping. Therefore, even if the effects of the two tasks were the same, waste management may be a more effective long-term strategy because it is less labor intensive. In the early stages of the project, changes in the crow population corresponded to changes in complaints, which was a useful indicator for determining effectiveness. However, as the project progressed, the relationship between the crow population and complaints weakened, indicating that different indicators and approaches are required to further reduce complaints. As the world enters an era of declining human populations, it will be necessary to consider the ratio between effort and effectiveness of total bird damage controls, as well as the effects of countermeasures alone.

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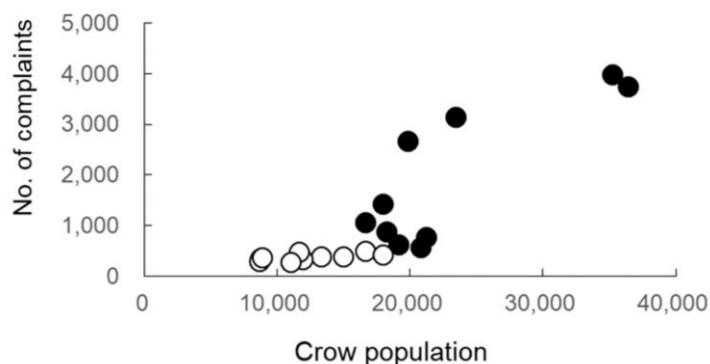


Figure 6. Number of complaints about crows in relation to the crow population in Tokyo. Solid and open circles represent data of the first (2001-2010) and the second decades (2011-2020) of the crow control project, respectively.

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