# The Occurrence, Distribution and Relative Abundance of Exotic Starlings and Mynas in Taiwan

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## Abstract

Based on the databases of 1993-1999 provided by the Wild Bird Federation Taiwan and the Taiwan Endemic Species Research Institute, there were 10 exotic species of starlings and mynas belonging to the family Sturnidae in Taiwan. *Acridotheres javanicus* and *Acridotheres tristis* were the most common exotic species; each occurred in 36% of the total number of administrative units (towns, townships and districts) of the island. They were followed by *Acridotheres fuscus* and *Sturnus nigricollis*. The other six species were rare. They were *Acridotheres albocinctus*, *Acridotheres ginginianus*, *Sturnus burmannicus*, *Sturnus contra*, *Aplonis panayensis* and *Gracula religiosa*. Each of these species was found in less than 10% of the number of the administrative units. All exotic species were distributed primarily in lowlands, peripheral hills and mountains at elevations less than 500m.

**Key words**: exotic species, Sturnidae, distribution, Taiwan
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## Introduction

An exotic species is an alien species or lower taxon occurring outside of its natural or potential dispersal range, after being introduced directly or indirectly by man (IUCN/SSC Invasive Species Specialist Group 2000). The introduction of exotic species is one of the major causes for extinction of many native species throughout the world (Primack 1993; Hunter 1996; Foin *et al*. 1998). Starlings and mynas of the family Sturnidae are the birds of wide dispersion due to human introduction. Some species was introduced as pet animals, because they imitate human speech, while the others were for insect pest controls (Long 1984; Lever 1987). Consequently, starlings and mynas have been found in many parts of the world where they were previously absent. At least six species have been known to establish their breeding populations successfully outside their native ranges. They are *Acridotheres javanicus*, *Acridotheres tristis*, *Acridotheres fuscus*, *Acridotheres cristatellus*, *Gracula religiosa*, and

*Sturnus vulgaris* (Long 1984; Lever 1987; Feare *et al*. 1998).

Some species of exotic starlings and mynas have become pest animals in many countries, adversely affecting their environments and native bird populations. In Singapore noise and droppings of noctournal communal roosting flocks of *A. tristis* and *A. javanicus* annoyed the nearby residents (Kang 1989). In Nevada *S. vulgaris* displaced native birds from cottonwood sites (Weitzel 1988), while in Arizona this exotic species took over nest sites of many species of native woodpeckers (Kerpez and Smith 1990). In Australia *A. tristis* and *S. vulgaris* dominated the uses of available nest sites of two native hollow-nesting parrots (Pell and Tidemann 1997). In Seychelles there were instances of direct predation and interference of *A. tristis* on endemic *Copsychus sechellarum* (Watson *et al.* 1992; Komdeur 1996). In Hawaiis diseases transmitted by *A. tristis* caused the decline or extinction of many endemic species of birds (Warner 1968).

Severinghaus (1999) identified 75 exotic species of birds in Taiwan in 1994 to1999, while the number of the resident species during the same period was 154. In other words, about 30% of the birds in Taiwan were not the species of native residences but the species of foreign origins. Among these exotic species reported, 11 species were starlings and mynas of the family Sturnidae. Up to date there was very little information available on the biology of these exotic birds on the island (Lee *et al*. 1996; Severinghaus 1999). This study was intended to provide the current status of distribution and relative abundance of exotic starlings and mynas in Taiwan.

## Materials and Methods

The study areas consisted of the Taiwan Island and its adjacent small islands: the Penghu Archipelago, the Green Island, the Orchid Island and the Hsiaoliuchiu Island. Data on species, dates, locations and numbers of starlings and mynas observed were obtained from the bird inventory survey data (July 1993 to June 1999) of the Taiwan Endemic Species Research Institute (TESRI), and the bird database (July 1994 to June 1999) and the exotic bird database (October 1994 to August 1999) of the Wild Bird Federation Taiwan (WBFT).

Because the databases obtained did not provide detailed information on locations of birds recorded, I used 361 administrative units (towns, townships and districts) of Taiwan to determine the locations of their occurrences. In each unit the largest number of birds recorded for a species was used to represent the relative abundance of that particular species in that particular unit. The abundance were divided into five levels: the largest number of birds observed$\leq$ 5, 6-20, 21-50, 51-200 and > 200. Elevations at where the birds were observed were divided into four levels: $\leq$ 200m, 201-500m, 501-1,000m, and >1,000m.

## Results

According to the three databases of TESRI and WBFT, there were 10 exotic species of starlings and mynas belonging to the family Sturnidae in Taiwan (Table 1). Their native ranges are in the tropical regions of South Asia, Southeast Asia and southern China (Table 2). Apparently, they were recently introduced as pet

**Table 1.** Total numbers of records and birds of the 10 exotic species of the starlings and mynas in Taiwan based on the bird databases of the Wild Bird Federation Taiwan July 1994-June 1999 and the Taiwan Endemic Species Research Institute July 1993-August 1999

| Species | Total records (%) | Total birds (%) |
|---|---|---|
| *Acridotheres javanicus* | 1900(38.7) | 22985(56.1) |
| *Acridotheres tristis* | 2389(48.7) | 15050(36.8) |
| *Acridotheres fuscus* | 238(4.9) | 1911(4.7) |
| *Acridotheres albocinctus* | 10(0.2) | 29(>0.1) |
| *Acridotheres ginginianus* | 3(>0.1) | 8(>0.1) |
| *Sturnus nigricollis* | 286(5.8) | 732(1.8) |
| *Sturnus burmannicus* | 13(0.3) | 18(>0.1) |
| *Sturnus contra* | 3(>0.1) | 7(>0.1) |
| *Gracula religiosa* | 44(0.9) | 73(0.2) |
| *Aplonis panayensis* | 30(0.6) | 134(0.3) |
| Total | 4916 (100) | 40947 (100) |

**Table 2.** The native ranges of the 10 exotic starlings and mynas in Taiwan

| Species | Native ranges* |
|---|---|
| *Acridotheres javanicus* | Java and Bali |
| *Acridotheres tristis* | Iran, Pakistan, India, Burma, southern China, Thailand, Indochina and Malaysia |
| *Acridotheres fuscus* | Pakistan, India, Burma and central Malaysia |
| *Acridotheres albocinctus* | Northeast India, northern Burma and southern China |
| *Acridotheres ginginianus* | Northern and central India, Bangladesh, Nepal and eastern Pakistan |
| *Sturnus nigricollis* | Southern China, Burma, Indochina and Thailand |
| *Sturnus burmannicus* | Burma, Thailand and Indochina |
| *Sturnus contra* | Pakistan, northern India, Burma, Thailand, southern China (Yunnan), Malaysia and western Indonesia |
| *Gracula religiosa* | Northern India, southern China, Indochina, Thailand, Malaysia, Indonesia east to Alor, Palawan (Philippines) |
| *Aplonis panayensis* | Western Burma, Assam, southern Indochina, Philippines and Indonesia |

* Long 1984; Feare *et al*. 1998.

animals to Taiwan from these regions.

The number of occurrences was the highest for *A. tristis*, which had 2,389 records, occupying 48.7% of the total number recorded. The number of birds observed was the highest for *A. javanicus*, which had 22,985 birds, occupying 56.1% of the total number of birds observed. *A. fuscus* had 4.9% of the records and 4.7% of the number of the birds, whereas *S. nigricollis* had 5.8% and 1.8%, respectively. The other six exotic species *Acridotheres albocinctus*, *Acridotheres ginginianus*, *Sturnus burmannicus*, *Sturnus contra*, *Aplonis panayensis* and *G. religiosa* were rare, each occupying less than 1% of the number of records and the number of birds.

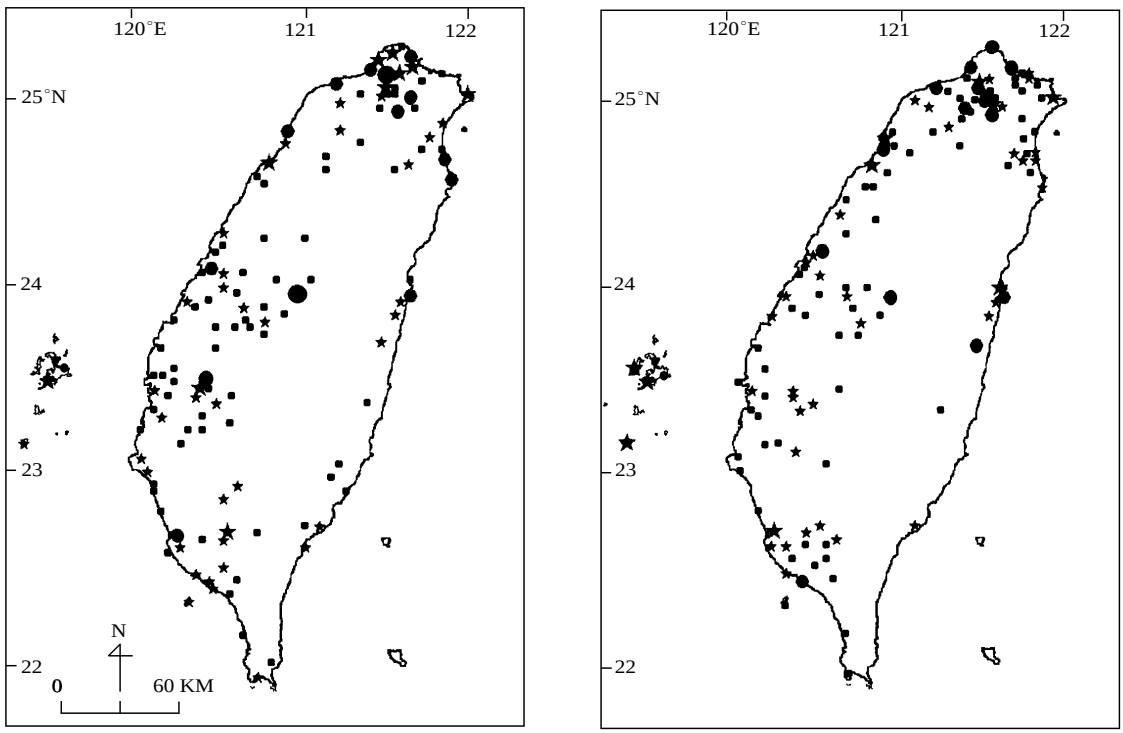
Table 3 shows the numbers and percentages of the administrative units where the exotic starlings and mynas were recorded. *A. javanicus* and *A. tristis* occurred, respectively, in 130 and 129 administrative units, occupying 36% of the total number of the units on the island, while the other eight species were rare and found only in two to 36 units (0.6% to10%).

The 10 species of the exotic starlings and mynas tended to show higher frequency of occurrences and higher number of birds observed in the northern and central-western regions of the island as compared to the other regions. *A. javanicus* and *A. tristis* were found to be the most common exotic mynas in Taiwan. They occurred in greater numbers in the northern region as compared to those in the southern region (Figs. 1-3).

The highest number of occurrences (66.7-100%) and the highest number of birds observed (37.5-100%) for the 10 exotic species of starlings and mynas in Taiwan occurred in coastal plains and peripheral hills at elevations less than 200m. They were then followed by those in hills and mountains at elevations of 201m to 500m (0-35.4% for occurrence and 0-62.5% for number) (Table 4). In mountains at elevations higher than 500m, both the number of

**Table 3.** The numbers and percentages of the administrative units (towns, townships and districts) in Taiwan (total administrative units 361), where the 10 exotic species of the starlings and mynas were recorded

| Species | Number of administrative units | Percent |
|---|---|---|
| *Acridotheres javanicus* | 130 | 36 |
| *Acridotheres tristis* | 129 | 36 |
| *Acridotheres fuscus* | 36 | 10 |
| *Acridotheres albocinctus* | 8 | 2.2 |
| *Acridotheres ginginianus* | 3 | 0.8 |
| *Sturnus nigricollis* | 28 | 7.8 |
| *Sturnus burmannicus* | 7 | 1.9 |
| *Sturnus contra* | 2 | 0.6 |
| *Gracula religiosa* | 21 | 5.8 |
| *Aplonis panayensis* | 15 | 4.2 |



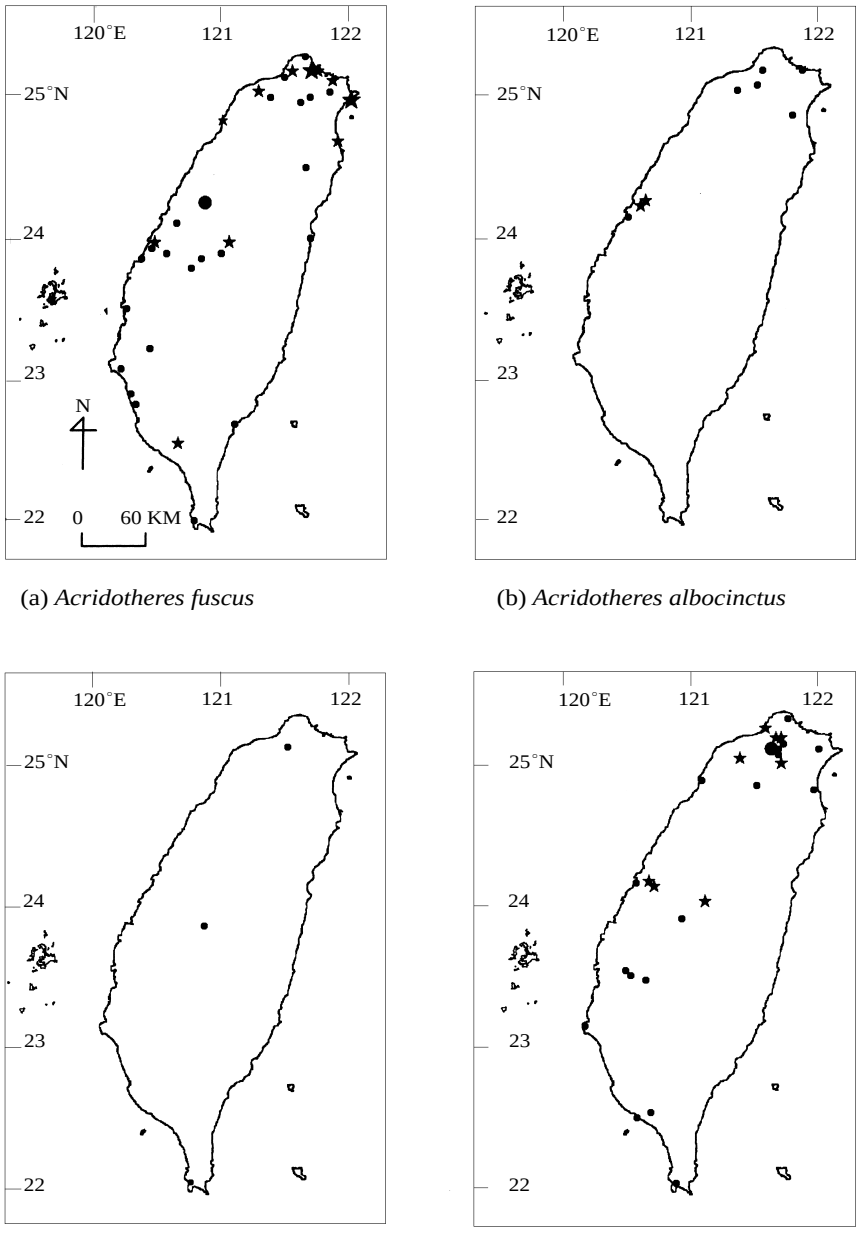

(a) *Acridotheres javanicus* (b) *Acridotheres tristis*

**Fig. 1.** The distribution of *Acridotheres javanicus* and *Acridotheres tristis* in Taiwan based on the bird database and exotic bird database of the Wild Bird Federation Taiwan, July 1994 to August 1999, and the Taiwan Endemic Species Research Institute, July 1993 to June 1999 (small dots, 1-5 birds; small stars, 6-20 birds; medium dots, 21-50 birds; medium stars, 51-200 birds; large dots, more than 200 birds).

occurrences and the number of birds decreased to less than 2% for *A. javanicus* and *A. tristis*, and 0-11% for the remaining eight species. In the mountains higher than 2,000m in elevation, they are extremely rare; *A. javanicus* was recorded twice and *G. religiosa* was once at the elevation of 2,500m, and *A. fuscus* was observed once at 2,000m.

## Discussion

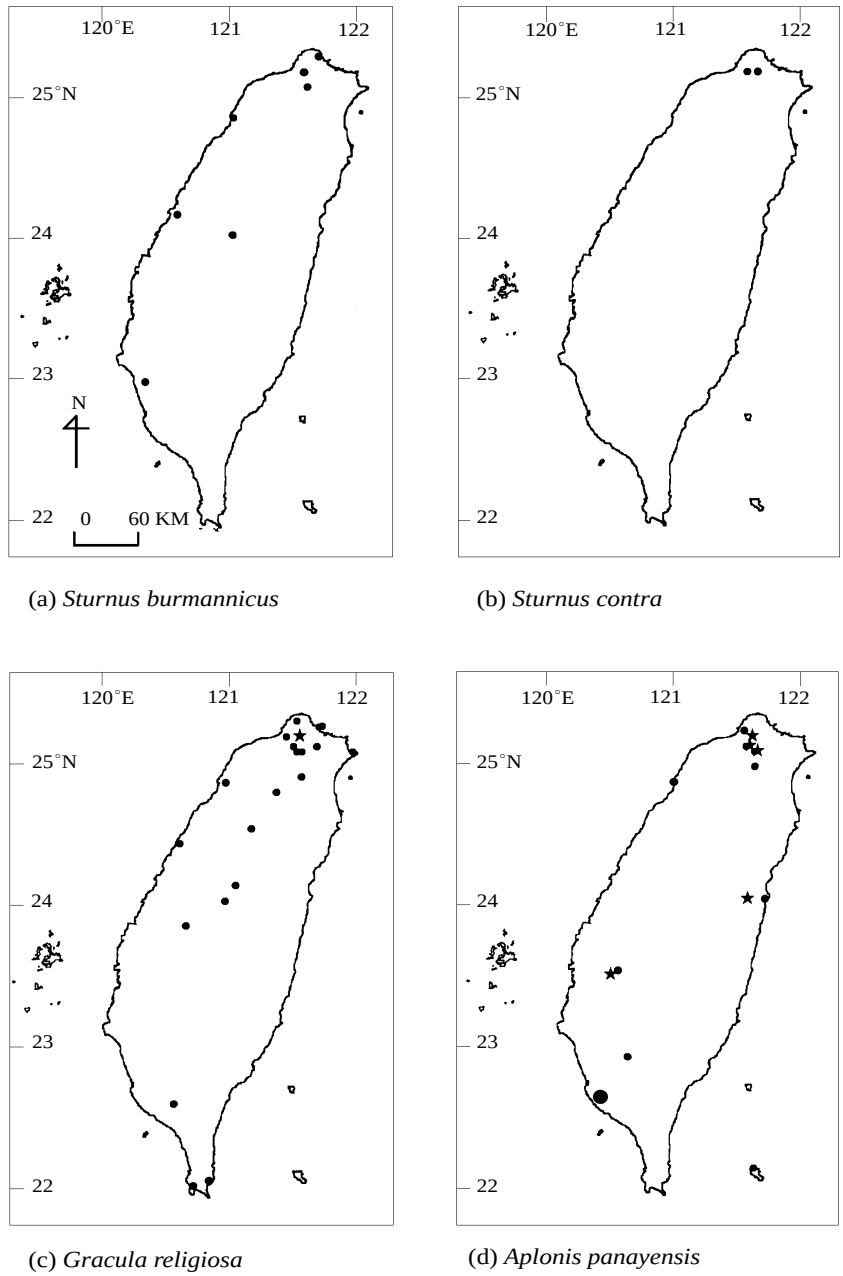
Starlings and mynas have been recognized as the successful immigrants in new territories where they are introduced (Long 1984; Lever 1987; Feare *et al*. 1998). Severinghaus (1999) identified 75 exotic species of birds in Taiwan, of which 11 species were starlings and mynas. Among these 11 species I regarded *A. cristatellus* is a resident species and *S. vulgaris* is an uncommon winter migratory species. The former is evidenced by the fact that its population in Taiwan has been identified as the




(a) *Acridotheres fuscus* (b) *Acridotheres albocinctus*

(c) *Acridotheres ginginianus* (d) *Sturnus nigricollis*

**Fig. 2.** The distribution of *Acridotheres fuscus*, *Acridotheres albocinctus*, *Acridotheres ginginianus* and *Sturnus nigricollis* in Taiwan based on the bird database and exotic bird database of the Wild Bird Federation Taiwan, July 1994 to August 1999, and the Taiwan Endemic Species Research Institute, July 1993 to June 1999 (small dots, 1-5 birds; small stars, 6-20 birds; medium dots, 21-50 birds; medium stars, 51-200 birds).




(a) *Sturnus burmannicus* (b) *Sturnus contra*

(c) *Gracula religiosa* (d) *Aplonis panayensis*

**Fig. 3.** The distribution of *Sturnus burmannicus*, *Sturnus contra*, *Gracula religiosa* and *Aplonis panayensis* in Taiwan based on the bird database and exotic bird database of the Wild Bird Federation Taiwan, July 1994 to August 1999, and the Taiwan Endemic Species Research Institute, July 1993 to June 1999 (small dots, 1-5 birds; small stars, 6-20 birds; medium dots, 21-50 birds; medium stars, 51-200 birds).

**Table 4.** The numbers of records and birds of the 10 exotic species of the starlings and mynas in four elevation ranges in Taiwan (percentages in parentheses)

| Species | 0 - 200m | | 201 - 500m | | 501 - 1000m | | >1000m | |
|---|---|---|---|---|---|---|---|---|
| | Records | Birds | Records | Birds | Records | Birds | Records | Birds |
| *Acridotheres javanicus* | 1614 (84.9) | 19241 (83.7) | 251 (13.2) | 3638 (15.8) | 33 (1.7) | 102 (0.4) | 2 (0.1) | 4 (>0.1) |
| *Acridotheres tristis* | 2219 (90.9) | 14509 (96.4) | 158 (6.7) | 503 (3.3) | 11 (0.5) | 36 (0.2) | 1 (>0.1) | 2 (>0.1) |
| *Acridotheres fuscus* | 156 (69.0) | 1700 (89.0) | 80 (35.4) | 205 (10.7) | 1 (0.4) | 4 (0.2) | 1 (0.4) | 2 (0.1) |
| *Acridotheres albocinctus* | 10 (100) | 29 (100) | - | - | - | - | - | - |
| *Acridotheres ginginianus* | 2 (66.7) | 3 (37.5) | 1 (33.3) | 5 (62.5) | - | - | - | - |
| *Sturnus nigricollis* | 264 (92.3) | 694 (94.8) | 20 (7.0) | 34 (4.6) | 2 (0.7) | 4 (0.5) | - | - |
| *Sturnus burmannicus* | 10 (76.9) | 13 (72.2) | 3 (23.1) | 5 (27.8) | - | - | - | - |
| *Sturnus contra* | 3 (100) | 7 (100) | - | - | - | - | - | - |
| *Gracula religiosa* | 34 (77.3) | 59 (80.8) | 5 (11.4) | 6 (8.2) | 4 (9.1) | 5 (6.8) | 1 (2.3) | 3 (4.1) |
| *Aplonis panayensis* | 27 (90.0) | 123 (91.8) | 2 (6.7) | 4 (3.0) | 1 (3.3) | 7 (5.2) | - | - |
| Total | 4339 | 36378 | 520 | 4400 | 52 | 158 | 5 | 11 |

endemic subspecies *A. cristatellus formosanus* (Hachisuka and Udagawa 1950). The latter species has some populations wintering in Taiwan, Japan and southern China without an evidence of breeding (Brazil 1990, Liao 2000, Robson 2000). Also, in this study I added *A. ginginianus* as a new record of exotic species of myna to Taiwan. This made a total of 10 known existing species of exotic starlings and mynas in Taiwan.

For the exotic starlings and mynas in Taiwan, *A. javanicus* and *A. tristis* were found to be the most abundant and widely distributed. They were then followed by *A. fuscus* and *S. nigricollis*. These four species showed the patterns of abundance similar to those mentioned by Severinghaus (1999). There were no records on dates and places of their introduction and subsequent dispersion on the island. Apparently, they were escaped from cages or released deliberately by man.

Most of the exotic starlings and mynas in Taiwan occurred in coastal plains and peripheral hills where natural environments have been transformed into agricultural, industrial and residential areas. Human activities such as deforestation and creation of open areas for herbaceous plants have transformed the natural

forests into habitat suitable for these exotic birds (Kang 1989; Feare *et al*. 1998). These exotic birds are omnivorous and aggregate in large flocks whenever food is available. They roost communally in large assemblages at night. The transient food supplied by man makes these exotic birds with better surviving and population growth (Kang 1989).

In this study the frequency of occurrences for the exotic starlings and mynas was higher in the northern and central-western regions of Taiwan as compared to the other regions. This does not mean that they were more common or more abundant in those regions, but it is more likely that they were recorded more often in the regions due to the enthusiasm of the people.

Because the two databases from WBFT were more or less the records of "bird watchers" and not sampled statistically, their reliability and representative is somewhat questionable. Even so, the results of this study may at least demonstrate that some of the exotic starlings and mynas are fairly common and widely distributed in Taiwan. This raises a question what is the impacts of these exotic birds on the environments, particularly the native birds. In order to develop management strategies for exotic starlings and mynas in Taiwan, the environmental impacts of these birds should be assessed. For this it requires to develop a statistically sound methodology to monitor their populations and their interactions with environments and native birds.

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# 臺灣地區外來椋鳥科（Sturnidae）鳥類的出現、分布與相對數量

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## 摘要

本研究利用來自於中華民國野鳥學會及行政院農業委員會特有生物研究保育中心的三個資料庫，探討臺灣地區10種外來椋鳥科鳥類的分布。白尾八哥(*Acridotheres javanicus*)及家八哥(*Acridotheres tristis*)爲其中最普遍的種類，其次爲林八哥(*Acridotheres fuscus*)及烏領椋鳥(*Sturnus nigricollis*)。其餘六種，白領八哥(*Acridotheres albocinctus*)、岸八哥(*Acridotheres ginginianus*)、葡萄胸椋鳥(*Sturnus burmannicus*)、斑椋鳥(*Sturnus contra*)、輝椋鳥(*Aplonis panayensis*)及九官鳥(*Gracula religiosa*)數量仍不多。 在臺灣 361個鄉、鎮、區層級的行政區中，超過三分之一已有白尾八哥及家八哥的紀錄，其餘八種都在10%以下。10種外來椋鳥主要分布於平原及週遭低於海拔500m以下的丘陵地帶。

**關鍵詞**：外來物種、椋鳥科、分布、臺灣

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