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Original Article

Effects of distress, alarm, and pre-flight calls on the behavior of Myna birds

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Abstract

Roosting flocks of Mynas have adapted their behavior to live in urban areas of Thailand. Sometimes, they disturb people in their working and living environments which has created the need to develop a method of population control in the roosting areas. Bioacoustics repellent are non-lethal methods that have been selected to repel Myna birds in roosting sites. Distress, alarm, and pre-flight calls of Myna birds were tested on high, middle, and unharmful levels, respectively. The distress calls made birds fly from the roosting trees more quickly than alarm calls or pre-flight calls (P=0.01). Acoustic Myna calls (AMC) that were combinations of distress and pre-flight calls were tested to prove the efficiency of distress calls. Each combination was not different in the bird repellent effect (P=0.14). The results indicated success in the use of distress calls to repel Myna birds from roosting sites.

Keywords: Mynas' playback, distress calls, pre-flight calls, alarm calls, habituation

1. Introduction

Some species of Myna birds such as the Common Myna (*Acridotheres tristis*) and White-vented Myna (*Acridotheres grandis*) can be a nuisance in Thailand. They have adapted to urban environments and may cause problems. Some roosting flocks of Myna may be very noisy and can cause a bad odor because they soil their roosting areas with their feces. Myna birds are also a potential risk for disease because they can carry disease-causing organisms that cause infections such as histoplasmosis from *Histoplasma capsulatum*, ornithosis from *Chlamydia psittaci*, tularemia from *Francisella tularensis*, Rocky Mountain spotted fever from *Rickettsia rickettsia*, and Lyme disease from *Borrelia burgdorferi* (Mclean, 1994).

Researchers have tried to use the most effective methods such as falconry, to control Myna populations in urban environments (Cook, Rushton, Allan, & Baxter, 2008). Falconry is illegal in Thailand because the Myna is protected under the wildlife protection act. Repellent methods such as bioacoustics have therefore become necessary in Thailand. Bioacoustic methods are non-lethal which use audio signals to stimulate a response in birds. Distress calls were effective signals that were used to control the Common Starling (*Sturnus vulgaris*) in woodland areas (Brough, 1969) and urban roosting sites (Pearson, Skon, & Corner, 1967). Additionally, they were used together with other signals such as alarm calls (Berge, Delwiche, Salmon, Gorenzel, & Andrew, 2005; Conklin, Delwiche, Gorenzel, & Coates, 2009) to increase the effectiveness of the repellent. However, previous research lacked assessment in some important areas such as latent time

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and the number of moving birds that could be used to support the efficiency of the repellent stimuli.

The efficiency of bioacoustic repellents on Mynas was investigated by testing the responses of distress, alarm, and pre-flight calls. Acoustic Myna calls (AMC), which are comprised of distress and pre-flight calls, were evaluated after the most effective sound was found. The procedures were developed to evaluate quantitative data that are important in bird repellent research. This paper clarifies the performance of bioacoustic playback methods that can be used to decrease roosting flock populations of the Myna bird in Thailand.

2. Materials and Methods

2.1 Population and study sites

The experiments were conducted between October 2015 and October 2016 at the Naresuan University Hospital in Phitsanulok, Phitsanulok Province and at the Chiang Mai municipal office in Chiang Mai Province, Thailand. There were roosting trees along the footpath in front of the hospital and also at the municipal office. A flock of about 100 Common Myna (*A. tristis*) was chosen at different roosting trees for the experiments. One hundred individuals were selected because it was deemed appropriate to limit the amplitude of the sound. The test trees were simply used to count the number of moving birds in the evening.

2.2 Sound recording and recreation

Sound stimuli of the Common Myna (*A. tristis*) were tested at their roosting sites. To record the sounds, the birds were captured at Naresuan University, Phitsanulok Province, Thailand. A mist net (mesh size 3x3 cm) was used to capture the birds. Distress and pre-flight calls were recorded when a bird was held in the hand and then released. Alarm calls are produced to warn the other birds. These alarm calls were recorded when we approached a bird. The sounds were analysed using Raven Pro V.1.5 which is a sound analysis program. The stimuli were recreated from the original length (approximately half a min) to be 6 min long with a 5 s fade in and a 5 s fade out. All sounds were cleared of background noise. Two patterns of stimuli were generated. Each of them was 6 min long comprised of distress calls (total 576 elements), pre-flight calls (total 720 elements), and alarm calls (total 360 elements). Acoustic Myna calls 1 (AMC1) was comprised of 1-min distress calls followed by 1-min pre-flight calls that was repeated 3 times. In contrast, Acoustic Myna calls 2 (AMC2) was composed of 1-min pre-flight calls followed by 1-min distress calls that were repeated 3 times. Six minutes of stimuli were used because preliminary studies showed that more than 80% of birds in small flocks of about 100 individuals flew out within 3 min of playback and all of them flew out in 6 min. The birds did not return to the roosting trees within 30 min.

2.3 Experiment

The devices were setup about 10 m away from the roosting flocks of the Myna birds which was outside the flight initiation distance (MØller, 2010). The sounds were broadcast using a loud speaker (Deccon, PWS-210) that was set up and connected to a sound player (Apple ipod) at 10 m below the test trees with an upward direction. The amplitude of the sounds was set at 100 dB which the birds could still detect while they were producing a roosting noise (maximum at 94 dB). The responses of the birds were recorded before and after the tests using a video camera (Sony Handicam, HDR-XR200). Another video camera (Sony Handicam, HDR-XR260) was set up 20 m away from the roosting tree to count the number of moving birds. Video of the time the first individual came to roost was recorded until 30 min after the end of our experiments.

The sounds were broadcasted when all of the birds had settled in to the roosting trees. Each sound was tested once a day. The same testing area was not used for at least 3 days following the original test. Distress and pre-flight calls were tested 30 times, alarm calls were tested 10 times, and AMC1 and AMC2 were tested 15 times. In our tests, some factors such as a high level of noise from human activity or vehicles disturbed the experiment. These factors possibly affected the responses of the birds, so some experiments were not included in the data analysis.

2.4 Data analysis

Distress, pre-flight, and alarm calls of the Common Myna (*A. tristis*) were analysed by Raven Pro V.1.5 sound analysis (44 kHz, 16 bit, 512 window size). The factors that were analysed included bird behavior, percentage of birds flying out in the 1st, 2nd, 3rd, 4th, 5th, and 6th min and the length of each response, which was categorized into three periods. Latent time (LT) was the time (s) until the first individual moved their head after they received the stimuli. First departure (FD) was the time (s) until the first individual flew out. Last departure (LD) was the time (s) the last individual left the roosting trees. The quantitative data were analysed by MYSTAT freeware program V.12. The acceptable level as a bird repellent was to have an over 50% reduction in the number of roosting birds (Bishop, McKay, Parrott, & Allan, 2003).

3. Results and Discussion

3.1 Structure of distress calls, alarm calls, and pre-flight calls

The structure of the recorded sounds was described as the shape of the element, the number of elements, the frequency, call length, and time of interval (Table 1 and Figure 1). Birds used distress calls when they are captured by predators and they may use alarm calls when they detect danger (Marler, 2004). Pre-flight calls are used when birds prepare to fly out with their companions (Marler, 2004). These stimuli were chosen to eliminate nuisance flocks of birds from roosting sites, vineyards, highway structures, and landfill sites (Brough, 1969; Conklin *et al.*, 2009; Cook *et al.*, 2008; Pearson *et al.*, 1967).

Table 1. Structures of distress, alarm, and pre-flight calls.

Structures of sound	Distress call	Alarm call	Pre-flight call
Call shape	Scowl-curve shape	Band shape	Frizzy-lineshape
Harmonic	yes	no	Yes
No. of element in a phrase	32	1	2
Max. frequency (kHz)	2.98	5.09	2.85
Min. frequency (kHz)	1.84	1.41	1.17
Call length (seconds)	0.44	0.55	0.25
Interval (seconds)	0.19	no	0.19

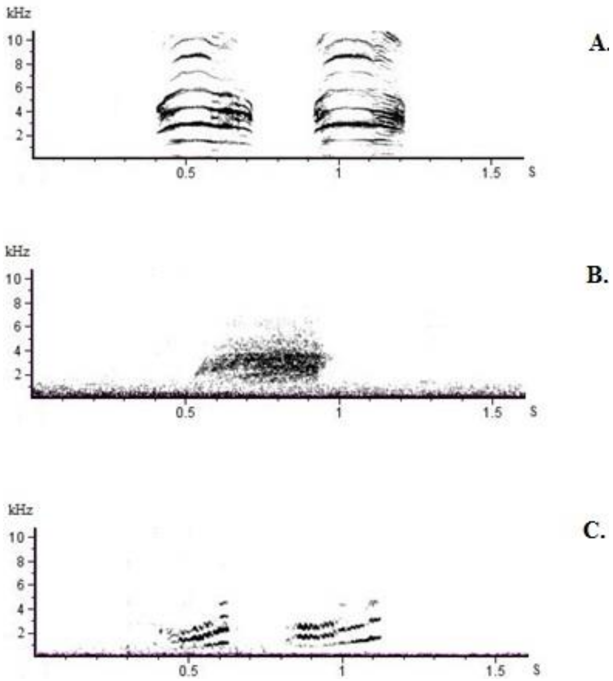

Figure 1. Spectrograms showing structure of distress calls (A.), alarm calls (B.), and pre-flight calls (C.).

3.2 Behavioral responses of Mynas to the calls

3.2.1 Behavior of the birds before the tests

The behavior in the Mynas was observed as they searched for safe places to roost. The roosting behavior of the Myna showed that they landed on pre-roosting trees before they chose their roosting trees. They came to roost and waited for the sunset and the lampposts to turn on. They then flew into the roosting trees with their group members. Zoratto *et al.* (2014) explained that birds that lived in flocks have a lower risk of predation compared to single birds. Suitable roosting areas of many birds species, such as the Common Myna (*A. tristis*), the great grey shrike (*Lanius excubitor*) or the buff-throated partridge (*Tetraophasis szechenyii*), are the dense canopies of trees (Antczak, 2010; Xu, Yang, Wang, Yue, & Ran, 2010; Yap, Sodhi, & Brook, 2002). The behavior of the birds before the experiments was comfort behaviors such as preening. Delius (1988) showed that birds preen when they are relaxed or they emit roosting calls between 80-94 dB. In our experiment, the Myna birds had a very low individual distance (less than 1 meter) in their own group. The early birds roosted on the top branches, but were sometimes replaced by other birds. Sometimes they competed for roosting branches and displayed aggressive behavior and aggressive calls.

3.2.2 Responses of birds in the tests

The distress calls made the birds increase their head movements, stop their roosting calls, caused them to jump out from hiding, break up their big groups into smaller groups, look for their members, and then to fly away from the roosting tree. Head movement activities may correspond to vigilance behavior, that enables them to gather information about predators (Jones, Krebs, & Whittingham, 2007; Juricic, 2012; Juricic, Beauchamp, Treminio, & Hoover, 2011). The birds flew out and hid in other trees or sometimes they dispersed in several directions up to 200 meters away without returning. Occasionally, a few birds would try to access the test trees, but they flew out again while the sounds were being broad-cast. Ferron, Doligez, Dall, & Reader reported that animals can copy the behaviors of others when they receive social information about risk (2010). However, Griffin reported that distress calls may have several effects on birds based on their specific function (2008). Classical conditioning says that the response of birds will be affected by the stimuli they receive (Griffin, 2008). Hence, the Myna in these tests may have had previous experience of similar conditions involving distress calls from a group member. When the alarm calls were broad-cast, some of the birds responded with head movements and then flew away, while others carried on with roosting behavior.

Most of the birds continued resting, preening, and producing roosting calls. After that, some birds increased their head movement, jumped out from their hiding places, and flew away from the roosting trees. Some birds flew out and then returned to the roosting tree. The birds in our experi-ments were less excited when alarm calls were broadcast com-pared to distress calls. Alarm calls imply a degree of danger but less than for distress calls. However, they could be used in combination with distress calls to improve the repellent results (Berge *et al.,* 2005; Conklin *et al.,* 2009)

The birds had the lowest level of excitement when tested with pre-flight calls. Some birds increased head movement, but most continued to roost and stay relaxed. Sometimes they flew up over the roosting tree for a few moments and then returned to roost again. The responses of the birds to pre-flight calls showed that most of them rested and preened. Black (1988) showed that birds used pre-flight calls to maintain proximity to their partners. Myna birds have to maintain group bonding at roosting time. Therefore, pre-flight signals without taking flight may be less effective for them.

3.2.3 Movement of birds in the tests

Movement of birds to distress, alarm, and pre-flight calls were different. On average, 78%, 58%, and 18% of the birds in the flocks flew away after hearing distress calls, alarm calls, and pre-flight calls, respectively (P=0.01) (Figure 2). The proportions of birds leaving in the first to the sixth minute of the distress call tests were 74%, 13%, 9%, 2%, 1%, and 1%, respectively. The proportions of birds leaving in the first to the sixth minute of alarm call tests were 66%, 24%, 6%, 2%, 1%, and 0%, respectively. The proportions of birds leaving in the first to the sixth minute of pre-flight call tests were 46%, 18%, 12%, 6%, 5%, and 6%, respectively (Figure 3). Results from a Discriminant Function Analysis (DFA) test showed different responses of birds for all parameters (P=0.01). The percentages of birds leaving from the roosting trees during distress calls decreased after 30 repetitions (Figure 4). After broadcasting all types of stimuli, the birds that left did not return again for at least 30 min.

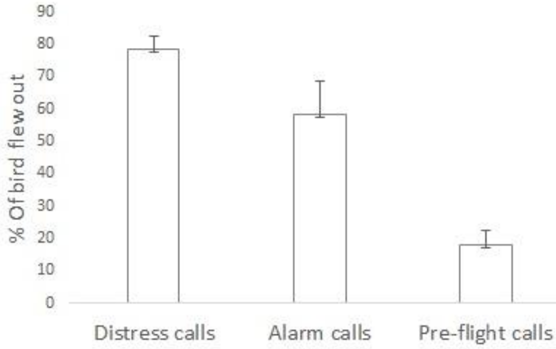

Figure 2. Percentages of total leaving birds on distress, alarm, and pre-flight calls.

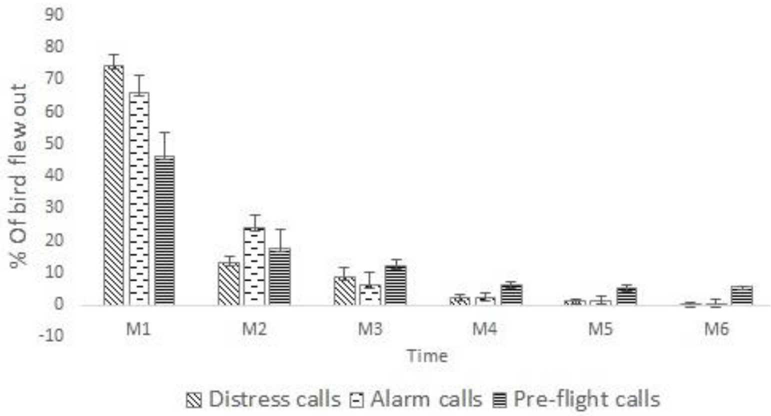

Figure 3. Percentages of leaving birds on distress, alarm, and pre-flight calls in 6 min.

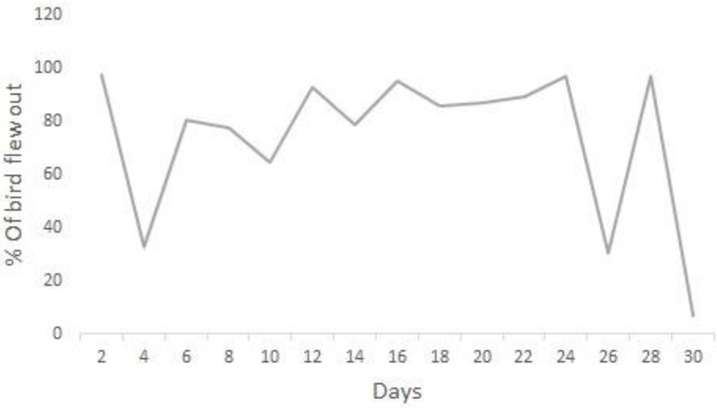

Figure 4. Percentages of birds that left on distress calls in 30 days.

The percentages of birds that left showed that AMC1 and AMC2 affected the Myna in similar ways. The sounds of AMC1 and AMC2 made 58% and 38% of the birds fly away, respectively (Figure 5). The proportions of birds leaving in the first to the sixth minute of AMC1 tests were 47%, 22%, 21%, 6%, 3%, and 1%, respectively (Figure 6). The proportions of birds that left in the first to the sixth minute of the AMC2 tests were 15%, 37%, 24%, 14%, 6%, and 4%, respectively (Figure 6). The results from the DFA test showed different responses among the parameters (P=0.05). In addition, the percentages of birds that left from AMC1 and AMC2 were not statistically different (P=0.14) and the stimuli decreased after 15 repetitions (Figure 7). After broadcasting all types of stimuli, the birds that left did not return within 30 min.

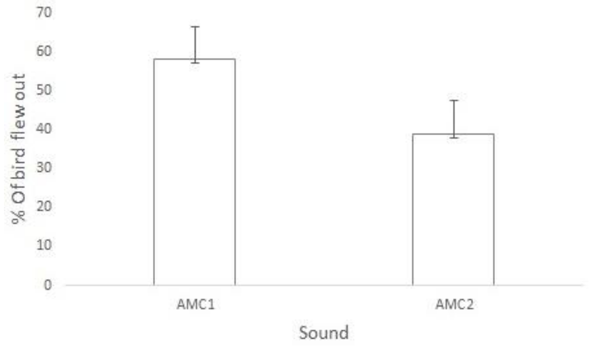

Figure 5. Percentages of all birds that left on AMC1 and AMC2.

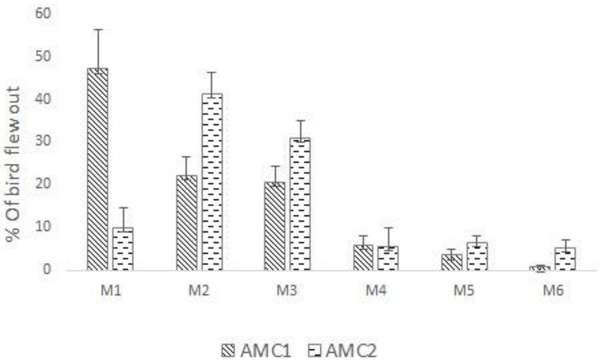

Figure 6. Percentages of birds that left on AMC1 and AMC2 within 6 min.

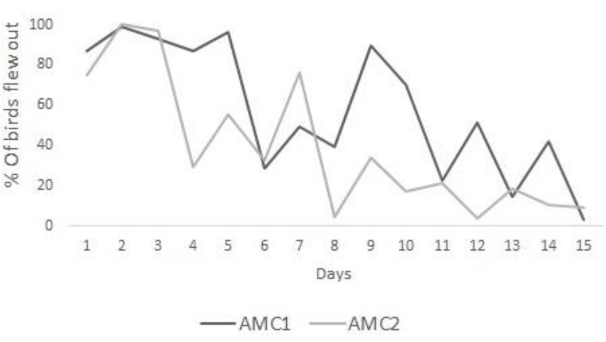

Figure 7. Percentages of birds that left on AMC1 and AMC2 in 15 days.

3.2.4 Using distress calls in the family Sturnidae

By stimulating predator avoidance behavior in birds, researchers reported that distress calls could repel Common Starlings (*S. vulgaris*) away from roosting areas (Brough, 1969; Pearson *et al.*, 1967). Previous work done by Brough (1969) and Pearson *et al.* (1967) found some success in repelling birds; however, in the current experiments, at first the birds responded by temporally moving to other roosting trees, and later returning to their original roosts.

There are several factors that affect the responses of birds, such as the total number of birds, the total number of roosting trees, the specific stimuli, the sequence of the stimuli, the length of stimuli, and the time of beginning the roosting. Brough (1969) used distress calls to repel Common Starlings in the woodland. The environmental conditions were clearly different. However, Pearson *et al.* (1967) used distress calls in urban areas. The calls were repeated with the result that they did not return. In these experiments, local residents participated in the experiments and used stimuli in each roosting location. The experiments were performed in a roosting tree. Therefore, the birds changed to roost in other trees along the sites. In addition, the methods were developed to evaluate the movements of the birds in each roosting tree. It became apparent that after repeating the stimuli, the birds began to ignore it and carried on using their chosen roosting trees.

3.2.5 Habituation in the tests

Habituation occurred in our tests. The results of distress calls, AMC1, and AMC2 indicated that the number of birds flying out decreased in later repetitions. We could not confirm that all individuals in the flocks were the same. Therefore, they possibly increased their flying out response in some later cases (Figures 4 and 7). Although, distress calls may be the most effective non-lethal bird repellent method (Bomford, & O'Brien, 1990), habituation may decrease value of the distress calls as a bird repellent (Cook *et al.*, 2008; Soldatini, Barajas, Vladimir, Torricelli, & Mainardi, 2008). In this case, the Myna birds decreased their movement responses because of habituation to the stimuli. Real predators were not used in the tests, while Conover (1994) reported that birds go to the source of the distress calls to acquire information about the predator. Griffin and Boyce (2009) reported that the Common Myna (*A. tristis*) feared a response after they observed another bird attacked by a predator. The researcher agrees with Griffin, Boyce, and MacFarlane (2010) that birds should have real experiences with predators to resolve habituation. The problem of habituation in roosting flocks of Myna birds in Thailand could be solved by using predators together with distress calls.

4. Conclusions

Some flocks of Myna birds may annoy people in roosting places in Thailand. Distress calls repelled the Myna birds in roosting sites as a non-lethal method, but habituation occurred when the tests were repeated on flocks of birds. These results showed that a bioacoustic repellent alone would not be effective in the long term. Therefore, developing a reliable, long term repellent method still needs more experimental work to understand the cognitive system of birds in the family Sturnidae.

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