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Effectiveness of Playbacks in Censusing the Fairy Pitta (*Pitta nympha*) during the Breeding Season in Taiwan

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Ruey-Shing Lin, Pei-Fen Lee, Tzung-Su Ding, and Yu-Teh Kirk Lin (2007) Effectiveness of playbacks in censusing the Fairy Pitta (*Pitta nympha*) during the breeding season in Taiwan. *Zoological Studies* **46**(2): 242-248. We evaluated the effectiveness of using playbacks of recorded calls to census the presence and abundance of the Fairy Pitta (*Pitta nympha*) in the hills of Yunlin County, west-central Taiwan from late Apr. to May 2001. The responses of Fairy Pittas to playbacks were quick, with 94% occurring in the 1st 5 min. Playbacks substantially increased the likelihood of detecting Fairy Pittas. Both the number of stations at which pittas were detected and the number of pittas detected per station increased with the use of playbacks. In addition, both the number of stations that detected pittas and the number of pittas detected per station were significantly higher in early than mid- and late May, but did not differ among different times of the day (among early morning, noon, and afternoon). Our results indicate that playbacks considerably increased detectability, and 5 min of playback at a station is sufficient. However, it is important to census the Fairy Pitta populations during the pre- to early-nesting period, and this should be carried out at least twice to ensure a high certainty of determining the presence or absence of Fairy Pittas at a station. http://zoolstud.sinica.edu.tw/Journals/46.2/242.pdf

Key words: Playback, Census, Pitta, *Pitta nympha*.

The Fairy Pitta (*Pitta nympha*) is a migratory bird that inhabits secondary lowland forests. The species breeds in South Korea, southern Japan, southeastern China, and Taiwan, and winters in the islands of Borneo (BirdLife International 2001). The breeding grounds of the Fairy Pitta have been highly impacted by habitat deterioration, resulting from the clearance, fragmentation, and degradation of subtropical and tropical forests in recent years. The species is listed as vulnerable by the IUCN, while its current population size is estimated to be fewer than a few thousand individuals (BirdLife International 2001). Thus, it is critical to efficiently monitor the breeding ground and population size of the Fairy Pitta for conservation and management purposes (Lambert and Woodcock 1996, BirdLife International 2000 2001).

Using playbacks to elicit vocal responses is an effective technique in determining the presence of elusive birds (Johnson et al. 1981, Marion et al. 1981). For example, it has been used in surveys of Gurney's Pittas (*P. gurneyi*) (Gretton et al. 1993) and Rainbow Pittas (*P. iris*) (Zimmermann and Noske 2003). Particularly, it is a valuable tool for censusing rare species (Wunderle 1994). However, the effectiveness of playbacks as a censusing technique has not been investigated for pittas. To facilitate the monitoring of the breeding distribution and population size of the endangered Fairy Pitta in Taiwan, we investigated the effectiveness of using playbacks in determining the presence of the Fairy Pitta. We hypothesized that playbacks increased the detectability of Fairy Pittas at survey/census points. In addition, we

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examined if the responses of pittas varied at different times of the day, on different dates of the breeding season, and at different distances from the playback source.

METHODS

Study area. The study area was located on the hills of Linnen and Douliu of Yunlin County, west-central Taiwan (120°37.1'E, 23°44.5'N) (Fig. 1). This location is designated an Important Bird Area, specifically for the Fairy Pitta, by the Wild Bird Federation of Taiwan (2001). The area is embedded in an agricultural region dominated by Taiwanese giant bamboo stands (*Dentrocalamus latiflorus*) mixed with natural broadleaf trees, such as *Ficus septica*, *F. fistulosa*, *Machilus zuihoensis*, *Trema orientalis*, and *Sapindus mukorossii*, among sparsely distributed fruit orchards and betel nut (*Areca catechu*) plantations. The climate is cool and dry in winter (Dec. to Feb.) with < 50 cm of total precipitation, and hot and wet in summer (Apr. to Oct.) with a total precipitation of ~200 cm (Wild Bird Federation of Taiwan 2001).

Playbacks. Based on earlier surveys, calls of the Fairy Pitta, composed of double whistles, with 2 disyllabic notes sounding like *kwah-he*, *kwah-hu* (Lambert and Woodcock 1996), were often heard from late Apr. through May. Nestlings have been found from late May through July (R.S. Lin unpubl. data). The calls ceased after May, with a few heard only occasionally after that (R.S. Lin pers. obs.). Therefore, we determined that the period of late Apr. through July was the breeding season of the Fairy Pitta in Taiwan. However, the playback experiment was performed only during May because very few responses to playbacks occurred after May (R.S. Lin pers. obs.).

In 2001, we randomly selected 16 stations where Fairy Pittas had been sighted or heard in late Apr. for the playback experiment. The chosen stations were separated from each other by > 200 m in distance. The playbacks were conducted on 3 different dates: May 3-4 (early-May), 14-15 (mid-May), and 29-30 (late-May). Since the 16 stations chosen based on Apr. information might not have pittas within the sampling area during the playback surveys, the estimates of detectability made here are therefore minimum estimates. For each of 2 consecutive days, we randomly divided the 16 stations into 2 groups of 8 stations, and visited 1 group on the 1st day and the other the following day. On each day, each of the 8 stations was visited 3 times at 06:00-09:00 (morning), 10:30-13:30 (noon), and 15:00-18:00 (afternoon). Overall, we made 144 visits to 16 stations.

Each visit consisted of 2 periods. It began with a 5 min pre-playback period, followed immediately by a 10 min playback period. All sightings and calls of pittas during both periods were recorded. The playbacks consisted of a tape of the Fairy Pitta's vocalization played on a tape player (Sony WM-FX 171, Tokyo, Japan) equipped with a

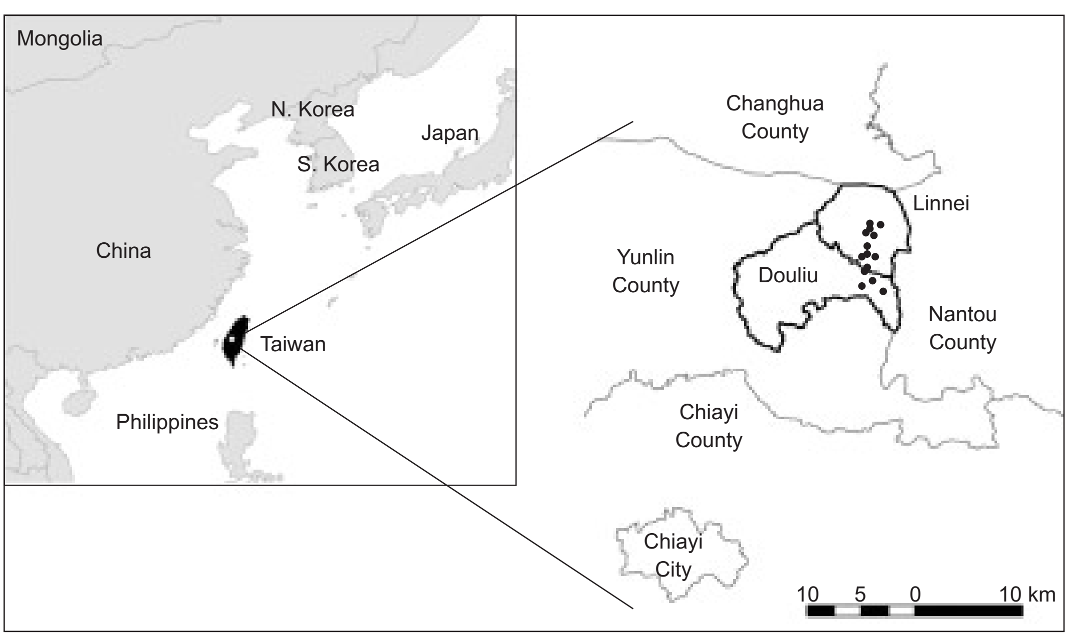

Fig. 1. Study area located in the hills of Yunlin County, west-central Taiwan.

portable 6-W output speaker (Kaotek WPA-66, Kaohsiung, Taiwan). The maximum sound pressure 1 m from the speaker was 100 dB. The male Fairy Pitta calls played had been recorded in early May 2000 in the study area with a Sony TC-D5M tape recorder (Sony, Tokyo, Japan) and a Sennheiser MKH 816 P48 microphone (Sennheiser, Wedemark, Germany).

An inner (50 m radius) and outer (100 m radius) circle, centered at the playback speaker, were established at each survey point (Bibby et al. 1992). The sighted or calling pittas were recorded as located within the inner circle or between the inner and outer circles (outer circle, hereafter), and the distances were estimated. A training session was held in a pitta habitat to ensure that all field workers could closely estimate the calling distance of pittas. Very few pitta calls beyond 100 m were heard and were included in the outer circles when they occurred. During each playback period, the time lapse between the start of a playback and the detection of each responding Fairy Pitta was recorded. The intensity of each vocal response and the movement of each responding Fairy Pitta were recorded as well. The intensities of the vocal responses were categorized into 3 levels: strong responses with continuous whistles more than 10 times during the playback period; moderate responses with discontinuous whistles more than 10 times; and weak responses with continuous or discontinuous whistles of fewer than 10 times. The movement of each responding Fairy Pitta was recorded as remaining in situ or approaching the speaker.

Data analyses. The detectability (D) of the Fairy Pitta was calculated as the fraction of the total number of stations where Fairy Pittas were known to exist (Gibbs and Melvin 1993): $D = N_d/N_t$, where N_d is the number of stations that a Fairy Pitta was detected, and N_t is the total number of stations. The effectiveness (E, expressed as a percentage) of playbacks was assessed by the improvement in detectability, and calculated as $E = 100*(D_e - D_c)/ D_c$, where D_e is the detectability of the playback periods, and D_c is the detectability of the pre-playback periods.

To compare among the 3 different times of day, among the 3 different dates in May, and between the pre-playback and playback periods, we used a Poisson regression (Turcotte and Desrochers 2002) to evaluate differences in the number of Fairy Pittas detected. The Poisson regression was performed using SAS's (Chicago, IL, USA) GENMOD procedure with the number of pittas detected as the dependent variable, and the time of day, date of the month, and pre-playback vs. playback periods as independent variables. We used Kruskal-Wallis tests to determine differences in the number of stations at which pittas were detected. To determine the number of visits required to effectively detect the pittas, we calculated the percentage of stations at which pittas were detected after 1, 2, or 3 visits by considering the morning, noon, and afternoon visits individually and combined. For the distance of the responding pittas, we used chi-square tests for goodness of fit to compare between the inner and outer circles, and Kolmogorov-Smirnov tests to compare among the 3 different dates of the month.

For the proportion of pittas that approached the speaker, and the proportion of pittas that gave strong responses to playbacks, we used the paired *t*-test to compare between the inner and outer circles, and modified Chi-square tests with 2 x 3 contingency tables to test for temporal trends among the 3 different dates in May (Zar 1995: 566-567).

RESULTS

Response times. Of the 144 playback periods, the presence of the Fairy Pitta was detected in 78 (54%) periods. The response times were short; 94% (73 periods) of the responses were recorded within the 1st 5 min. Without playback, the presence of the Fairy Pitta was detected in 10, 7, and 7 stations in early, mid-, and late May, respectively. With 10 min of playback, the presence of the Fairy Pitta was detected in 16, 13, and 10 stations in early, mid-, and late May, respectively. Within the first 5 min of playback, the presence of the Fairy Pitta was detected in 15, 12, and 9 stations in early, mid-, and late May, respectively. We used the first 5 min of each playback period to compare differences in detectabilities between pre-playback and playback periods.

Effectiveness of playbacks. The number of stations at which Fairy Pittas were detected during the pre-playback and playback periods at different times of the day during different dates is shown in table 1. The number of stations at which Fairy Pittas were detected was significantly higher for the playback periods than the pre-playback periods (8.11 ± 1.25 and 3.78 ± 0.60 stations, respectively; Kruskal-Wallis test, $H = 6.89$, $n_1 = n_2 = 9$, $df = 1$, $p < 0.01$). Playbacks increased the detectability of the Fairy Pitta by up to 225% (Table 1). Pittas were detected at more stations in early or mid-May than in late May (8.83 ± 1.78, 6.33 ± 1.28, and 3.92 ± 0.61 stations, respectively; Kruskal-Wallis test, H = 7.29, $n_1 = n_2 = n_3 = 6$, df = 2, $p < 0.05$). There was no significant difference among different times of the day (6.67 ± 1.71, 8.75 ± 2.28, and 7.67 ± 2.24 stations, respectively; Kruskal-Wallis test, H = 1.12, $n_1 = n_2 = n_3 = 6$, df = 2, $p > 0.75$). The number of visit to a station increased the probability of detecting pittas. The probabilities after 1 visit were 79.2%, 35.4%, and 31.3%; after 2 visits were 94%, 65%, and 48%; and after 3 visits were 94%, 75%, and 56% for early, mid-, and late May, respectively.

The average number of Fairy Pittas detected per station during the pre-playback and playback periods at different times of day during the different dates are shown in table 2. There was no significant difference among the time of the day (0.61 ± 0.17, 0.59 ± 0.18, and 0.42 ± 0.12 pittas for morning, noon, and afternoon, respectively; Poisson regression, p = 0.15), but it was significantly higher during playback periods than pre-playback periods (0.75 ± 0.14 and 0.33 ± 0.06 pittas, respectively; Poisson regression, $p < 0.001$). More pittas were detected in early May than in mid- or late May (0.90 ± 0.18, 0.42 ± 0.09, and 0.31 ± 0.05 pittas, respectively; Poisson regression, $p < 0.001$).

Distance of responding pittas. The area of the outer circle was 3 times larger than that of the inner circle. Thus, the number of pittas in the outer circles should have been 3 times the number in the inner circles. However, the average number of

Table 1. Number of stations at which Fairy Pittas were detected during the pre-playback and playback periods at different times of the day on different dates

	Morning	Noon	Afternoon	Combined
Pre-playback period				
Early May	7[a] (0.44)[b]	6 (0.38)	4 (0.25)	10 (0.63)
Mid-May	4 (0.25)	4 (0.25)	2 (0.13)	7 (0.44)
Late May	2 (0.13)	2 (0.13)	3 (0.19)	7 (0.44)
Playback period				
Early May	14 (0.88)	11 (0.69)	13 (0.81)	15 (0.94)
Mid-May	8 (0.50)	7 (0.44)	6 (0.38)	12 (0.75)
Late May	5 (0.31)	6 (0.38)	3 (0.19)	9 (0.56)
Effectiveness of playback				
Early May	100%	83%	225%	50%
Mid-May	100%	75%	200%	71%
Late May	150%	200%	0%	29%

[a]The highest possible number of stations is 16. [b]Numbers in parentheses show detectabilities.

Table 2. Average numbers of Fairy Pittas (mean ± 1 SE) detected per station during the pre-playback and playback periods in west-central Taiwan in May 2001

Period	Average number of pittas detected			
	Morning	Noon	Afternoon	Combined
Pre-playback Period				
Early May	0.63 ± 0.20	0.69 ± 0.25	0.31 ± 0.15	0.54 ± 0.12
Mid-May	0.25 ± 0.11	0.25 ± 0.11	0.19 ± 0.14	0.23 ± 0.07
Late May	0.31 ± 0.22	0.13 ± 0.09	0.25 ± 0.14	0.23 ± 0.09
Playback Period				
Early May	1.40 ± 0.22	1.40 ± 0.33	1.00 ± 0.16	1.25 ± 0.13
Mid-May	0.69 ± 0.20	0.69 ± 0.27	0.44 ± 0.16	0.60 ± 0.08
Late May	0.44 ± 0.18	0.44 ± 0.16	0.31 ± 0.15	0.40 ± 0.04

Fairy Pittas (averaged over the 3 dates in May) detected in the inner circles was significantly greater than one would expect (Table 3; χ^2-test, $\chi^2 = 5.85$, df = 1, $p = 0.02$). The average number of Fairy Pittas detected decreased with the date (Table 3). The magnitude of reduction from early to late May was significant only for the outer circle, with 53.3% and 85.0% reductions for the inner (Kolmogorov-Smirnov test, D = 0.12, $n = 22$, $p > 0.5$) and outer (Kolmogorov-Smirnov test, D = 0.36, $n = 19$, $p < 0.02$) circles, respectively.

Furthermore, 21%-57% of Fairy Pittas responding to playbacks in the inner circles moved toward the speaker during the playback periods, whereas 16%-25% of those in the outer circles did. The difference was not significant (paired *t*-test on transformed data, $t = 2.15$, df = 2, $p = 0.16$). We pooled the data from the inner and outer circles together in the next analysis. The proportion of responding pittas that approached the speaker tended to decrease from early to late May (Table 3; 39%, 24%, and 20% for early, mid-, and late May, respectively), however the trend was not significant (χ^2-test of linear trend, $\chi^2 = 1.18$, df = 1, $p = 0.28$).

Intensity of vocal responses. There was no significant difference in the proportion of responses that were strong calls between the 2 circles (paired *t*-test on transformed data, $t = 0.96$, df = 2, $p = 0.44$). We pooled the data from the inner and outer circles together in the next analysis. Although the proportion of responses that were strong calls tended to decrease from early to late May, the trend was not significant (23%, 11%, and 7% for early, mid-, and late May, respectively; χ^2-test of linear trend, $\chi^2 = 1.17$, df = 1, $p = 0.28$).

DISCUSSION

The results showed that during the early breeding season, playbacks substantially increased the likelihood of detecting Fairy Pittas. Both the number of stations at which pittas were detected and the number of pittas detected per station increased. Playbacks improved the detectability of the Fairy Pitta at a station by 50%, 71%, and 29%, in early, mid-, and late May, respectively. When Fairy Pittas responded to a playback, they did so quickly. Ninety-four percent

Table 3. Average numbers of Fairy Pittas responding to playbacks that approached the speaker or remained *in situ* during the 10 min playback period in the inner and outer circles on 3 different dates in May 2001

Period	Inner circle			Outer circle		
	Approached speaker	Remained *in situ*	Total	Approached speaker	Remained in situ	Total
Early May	5.67[a]	4.33	10	3.33	10	13.33
Mid-May	2	5.33	7.33	0.67	3.33	4
Late May	1	3.67	4.67	0.33	1.67	2
Average			7.33			6.44

[a]Values from all stations were combined, and averaged over morning, noon, and afternoon.

Table 4. Average numbers of Fairy Pittas responding at 3 vocal intensities (strong, moderate, and weak) during the 10 min playback period in the inner and outer circles on 3 different dates in May 2001

Period	Inner circle				Outer circle			
	Strong	Moderate	Weak	Total	Strong	Moderate	Weak	Total
Early May	5[a]	2.67	2.33	10	5.67	2.67	5	13.33
Mid-May	2	1.33	4	7.33	1.67	0.33	2	4
Late May	1	0.67	3	4.67	0.67	0.33	1	2

[a]Values from all stations were combined, and averaged over morning, noon, and afternoon.

of the responses were recorded within the 1st 5 min of a playback.

Fairy Pittas arrived at the study area around 20 Apr. in 2000 and 2001. Thirteen nests were located in 2001. In four of them, the 1st egg was laid between 8 and 10 May, and in another 5 nests, between 11 and 31 May (R.S. Lin unpubl. data). Nestlings were observed from late May through July. Our earliest 2 sampling periods corresponded with the pre-nesting and early-nesting periods of the Fairy Pitta in the study area. The results suggested that in Taiwan, it is critical to census the Fairy Pitta population during the pre- to early-nesting period, from late Apr. to early May, because the detectability of pittas dramatically decreased after mid-May. Nevertheless, when applying our results to other breeding ranges of the Fairy Pitta, the census should be carried out based on the local breeding schedule of the Fairy Pitta.

Although it seemed that responding Fairy Pittas were likely to remain at the same locations and reduce their calling intensity as the breeding season progressed, the temporal trends were not significant. The calling activity of several other pitta species, such as Noisy Pitta (*Pitta versicolor*) and Gurney's Pitta also peak in the pre-nesting period and decrease with progression of the breeding season (Round 1995, Woodall 1997). This decreasing trend is also consistent with the seasonal patterns of vocalization in other avian taxa (e.g., warblers, Catchpole 1973; crakes, Kaufmann 1988; and rails, Conway et al. 1993).

Playback surveys have been used not only in detecting the presence (e.g., Burger and Lawrence 2001; Currie et al. 2004), but also in estimating the abundance of avian species (e.g., Marion et al. 1981, Richard and Lill 1998, Prescott 2003). Our results suggest that the number of pittas were higher in early May than in mid- or late May. However, several factors could have biased the density estimation of the Fairy Pitta from the playback surveys. First, Fairy Pittas may move toward the playback source before vocalizing. If such a responses occurred, as with Black Rails (*Laterallus jamaicensis*, Legare et al. 1999), the density would have been overestimated. The Fairy Pitta in this study did tend to move toward the speaker after the initial vocalization. Second, the presence of observers and a playback source may silence nearby Fairy Pittas (Gibbs and Melvin 1993), which may have caused an underestimation of the density. For example, even during the most responsive season, only 40% of Yuma Clapper Rails (*Rallus longirostris*) responded to playbacks (Conway et al. 1993). Consequently, it is necessary to determine the proportion of non-responding Fairy Pittas within a certain distance. Marion et al. (1981) found that only approximately half of the Plain Chachalacas (*Ortalis vetula*) responded to playbacks, and thus, they used a correction factor of 2.0 to correct for the density. Third, differences in responsiveness between male and female Fairy Pittas are not clear. Although playbacks normally elicit responses by males in the breeding season (Johnson et al. 1981), responses by females are not uncommon (Appleby et al. 1999, Legare et al. 1999). Both sexes in many species of the family Pittidae give similar calls (Erritzoe and Erritzoe 1998). Finally, the above-mentioned factors may interact with the breeding period, making it difficult to explain the short-term temporal trend we observed. Nevertheless, annual visits to fixed stations during the right time of year can provide a reliable and possibly more-accurate index of abundance that will be useful in assessing long-term population trends over large geographic areas (Geissler and Noon 1981, Legare et al. 1999), and playbacks will play a crucial role in such large-scale surveys.

Overall, our results support the hypothesis that playbacks increase the detectability of Fairy Pittas. We suggest that it is important to census the Fairy Pitta populations during the pre- to early-nesting period. A 5 min playback at a station is sufficient, and could be carried out at any time of the day. However, it may require a visit in the morning and afternoon to ensure a high certainty of the presence or absence of Fairy Pittas at a station, and a better estimation of population density.

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