Short Note (短 報)

**Whisper Song in the Grey Thrush *Turdus cardis*
Immediately Before and After Feeding Their Young**

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Abstract. Many bird species utter a “whisper song” at the nest site, e.g., during nest relief. However, studies on the song and its function tend to be wholly descriptive, and very few quantitative analyses have been conducted. The male Grey Thrush *Turdus cardis* emits the whisper whistle song immediately before and after feeding his young. In this study, the male’s behavior was examined in relation to the female’s presence, for four nests. The male sang on 59.5% of the occasions immediately before arrival at the nest, and on 44.6% of the occasions immediately after departure. In most males, the frequency of singing before arrival did not relate to the presence of the female at the nest. However, on occasions when the male sang before arrival, the female tended to fly away before the male’s arrival, suggesting that the song was used as a sign of nest relief. The male tended to sing immediately after departure more frequently when the female was absent from the nest than when she was present, although the singing did not affect the timing of the female’s next arrival. According to observations made immediately before fledging, nestling activity was synchronized with the frequency of the male’s singing behavior. Thrushes might be suitable subject species to study the role of songs within the family group.

Key words: Grey Thrush, Nestling period, *Turdus cardis*, Whisper song, Whistle.

キーワード: クロツグミ, 育雛期, *Turdus cardis*, 小声のさえずり, ホィッスル.

Introduction

The songs of birds have been well studied, both qualitatively and quantitatively, and arguments have been made regarding functions, such as territory defense, attraction of possible mates, reproductive stimulation of the mate, and guarding of the fertile mate (Catchpole & Slater 2008). However, there have been comparatively fewer investigations into other functions of songs such as the maintenance of the pair bond or family group, and the signal for incubation relief or for feeding the young (e.g., Ritchson 1983, 1986). Although songs during nest relief are recognized in many species, most of the reports have been wholly descriptive (e.g., Armstrong 1973). For example, in Japan, the singing behavior before nest relief has been reported and focused on as the song sung by both sexes (Maruyama 1975, Fujibayashi 1976, Hayashi 1982, Kobayashi 1985). The investigation into the song of the Warbling Vireo *Vireo gilvus* (Howes-Jones 1985) is one of the few studies in which the frequency of the male’s singing at his arrival and departure from the

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nest has been reported quantitatively. However, with respect to nest relief, it has been stated only that the male song appears to be a cue to the female to fly from the nest. Johnson & Kermott (1991) studied the context of the song of the House Wren *Troglodytes aedon* in detail. They determined that the male's whisper song at the nest site functions as a signal of nest relief and provides information regarding safety around the nest for the mate; however, this report was also descriptive.

Recently, several studies have been conducted on the song structure and song function of the Grey Thrush *Turdus cardis*. The full song of this species consists of two parts: a whistle part (low-rate and narrowband frequency elements) and a trill part (high-rate and broadband frequency elements). The male emits the whisper whistle-only song near the mate during the mating period (Ishizuka 2006). This song might play a role in reproductive stimulation of the mate. Dabelsteen *et al.* (1998) proposed that the whisper might be used to avoid attracting neighboring males that are intent on extra-pair copulations. The male Grey Thrush also utters whisper whistle-only songs at the nest site during the nestling period (Ishizuka 2006). It is speculated that this song might function as a communication between the pair and/or between the parent and the young. This whisper signal design is thought to have evolved to counteract detection by predators (Dabelsteen *et al.* 1998).

Conversely, the roles of the full song and trill-only song are closely related to repelling intruders as well as to attracting females (Ishizuka 2008, 2009a, 2009b). The trill-only song (twitter song) is involved in the "quiet song" referred to by Dabelsteen *et al.* (1998). Dabelsteen *et al.* (1998) and Morton (2000) provided some examples of quiet songs functioning as aggressive signals, and proposed the idea of "why quiet." However, these quiet songs are not the subjects of the present study.

Instead, this study focuses on the whisper whistle-only song during the nestling period. It investigates why the male sings near the family, rather than "why quiet," and attempts to analyze the singing behavior quantitatively in order to ascertain whether it provides any function for the mate and/or the nestlings. We examined whether the presence of the female in the nest influenced the male's singing, and whether the male's singing had any effect on the timing of the female's arrival. Furthermore, we observed the feeding the young during the nestling period and also assessed the relationship between the activity of the young and the male's singing in one fledging. If songs were used frequently in the family, and if this is a general habit in thrush species, this group might be suitable subjects to study further themes, e.g., the song learning and the individual recognition by songs.

Methods

Between 1987 and 1989 field observations on the Grey Thrush were conducted in a coastal forest of northwest Kanazawa, Ishikawa Prefecture (36° 35'N, 136° 35'E) from late May to late June, the nestling period of this species. In the Grey Thrush, although only females incubate, males feed young more than do females (Miyazawa 1971). The feeding behavior was observed from a blind set at a distance of 6–8 m from four nests,

which were termed N₁, N₂, N₃, and N₄, respectively. A portion of the observations was made using a video camera (SONY HVC-2500). N₁ was observed for a total of 41.5 h on the 2nd, 4th, and 6th day after the hatching. N₂ was observed for a total of 85.6 h on the 1st, 3rd, 5th, 7th, 9th, and 11th day after the hatching. N₃ was observed for a total of 34.2 h on the 4th, 6th, 8th, and 10th day after the hatching. N₄ was observed for a total of 23.2 h on the 6th, 8th, 10th and 12th day after the hatching. The time of day of the arrival at and departure from the nest and the vocalization of the parent birds were recorded. To facilitate individual recognition, the parent birds were captured using mist nets and uniquely color banded.

The relationship between the male's song and the female's presence at the nest was analyzed using a chi-square test for independence. The relationship between the male's song and the timing of the female's arrival to the nest was also analyzed using Student's *t*-test. In the observation of N₂, the activities of the two nestlings (the last two of the four) were analyzed from the video data for approximately 30 min before fledging. Behaviors of the nestlings were classified into the following seven degrees, which were allotted points; looking around (1 point), stretching (2 points), begging call (3 points), stepping on the edge of the nest (4 points), flapping (5 points), jumping to a perch (6 points), and flying away (7 points). Every 30 s, the total points of the two nestlings were calculated. The points recorded during the male's song and with those recorded at times when he did not sing, except for the period during which he was at the nest, were compared using a *t*-test.

Results

Singing behavior was observed only in the males, and was divided into four patterns as follows:

Pattern A) Singing before arrival at the nest (mean $\pm$ SE: 14.1 $\pm$ 1.0 s before arrival, *n* = 55; the male of N₂), delivering food (usually 3–4 earthworms), on a perch 2–5 m from the nest. Emitting usually 1–2 songs (92.6% of 54 occasions by the male of N₂).

Pattern B) Singing at the nest immediately after feeding the young.

Pattern C) Singing upon flying away from the nest, and sometimes emitting trills.

Pattern D) Singing after departure from the nest (mean $\pm$ SE: 6.5 $\pm$ 1.1 s after departure, *n* = 24; the male of N₂), on a perch 2–5 m from the nest. Emitting usually 1–2 songs (83.4% of 18 occasions by the male of N₂).

The volume of all of the above songs was very low and was barely audible from 10–20 m away, although the male of N₂ often sang loudly at the nest after whisper singing. The mean ($\pm$ SD) frequency of each pattern on all occasions of feeding was 59.5 $\pm$ 15.1%, 13.7 $\pm$ 22.0%, 5.4 $\pm$ 6.4%, 44.6 $\pm$ 10.4%, respectively (*n* = 4, see Table 1). Pattern B was not observed in N₁ and N₄. Pattern C was not observed in N₄. Additionally, the male, in general, uttered low calls while approaching the nest, whether he sang or not.

For N₂, Pattern A was observed more frequently when the female was present at the nest than when she was absent; however, no significant differences were detected for the other three nests (Table 2). When the female changed places with the male and flew away from the nest, two aspects of the male's behavior were observed: the male either sang in

Table 1. Frequency of singing in feeding the young (%). For explanation of the "singing pattern," refer to the text.

Singing pattern	Nest			
	N ₁	N ₂	N ₃	N ₄
A	77.4	71.2	46.3	42.9
B	0.0	51.8	2.9	0.0
C	0.6	15.9	5.1	0.0
D	29.2	42.0	50.0	57.1
Number of the male's feedings observed	168	226	136	28

Table 2. The number of arrivals of the male divided by whether he uttered the whisper song before arrival and whether his mate was present at the nest.

Nest	Female at the nest	Song before arrival		χ^2	<i>P</i>
		+	—		
N ₁	+	107	28	1.39	0.23
	—	23	10		
N ₂	+	88	21	9.26	< 0.01
	—	73	44		
N ₃	+	28	25	0.95	0.33
	—	34	43		
N ₄	+	10	8	3.32	0.07
	—	2	8		

Table 3. Timing of the female's departures from the nest.

Nest	Song before arrival	Timing of the female's departure		χ^2	<i>P</i>
		Before the male's arrival	After the male's arrival		
N ₁	+	71	2	7.26	< 0.01
	—	17	4		
N ₂	+	55	4	4.39	< 0.05
	—	12	4		
N ₃	+	19	1	2.53	0.11
	—	22	6		
N ₄	+	12	0	7.50	< 0.01
	—	4	4		

Pattern A or he did not; further, two aspects of the female's behavior were observed: the female departed either before or after the male's arrival at the nest. On occasions when the male sang in Pattern A before nest relief, the female tended to fly away before the male's arrival (significant differences were detected for three of the four nests; Table 3).

Table 4. The number of departures of the male divided by whether he uttered whisper songs after departure and whether his mate was present at the nest.

Nest	Female at the nest	Song after departure		χ^2	P
		+	—		
N ₁	+	1	47	23.86	<0.01
	—	48	72		
N ₂	+	4	42	26.35	<0.01
	—	91	89		
N ₃	+	0	5	5.44	0.02
	—	68	60		
N ₄	+	0	2	2.87	0.09
	—	16	10		

Table 5. Interval between the male's departure and the female's next arrival (min). Mean $\pm$ SE (n).

Nest	Song after departure		t	P
	+	—		
N ₁	6.2 $\pm$ 0.8 (56)	5.4 $\pm$ 0.5 (40)	−0.92	0.36
N ₂	7.1 $\pm$ 1.0 (61)	5.5 $\pm$ 1.0 (49)	−1.16	0.25
N ₃	6.7 $\pm$ 0.7 (35)	7.3 $\pm$ 0.7 (43)	0.59	0.56
N ₄	10.7 $\pm$ 2.6 (10)	8.7 $\pm$ 2.6 (9)	0.54	0.59

Pattern D tended to be observed more frequently when the female was absent from the nest than when she was present (significant differences were detected for three of the four nests; Table 4). The intervals between the male's departure and the female's next arrival during the instances when the male sang in Pattern D were not significantly different from those when he did not sing (Table 5).

According to the observations made approximately 30 min before the fledging of N₂, the nestlings were restless immediately before and after feeding by the male. During this period, the female did not appear at the nest site. During 5 min before the fledging, the male continued 20 whisper songs near the nest. The mean ($\pm$ SD) point (see the Methods section) for every 30 s was 1.2 $\pm$ 2.4 (n=32) during when the male did not sing, and 10.1 $\pm$ 7.5 (n=15) during when the male did sing (t = −6.13, P < 0.01). After fledging, the whisper songs were also heard in the nesting area of all four nests.

Discussion

There are several reports and interpretations of song in the nest site for various thrush species. The female Blackbird *T. merula* sings at feeding to elicit the begging calls from the young (Messmer & Messmer 1956); the Redwing *T. iliacus* sings to lead the young to fledge (Armstrong 1973); the male Rufous-backed Thrush *T. rufopalliatatus* has been

observed to utter whisper songs immediately after feeding his young (Grabowski 1979); and both the male and female Siberian Ground Thrush *T. sibiricus* utter whisper songs at incubation relief (Fujibayashi 1976). Whisper singing during the incubation or nestling period is probably not a rare habit in thrushes, although most reports are descriptive. If the singer's context and the temporal change in the song outputs are quantitatively analyzed, the results will contribute to the understanding of whether the whisper song emitted near the family has a certain general function.

In the present study of the Grey Thrush, the singing Patterns B and C were not observed in all of the nests, suggesting them to not be general habits in this species. In contrast, Patterns A and D were observed in all four nests. The male did not necessarily frequently sing in Pattern A in the presence of the female at the nest. However, the female tended to depart from the nest before the male's arrival when he sang in Pattern A. Therefore, singing in Pattern A seems to stimulate the female to depart from the nest, although the male's call and visual recognition might also contribute towards the female's departure before the male's arrival. That is, the female recognized the male's whisper song before feeding young as one of the signals of the nest relief. The male House Wren also sings whisper songs immediately before and after feeding his young, suggesting possible functions as a signal of arrival and as a way to inform the mate of the safety of the nest site (Johnson & Kermott 1991). This possibility might be consistent with the case of the Grey Thrush. The female's absence might elicit the male's singing in Pattern D. However, singing in Pattern D was not observed to affect the timing of the female's next arrival, i.e., there was no evidence that the male's whisper song after feeding his young was recognized as any signal by the female.

However, the whisper song is reliable evidence of the male being near the nest, which is beneficial for the young. According to the observations of fledging, the activity of the young synchronized with the frequency of the male's singing behavior. There is a possibility that the activity of the young and the song of the male elicited each other. Soon after fledging (2–7 days after), the female begins to build the nest for the second brood and the male mainly leads the fledglings (Miyazawa 1971). This is one possible reason why the female Grey Thrush does not sing and why the male uses not only calls but also songs to lead the young, if the whisper song has a function to maintain the family group.

It has been considered that the song after fledging provides the young with opportunities to learn the song (Greig-Smith 1982, Ritchson 1983). There is some evidence that the young recognize the song of their own parent (Ritchison 1983), and in which the female recognizes the song of her mate (Wiley *et al.* 1991, Lind *et al.* 1996). To evaluate these hypotheses, experimental studies in the nestling and fledgling periods are necessary. Thrushes might be suitable subject species for these themes, since songs sung near the family are observed generally within the genus *Turdus* and frequently within a species, e.g., the Grey Thrush.

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References

- Armstrong, E. A. 1973. *A Study of Bird Song*. Dover Publications, New York.
- Catchpole, C. K. & Slater, P. J. B. 2008. *Bird Song: Biological themes and variations, 2nd edition*. Cambridge University Press, Cambridge.
- Dabelsteen, T., McGregor, P. K., Lampe, H. M., Langmore, N. E. & Holland, J. 1998. Quiet song in song birds: an overlooked phenomenon. *Bioacoustics* **9**: 89–105.
- Fujibayashi, K. 1976. Responsive song to playback: Siberian ground thrush. In *The Life of Wild Birds, Vol. 2* (ed. K. Haneda), pp. 80–83. Tsukiji-shokan, Tokyo (in Japanese).
- Grabowski, G. L. 1979. Vocalizations of the rufous-backed thrush (*Turdus rufopalliatu*s) in Guerrero, Mexico. *Condor* **81**: 409–416.
- Greig-Smith, P. W. 1982. Seasonal patterns of song production by male stonechats *Saxicola torquata*. *Ornis Scandinavica* **13**: 225–231.
- Hayashi, M. 1982. New breeding record of fairly pitta (*Pitta brachyura*) in Nagano Prefecture. *Strix* **1**: 123–124 (in Japanese).
- Howes-Jones, D. 1985. Relationships among song activity, context, and social behavior in the warbling vireo. *Wilson Bulletin* **97**: 4–20.
- Ishizuka, T. 2006. Song structure, song repertoire and individual identification by song of the Grey Thrush *Turdus cardis*. *Journal of the Yamashina Institute for Ornithology* **37**: 113–136 (in Japanese with an English abstract).
- Ishizuka, T. 2008. Changes in song structure and singing pattern of the Grey Thrush *Turdus cardis* as responses to song playback and mate removal experiments. *Ornithological Science* **7**: 157–161.
- Ishizuka, T. 2009a. Repertoire sizes of the whistle and trill parts of the song of the Grey Thrush *Turdus cardis* in relation to the mating success of the males. *Journal of the Yamashina Institute for Ornithology* **40**: 83–89.
- Ishizuka, T. 2009b. Singing behavior in polygynous Grey Thrush *Turdus cardis* males. *Ornithological Science* **8**: 87–90.
- Johnson, L. S. & Kermott, L. H. 1991. The function of song in male house wrens (*Troglodytes aedon*). *Behaviour* **116**: 190–209.
- Kobayashi, T. 1985. The female singing in the nest: Paradise flycatcher. In *The Life of Wild Birds, Vol. 3* (ed. K. Haneda), pp. 94–98. Tsukiji-shokan, Tokyo (in Japanese).
- Lind, H., Dabelsteen, T. & McGregor, P. K. 1996. Female great tits can identify mates by song. *Animal Behaviour* **52**: 667–671.
- Maruyama, S. 1975. Less territoriality: Japanese grosbeak. In *The Life of Wild Birds, Vol. 1* (ed. K. Haneda), pp. 38–42. Tsukiji-shokan, Tokyo (in Japanese).
- Messmer, E. & Messmer, I. 1956. Die Entwicklung der Lautausserungen und Einiger Verhaltensweisen der Amsel (*Turdus merula merula* L.) unter Naturuchen Bedingungen und nach Einzelaufzucht in Schalldichtem Raumen. *Zeitschrift für Tierpsychologie* **13**: 341–441.
- Miyazawa, K. 1971. Life history of the Grey Thrush *Turdus cardis*: breeding ecology. *Miscellaneous Reports of the Yamashina Institute for Ornithology* **6**: 300–315 (in Japanese with English summary).
- Morton, E. S. 2000. An evolutionary view of the origins and functions of avian vocal communication. *Japanese Journal of Ornithology* **49**: 69–78.
- Ritchson, G. 1983. The function of singing in female black-headed grosbeaks (*Pheucticus melanocephalus*): family-group maintenance. *Auk* **100**: 105–116.
- Ritchson, G. 1986. The singing behavior of female northern cardinals. *Condor* **88**: 156–159.
- Wiley, R. H., Hatchwell, B. J. & Davies, N. B. 1991. Recognition of individual males' songs by female dunnocks: a mechanism increasing the number of copulatory partners and reproductive success. *Ethology* **88**: 145–153.

クロツグミ *Turdus cardis* における雛への給餌前後の小声のさえずり

巣の周辺における小声のさえずりは多くの鳴禽類で知られている（巣における雌雄の交代の際のさえずりなど）。しかし、そのさえずりやその機能についての研究は記述的な傾向にあり、定量的な分析は非常に少なかった。クロツグミ *Turdus cardis* の雄は雛への給餌の直前直後に少数回、小声のホイッスルでさえずる。本研究では4巣について、訪巣、離巣、小声のさえずりといった雄の行動を、雌の存在や行動と関連づけて調べた。雄は訪巣直前の59.5%の機会において、また離巣直後の44.6%の機会においてさえずった。ほとんどの雄で、訪巣直前のさえずりの頻度と、雌の在巣との関係はみられなかった。しかし、雄が訪巣直前にさえずった場合、雌は雄の到着前に離巣する傾向があった。このことは、さえずりが巣における交代の合図として使われていることを示唆する。雌が巣にいないときほど、雄は離巣直後にさえずる傾向があった。但し、そのさえずりは雌の次回の訪巣のタイミングに影響しなかった。巣立ち直前の観察では、雛の活発さと雄のさえずり行動の頻度は同調していた。ツグミ類は家族内のさえずりを研究する好適な対象かもしれない。

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