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The effect of environmental conditions on the start of dawn singing of blackbirds (*Turdus merula*) and Bulbuls (*Pycnonotidae*)

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Abstract

Environmental pollution is known to influence bird behavior in many ways. In this study, the effect of noise, street lighting, moon light and weather conditions on the start of dawn singing of the two most common bird species in the area, bulbuls (Pycnonotus barbatus) and blackbirds (Turdus merula) is studied in a filed environment over a period of three autumn months. Results show that streetand moon lighting and the call for prayers by mosque loud speakers did not affect the start of singing compared to sunrise. Weather conditions (wind and rain) are the main factors that influenced the onset of singing in these two species. A relationship between sunrise and start of singing is established for blackbirds and bulbuls. Results show that sunlight,but not moonlight, affected the onset of dawn chorus in bulbuls and blackbirds. This study could serve as a record for similar future investigations on the influence of environmental conditions on birds behavior in the region.

الملخص

يتأثر سلوك الطيور بالتغيير البيئي والمناخي بعدة طرق منها التغيير في بداية وقت الغناء الصباحي . لقد تم في هذه الدراسة الميدانية تتبع وقت الغناء الصباحي لكل من طائر البلبل وطائر السود ودراسة تأثير الصوت العالي / الضجيج، الإضاءة الصناعية، ضوء القمر والعوامل المناخية مثل المطر و الرياح لمدة 3 أشهر في نهاية الصيف وبداية الخريف . عند مقارنة بدء الغناء مع وقت شروق الشمس فانه لم يظهر أي فرق بين الطيور التي تعيش في منطقة مضاءة صناعيا (أضواء الشوارع) وبين المناطق غير المضاءة. كذلك لم يلاحظ آي تغيير في وقت الغناء عندما يكون القمر كاملا. إن نداء صلاة الفجر الأول و الثاني لم يظهر إنهما يوقظان هذه الطيور ولم تغن أي منها بعد الأذان مباشرة أو خلال فترة وجيزة. إن العوامل الوحيدة التي أحدثت تغييرا هي هطول الأمطار الغزيرة أو الرياح الشديدة. تكمن أهمية هذه الدراسة و أية دراسات مشابهة في مناطق أخرى من الشرق الأوسط في أنها ستحدد نمط سلوك طيور المنطقة بحيث يمكن الرجوع لهذه النتائج مستقبلا وسيكون هذا مرجعا للجميع وإذا كان هناك تغييرات في هذا النمط فسيدل ذلك على تغيير في سلوك الطيور وبالتالي على التغيير البيئي والمناخي

Keywords: Bulbuls, Blackbirds, Sunrise, Noise, Light, Weather, Singing.

1. Introduction

Environmental pollutants can trigger responses that might affect many animals behavior in a way that may enhance or harm their chances of survival and reproduction. Artificial lighting is considered as an environmental pollutant that might disrupt biological clocks that evolved to natural patterns of light and dark (Longcore and Rich 2004). Artificial light can cause disorientation and trapping of birds (Odgen 1996, Rich and Longcore 2006). Environmental noise was shown to affect birds singing. High daytime *noise* levels in urban areas have caused *robins* to *sing* at night (Fuller et al. 2007) and great tits (Parus major) to sing in noisy areas at a higher pitch to avoid the detrimental effect of auditory masking (Slabbekoorn and Peet 2003 and Brumm 2004).

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Bird's biological clock is adjusted to photoperiod. In the wild, animals rely on the cycling of the sun, and the seasons to adjust their biological clocks and metabolism (Thrush 1999). Birds have a highly developed sense of light. Their biological clock depends on the sun and changes in the quality of light and length of the day, which sets the stage for breeding, migration, molting, and daily behavior patterns. It is believed that relatively larger eyed birds start singing earlier (Berg et al. 2006)

The two bird species investigated in this study are the two most common resident bird species in the area. Both start singing before sunrise, singing throughout the day and stop singing just after sunset but do not sing during the night. It is thought that the increase of light intensity around sunrise makes the birds start singing. The onset of birds singing varies among species. Some start singing as early as one hour before sunrise such as robins (Erithacus rubecula) while others start around few minutes before sunrise like common house sparrow *(*Passer domesticus*)* . Northern mockingbirds (Mimus polyglottos) start singing 0.5 to 1 hour before sunrise and continue singing

throughout the day (Hill et al. 2005). The activity of birds can also be influenced by the intensity of moonlight (Wilson and Watts 2006).

In this study, the effect of moonlighting and other environmental factors such as noise, street lighting, and changing weather conditions on the start of singing of these two species is monitored in their natural habitat. It is expected that these birds will have a constant pattern of singing in future years and any change in this pattern might indicate a change in environmental conditions that lead to behavioral change.

2. Methods

In this study, we investigated free Bulbuls (*Pycnonotidae*) and blackbirds **(***Turdus merula***)** in their natural habitat without any human interference .The timing of first singing is recorded on a calendar that shows the daily sunrise / sunset and the five daily Moslem prayers in two adjacent locations; one is in front of a group of houses alongside a street where street lighting is installed and the other is in the back of the same houses about one hundred meters away where there is no artificial lighting or traffic. Street lights were switched on 15 minutes after sunset and switched off 40 minutes before sunrise. Tables and graphs showing singing times and sunrise times for the months of October, November and December 2008 are determined. October is early autumn in Middle East where days are still warm and some nights start to cool down a bit. Days also get shorter almost everyday which allows for comparing singing times with steady changes in sun photoperiod. This period also allows for monitoring of the effect of moon lighting on start of singing during full lunar months since the start of October coincided with the start of a lunar month. Nights are generally clear without clouds. The situation is very similar in November and December, but nights are usually colder than in October with the chance of having cloudy, windy or rainy nights. The study site is a hill at the outskirts of Tulkarem town in the West Bank, Palestinian Authority Territory. This is a very quiet location with few houses that have large gardens, and there are no main roads and no heavy traffic. It is very rare to have vehicles passing by between 10:00PM and 6:00AM. The number of birds investigated is not exactly known, but it can be assumed that there were 5-10 birds that started singing immediately after the first singer.

3. Results:

The start of singing of blackbirds and bulbuls changed with the time of sunrise. Birds commenced singing within one minute on both locations. This indicates that street lighting is not a determinant factor in birds singing in this study. Tables 1, 2 and 3 show the start of singing and sunrise times for the months of October, November and December 2008, consecutively. Graphs in figure 1, 2 and 3 show the time difference between start of singing and sunrise for the months of October, November and December consecutively. Blackbirds start singing earlier than bulbuls. In bulbuls the onset of singing was more regular than in blackbirds, though both species showed a

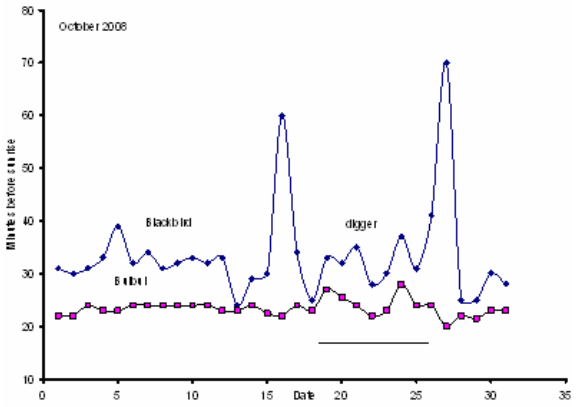

Figure 1. Difference between start of singing and sunrise for October 2008

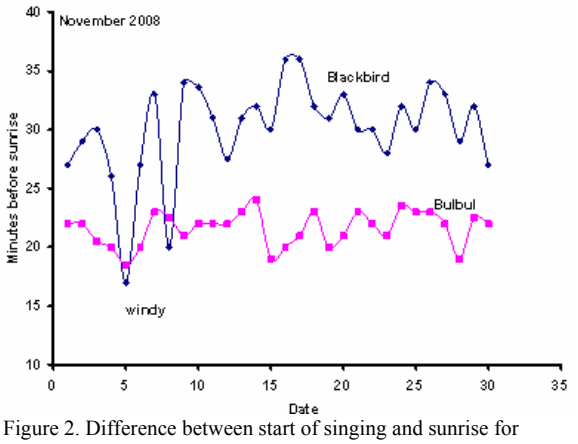

Figure 2. Difference between start of singing and sunrise for November 2008

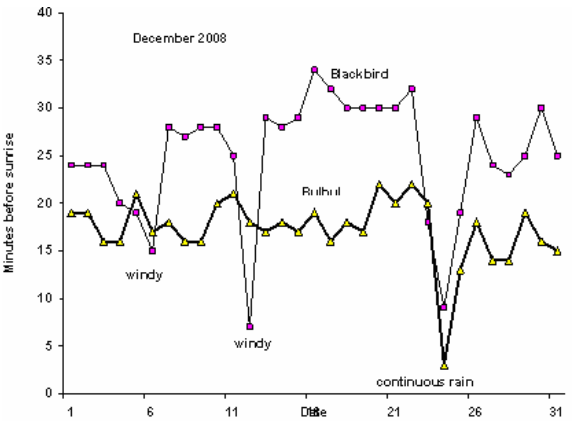

Figure 3. Difference between start of singing and sunrise for December 2008

similar pattern. Moonlight had no effect on the start of singing of both birds. As mentioned earlier, the start of October coincided with the start of a lunar month. Therefore, full moon was around the 15th of the month. Data and figures do not show any obvious variations in the start of singing of both these birds at this time or around it for three consecutive months. Moderate to strong wind and continuous moderate to heavy rain affected blackbirds and bulbuls considerably. Light drizzle a short time (15 min) before or at the time of singing has no effect. Blackbirds were more influenced than bulbuls. They started singing later than usual even later than bulbuls in some occasions. The first call for the dawn prayer by mosques loudspeakers is usually around 90 minutes before sunrise while the

Table 1. Start of singing and time difference before sunrise for October 2008

	Sunrise	Start of singing		difference (min)	
October	hr.min	Blackbird	Bulbul	blackbird	Bulbul
1	5.31	5.00	5.08	31	22
2	5.32	5.02	5.10	30	22
3	5.32	5.01	5.08	31	24
4	5.33	5.00	5.10	33	23
5	5.34	4.55	5.11	39	23
6	5.34	5.01	5.10	32	24
7	5.35	5.01	5.10	34	24
8	5.36	5.05	5.12	31	24
9	5.36	5.04	5.12	32	24
10	5.37	5.04	5.13	33	24
11	5.38	5.06	5.14	32	24
12	5.38	5.05	5.15	33	23
13	5.39	5.15	5.16	24	23
14	5.40	5.11	5.16	29	24
15	5.40	5.10	5.175	30	22.5
16	5.41	4.40	5.19	60	22
17	5.42	5.08	5.18	34	24
18	5.43	5.18	5.2	25	23
*19	5.43	5.10	5.16	33	27
20	5.44	5.12	5.185	32	25.5
21	5.45	5.10	5.21	35	24
*22	5.46	5.18	5.24	28	22
23	5.47	5.17	5.24	30	23
*24	5.47	5.10	5.19	37	28
25	5.48	5.17	5.24	31	24
26	5.49	5.08	5.25	41	24
*27	5.49	4.40	5.29	70	20
28	5.50	5.25	5.28	25	22
29	5.51	5.26	5.295	25	21.5
30	5.52	5.22	5.29	30	23
31	5.53	5.25	5.3	28	23
* digger			average	33.48387	23.43548

Table 2. Start of singing and time difference before sunrise for November 2008

	Sunrise	Start singing		difference (min)	
November	hr.min	Blackbird	Bulbul	blackbird	Bulbul
1	5.53	5.26	5.31	27	22
2	5.54	5.25	5.32	29	22
3	5.55	5.25	5.34.5	30	20.5
4	5.56	5.30	5.36	26	20
*5	5.57	5.40	5.39	17	18
6	5.57	5.30	5.37	27	20
7	5.58	5.25	5.35	33	23
*8	5.59	5.39	5.36.5	20	22.5
9	6.00	5.26	5.39	34	21
10	6.01	5.275	5.39	33.6	22
11	6.02	5.31	5.40	31	22
12	6.02	5.35	5.40	28	22
13	6.03	5.32	5.40	31	23
14	6.04	5.32	5.40	32	24
15	6.05	5.35	5.46	30	19
16	6.06	5.30	5.46	36	20
17	6.07	5.31	5.46	36	21
18	6.07	5.35	5.44	32	23
19	6.08	5.37	5.48	31	20
20	6.09	5.36	5.48	33	21
21	6.10	5.40	5.47	30	23
22	6.11	5.41	5.49	30	22
23	6.12	5.44	5.51	28	21
24	6.12	5.4	5.49	32	24
25	6.13	5.43	5.5	30	23
26	6.14	5.40	5.51	34	23
27	6.15	5.42	5.53	33	22
28	6.16	5.47	5.57	29	19
29	6.17	5.45	5.55	32	23
30	6.17	5.50	5.55	27	22
* light-moderate wind			average	30.03667	21.58333

second call for dawn prayer is around 75 minutes before sunrise. These calls do not seem to waken up these birds since blackbirds started singing around 30 minutes before sunrise while bulbuls started at around 20 minutes before sunrise. The disturbance shown between the 19th and the 25th of October might be due to noise caused by a digger that was doing some construction work in the neighborhood (Fig 1). There is no explanation for the big change (about one hour) on the days of the 16th and 27th of October (Fig 1,).

4. Discussion:

The start of bird singing is used as a marker to investigate the effect of light, noise and changing weather conditions on birds' behavior. The start of singing varies between different species of birds.

For example, mockingbirds occasionally sing more than one hour before sunrise (Merritt 1984) and this species are known to sing also in moonlit nights (Hill et al. 2005, Allard 1930). This study shows that blackbirds and bulbuls started singing about 30 min and 20 min respectively before sunrise. Street lights and moonlighting had no effect on the start of singing of the two birds while noise caused by diggers but not by mosques loudspeakers delayed the onset of dawn chorus. It was shown (Wilson and Watts, 2006) that moonlighting influenced the start of birds singing. This is in contrast to our findings.

The most prominent factor that affected the start of singing in blackbirds and bulbuls were weather conditions. It is known that weather has an influence on birds songs in that both cool and hot weather will decrease the amount of singing, as do rain and wind (Catchpole & Slater 2008).

Table 3. Start of singing and time difference before sunrise for December 2008

	sunrise	Start singing		difference (min)	
December	Hr.min	blackbird	bulbul	blackbird	bulbul
1	6,18	5,54	5,59	24	19
2	6,19	5,55	6,00	24	19
3	6,20	5,56	6,04	24	16
4	6,20	6,00	6,04	20	16
*5	6,21	6,02	6,00	19	21
*6	6,22	6,07	6,05	15	17
7	6,23	5,55	6,05	28	18
8	6,23	5,56	6,07	27	16
9	6,24	5,56	6,08	28	16
10	6,25	5,57	6,05	28	20
11	6,26	6,01	6,05	25	21
*12	6,26	6,19	6,08	7	18
13	6,27	5,58	6,10	29	17
14	6,28	6,00	6,10	28	18
15	6,28	5,59	6,11	29	17
16	6,29	5,55	6,10	34	19
17	6,29	5,57	6,11	32	16
18	6,30	6,00	6,12	30	18
19	6,30	6,00	6,13	30	17
20	6,32	6,02	6,10	30	22
21	6,32	6,02	6,08	30	20
22	6,32	6,00	6,10	32	22
23	6,32	6,04	6,12	18	20
**24	6,33	6,24	6,30	9	3
***25	6,33	6,14	6,20	19	13
26	6,34	6,05	6,16	29	18
27	6,34	6,10	6,20	24	14
28	6,34	6,11	6,20	23	14
29	6,35	6,10	6,16	25	19
30	6,35	6,05	6,19	30	16
#31	6,35	6,10	6,20	25	15
* moderate wind			average	25	17.25806

**medium rain all night, first real winter day in season

***light rain #light drizzle during night

The amount of clouds in the skies does not affect the start of singing in this study although it is reported that cloudiness in the morning will delay singing (Hill et al. 2005). The amount of sun light rather than moonlight and the time of day determined the beginning and end of singing. Most birds show a seasonal variation that is mainly correlated with breeding activities and hormone production. In winter months these birds start singing closer to sunrise, but the time difference is not too big, about 10 minutes only. For most species, hormones, stimulated by photoperiod, probably play a dominant role in determining the time of year a bird sings. The injection of male hormones into male birds in mid-winter will start them singing (Wilson and Watts 2006). Dawn chorus is also shown to be a reliable indicator of male quality and social interactions (Amrhein & Erne 2006). Harsh weather conditions can cause stress in birds. Birds produce cortisone in response to this stress that might trigger physiological and behavioral changes to ameliorate these effects (Romeo et al. 2000).

Finally, this study clearly shows that moonlight and street lighting had no effect on start of dawn singing and it establishes a pattern for the two main singing birds in the region with a clear correlation with sunrise. In comparison to other cities where similar studies were undertaken (Fuller et al. 2007) the anthropogenic impact on birdsong seems to be small.

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