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Effect of relative humidity in an arid environment on dawn chorus

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Abstract

Birds have adapted to arid environments by evolving suitable behaviour to cope with these environments. Outbursts of sudden rain in an arid environment can dramatically affect relative humidity. The effect of changes in relative humidity on start of dawn chorus is studied in two common resident passerine birds, bulbuls and sparrows. The study shows that start of dawn chorus has no significant correlation with relative humidity. The only significant correlation (0.026) was found in the month of January for sparrows. There was no significant correlation for bulbuls in period of study.

Keywords: Dawn chorus, relative humidity, desert, bulbuls, sparrows

1. Introduction

Birds have evolved their behaviour to cope with arid environments and harsh desert climate [1]. Many bird resident species have evolved hunting behaviour that enables them to remain inactive during the hottest parts of the day and become active during early morning or late evening periods. Desert bulbuls and sparrows, the main residential species in Riyadh start their dawn chorus exceptionally very early (more than two hours) at dawn from early spring to early summer. This is in contrast to the same species at different climates geographical locations [2, 3]. Weather conditions can significantly influence sound propagation [4, 5]. Water molecules are much less massive than oxygen, nitrogen or carbon dioxide molecules, and so the greater the fraction of air that is made up of water vapor, the less mass per unit volume, and the less dense the air becomes. Lower density translates into faster sound wave travel, so sound waves travel faster at high humidity [6, 7]. Lower temperatures and high humidity at dawn have been shown to restrict activity of both birds and their prey [8]. Temperature and relative humidity have been shown to independently affect animal behaviour [9, 10]. The objective of this study is to determine if marked fluctuations in relative humidity affect the start of dawn chorus in two residential local birds.

2. Materials and Methods

2.1 Start of dawn chorus: The start of dawn chorus for bulbuls (*Pycnonotus leucotis*) and sparrows(*Passer domesticus*) was recorded daily from December 2015 until end of February 2016 on a calendar that shows sunrise and sunset as previously mentioned according to Hasan et al [3]. The location was at a University Housing Compound that is located east of Riyadh city, 240 76' N 460 86 'E. Altitude is 576 m above sea level. This is a quiet and very large housing compound with lots of shrubs, trees. It has almost zero traffic noise (noise level did not exceed 30 dB) but it is well lit during nights The difference between the start of singing and sunrise is calculated and plotted against % relative humidity using Excel 2010 software.

2.2 Relative humidity: This was taken from appropriate websites (weatheronline.co.uk, www.accuweather.com/en/sa/riyadh).

2.3 Statistical Analysis: Pearson correlation coefficient and significance was calculated to determine any association between start of dawn chorus and relative humidity. The correlation coefficient was considered significant if the test p-value was <0.05.

3. Results and discussion

Increasing relative humidity results in decreasing air density and this might affect acoustic transmission which in turn could affect start of dawn chorus as bird songs propagate most

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effectively at dawn [11]. Therefore, the relationship between relative humidity and start of dawn chorus for bulbuls and sparrows was determined for the months of December 2015, January 2016 and February 2016. These months were chosen because significant differences in relative humidity can occur. Figures 1, 2 and 3 show data for the months of December 2015, January 2016 and February 2016 respectively.

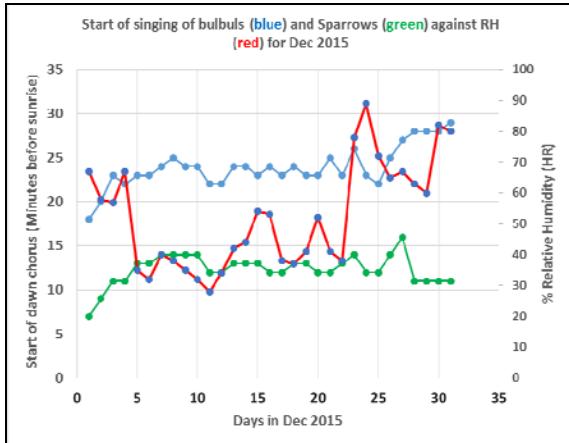


Fig 1: Effect of % relative humidity on dawn chorus for the month of December 2015.

Similarly, figures 2 and 3 show data for the months of January and February 2016 respectively.

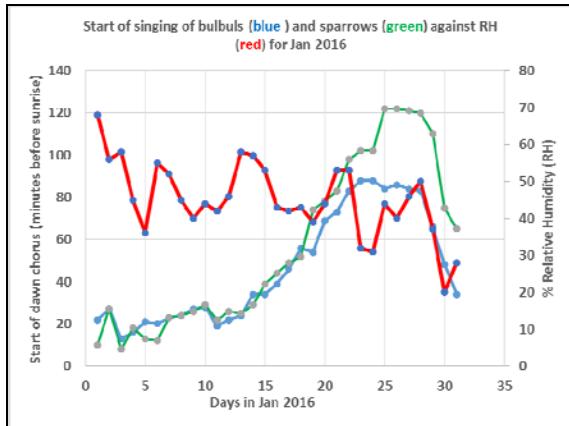


Fig 2: Effect of % relative humidity on dawn chorus for the month of January 2016.

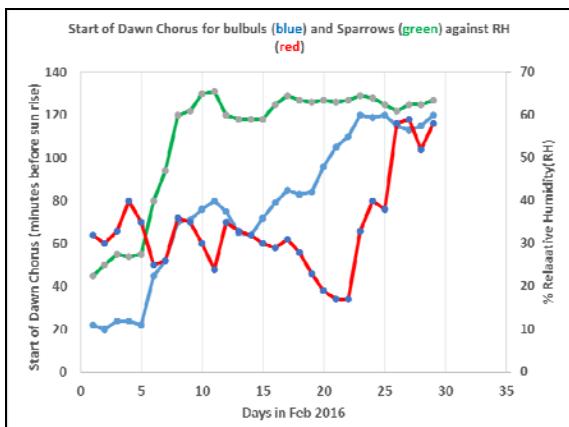


Fig 3: Effect of % relative humidity on dawn chorus for the month of February 2016

The correlation and significance between relative humidity and start of dawn chorus for these three months of study was investigated using appropriate statistical analysis is shown in table 1.

Table 1: Correlation and significance between start of singing and relative humidity

Variable	Bulbul	Sparrow		
Statistical values	r	p	r	p
Dec 2015	0.292	0.115	-0.315	0.0841
Jan 2016	-0.31	0.0895	-0.399	0.026
Feb 2016	0.285	0.133	0.043	0.82

Table 1 shows that there is a very weak correlation both positive and negative for both bird species but it is not significant anyway except for the month of January in case of sparrows only (0.026).

Another important factor that might affect acoustic transmission is temperature. Increasing temperature will also decrease density. If changing both at the same time, the effect on density will depend on which way you change each. Therefore, changing temperature and humidity will affect sound acoustics [12] and could change animal behaviour [13].

This study is mainly concerned with the effect of humidity on dawn chorus. The effect of changing temperature was studied extensively and it was clearly shown that increasing temperature late winter and early spring (months of January / February) has a dramatic effect in making birds start singing very early. Those studies have shown that fluctuations in ambient temperature have resulted in changing the start of dawn chorus in bulbuls and sparrows resident in arid environment especially in winter and spring months [3, 14].

Dabelsteen and Mathevon [15] showed that that dawn conditions in a temperate deciduous forest do not always constitute the best circumstances for long-range communication and therefore that the dawn chorus cannot be explained by the sound transmission hypothesis. This supports our findings that start of dawn chorus in arid environment may not be affected by changes in air humidity.

4. Conclusion

The results of this particular study under these conditions show that changes in relative humidity had no effect on the start of dawn chorus for bulbuls and sparrows. Dawn chorus is only affected during but not after precipitation. The only significant but negative correlation was for sparrows in the month of January. This only can be explained to be a coincidence since sparrow singing starts very early due to increasing temperature and not due to lowering humidity. This is in agreement with studies that suggest that dawn chorus cannot always be explained by sound transmission hypothesis.

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