Department of Biosciences

Using acoustic indices to track the avian dawn chorus across Great Britain

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Introduction

The collection of large-scale ecological data is increasingly moving towards automation to collate 'big data'. Autonomous acoustic recorders (ARUs) offer a novel means for collecting such data for vocal taxa such as birds. Acoustic Indices (AIs) provide a solution to the problem of extracting information from the huge amount of data amassed.

The onset and peak of the avian dawn chorus is hypothesised to track the rising sun[1], and birds may be expected to sing less, and later, on cold mornings[2]. However, the degree to which light levels interact with climate remains unknown, as does the degree of adaptation in local bird communities. We utilised ARUs and AIs to examine the relative importance of light and temperature on dawn vocalisation in birds.

Methods

- ARUs captured the daily dawn chorus at woodland sites throughout Britain for up to four annual breeding seasons.
- Entire soundscapes from selected sites were analysed using the Acoustic Complexity Index (ACI)[3].
- Peaks in ACI scores were correlated with minimum overnight temperature readings taken directly at each site.

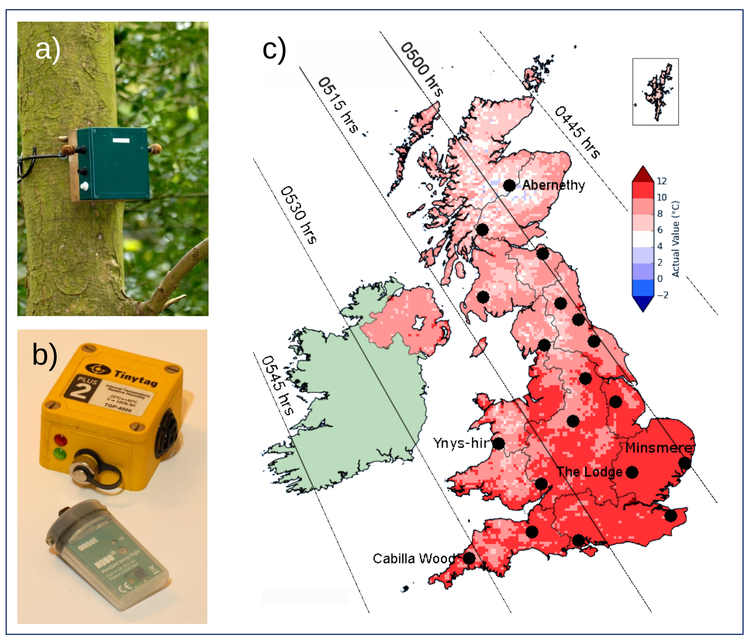

Figure 1 a) The SM2+ ARU in the field, b) loggers were used to record temperature, and c) The mean temperature of Great Britain in spring 2017. Markers show the location of study sites. Isochrones link locations with the same times of sunrise in May.

Results

- Timing of seasonal peaks in ACI scores varied between sites, most notably at the northernmost latitude (Abernethy). There was little variation longitudinally.
- With the exception of Abernethy, the timing of song onset in relation to sunrise was consistent between sites.

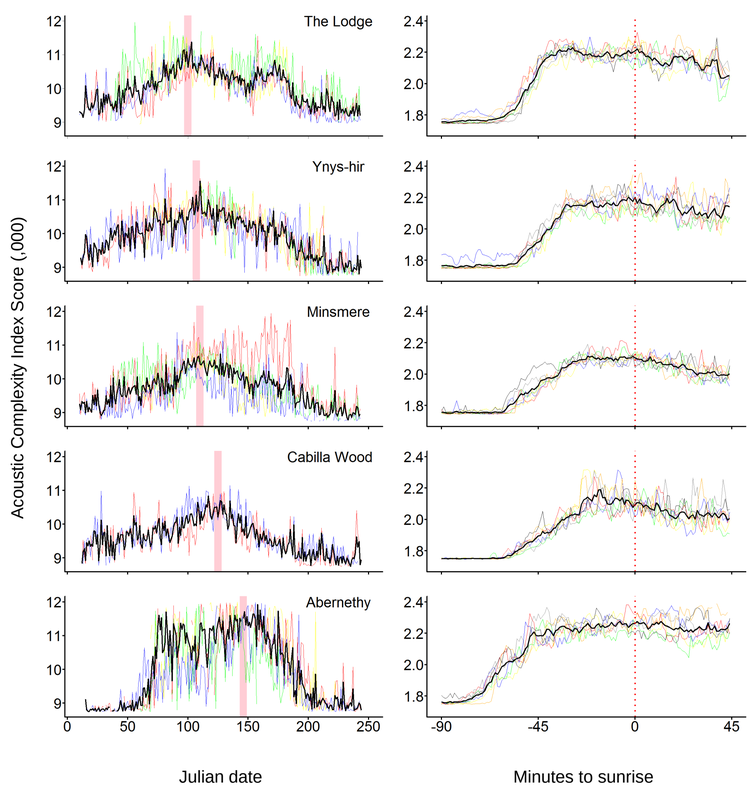

Figure 2 (left panel) The mean seasonal ACI scores for 5-minute periods at sunrise daily. Colours show different years, black shows the mean. Pink bars show the peak 7-day period. (right panel) ACI score per minute during the 7-day peak. Colours show the mean for each date, black shows the overall mean.

- During the seasonal peak at Abernethy, there was a negative relationship of minimum temperature with both ACI at sunrise and the time of the daily dawn peak in ACI. Minimum temperature had little influence at most other sites.

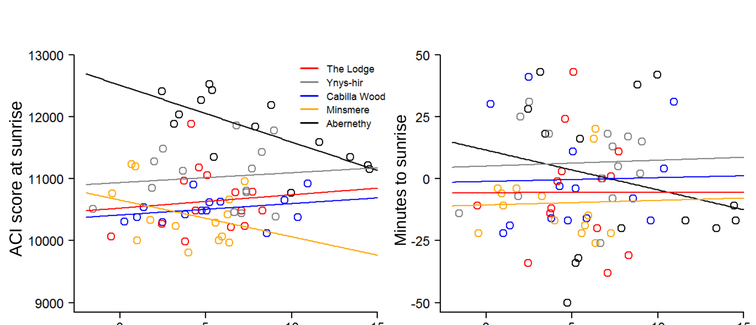

Figure 3 The relationship between minimum overnight temperature and (left) the ACI score at sunrise, and (right) the time of the daily peak in ACI score during the 7-day peak in seasonal ACI score.

Conclusions

- AIs produce a rapid and effective overview of seasonal and daily trends in the avian dawn chorus.
- A remarkable consistency amongst most sites of chorus onset relative to local sunrise suggests a light-related cue.
- Temperature was not always influential on daily chorus onset and peak. Factors relating to breeding stage may be more important during the seasonal peak in song activity.
- Further work will examine species-specific responses. Early singing species may have a closer association with light-levels.

Figure 4 Song onset in early singing species, such as Robin *Erithacus rubecula,* may be more sensitive to variation in light levels than species that sing later, such as chaffinch *Fringilla coelebs* (inset, top) and chiffchaff *Phylloscopus collybita* (inset, bottom).

References

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3 Pieretti, N, Farina, A. (2011) A new methodology to infer the singing activity of an avian community: the Acoustic Complexity Index (ACI). *Ecological Indicators*, **11**, 868-873

Acknowledgements

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