POLLINATOR MONITORING: THE ACCURACY OF BIOACOUSTIC TECHNOLOGY FOR POLLINATOR MONITORING IN COMPARISON WITH TRADITIONAL MONITORING METHODS

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INTRODUCTION

- Insect pollinators hold significant ecological and economic value.
- All major insect pollinator groups, including honeybees, bumblebees, solitary bees, and hoverflies, have experienced significant population declines.
- Urbanisation is considered a major cause of this decline.
- Urban areas have been relatively understudied in terms of pollination activity.
- Pollinator monitoring can help identify favourable habitats within urban areas, which can then inform targeted conservation strategies.
- Traditional pollinator monitoring involves methods like pan trapping, flower-insect timed (FIT) counts, malaise trapping, and pitfall trapping.
- While some research has been done into the accuracy of bioacoustic monitoring for pollinator detection and classification, there have not been studies that compare the accuracy of bioacoustics as a measure of pollinator activity with traditional monitoring methods.

AIMS

- It was hypothesised that, after accounting for variables such as weather conditions and site characteristics, bioacoustic data would exhibit a significant linear relationship with the activity recorded by traditional methods, thereby providing comparable results.
- Additionally, the study seeks to determine whether bioacoustic monitoring accurately represents the activity of all pollinator groups or predominantly reflects the activity of louder insect species.

METHODOLOGY

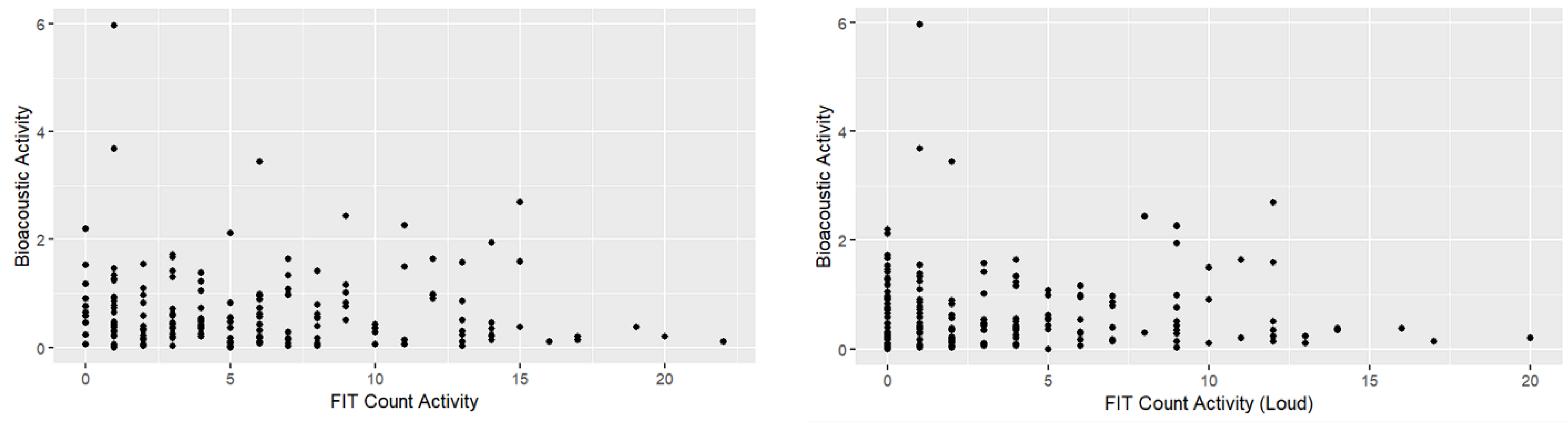
Six sites on the University of Leeds campus (an urban landscape) were selected for monitoring based on their habitat type and likelihood of experiencing pollinator activity.

- At each site, an Agrisound Polly 2.0 device was installed to record acoustic data for six weeks.
- FIT counts were conducted at each site 3 times a day, 2-3 times a week during this six week period.
- Pan-traps were set up at each site on 3 days with differing weather conditions and the collected samples were identified down to Family in the lab.

The data obtained was then compiled into suitable tables and the pollinator activity recorded by the different methods was compared using different linear models in RStudio.

ANALYSIS

- Each FIT count record was aligned with its corresponding bioacoustic record.
- Simple correlation tests and plots were used to check if there was a significant linear relation between the abundance recorded by the different methods without accounting for weather and site-specific conditions.
- To account for weather and site-specific conditions, generalized linear models were created to compare the pollinator abundance data from the different methods.
- There was a significant relation between the abundance data from the "loud" subset of the FIT counts (which included all bees, hoverflies, and wasps), and the bioacoustic abundance data, but not for any of the other models that were run.



(a) Plot of bioacoustic activity data vs FIT Count Activity over six weeks, (b) Plot of bioacoustic activity vs "loud" subset of FIT count activity - No significant linear relationship in either case as weather and site conditions were not accounted for

KEY FINDINGS

- The data analysis showed that on accounting for weather quality and site-specific characteristics, there was no significant correlation **(p=0.081)** between the bioacoustic activity recorded and the total FIT count activity observed, meaning that hypothesis 1 was incorrect and this bioacoustic method is not an accurate representation of pollinator activity by all insect groups.
- The significant correlation **(p=0.027)** between bioacoustic activity and the "loud" subset of FIT count activity (when accounting for weather and site), showed that bioacoustics can give an accurate representation of pollination activity by loud insect groups.

CONCLUSION

- Bioacoustic monitoring data is comparable to the pollinator abundance data collected by traditional methods, for loud pollinators, which are widely regarded as the most important pollinator species.
- The UK PoMS uses citizen science to collect pollinator abundance data through FIT counts, which is subject to human error. Considering that the methods give comparable results, more accurate data could be obtained by incorporating bioacoustic data collection to citizen science through the creation of smartphone applications.
- Bioacoustic monitoring has the potential to be used for urban conservation planning and testing of conservation schemes.

REFERENCES

Dally 2019; Potts et al., 2010; Isa et al., 2013; Baldock et al., 2015; Hernandez et al., 2009; Bates et al., 2011; Carvell et al., 2020; Roy et al., 2016; Martínez del Rio and Búrquez, 1986; Bergman et al., 1996; Fornoff et al., 2017; Creux et al., 2021; (Batáry et al., 2010; Kahane et al., 2022; Ballesteros et al., 2024; Kawakita and Ichikawa, 2019