REPORT FROM A BOU-FUNDED PROJECT

Robles, H. 2019. Assessing bioacoustics of middle spotted woodpeckers for non-invasive assessments of population structure and habitat quality in fragmented habitats.

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Assessing bioacoustics of middle spotted woodpeckers for non-invasive assessments of population structure and habitat quality in fragmented habitats

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BACKGROUND

In a rapidly changing world, ornithologists need efficient tools for assessing the response of avian populations to human-induced impacts associated with the current Global Environmental Change (e.g., anthropogenic habitat changes, climate change). Unfortunately, accurate assessments of avian populations are costly and not always feasible because they often require substantial resources to count, capture/recapture/re-sighting, and follow the reproduction of birds.

The use of non-invasive acoustic-based methods may reduce the costs and increase the feasibility of population studies. However, the effectiveness of acoustic-based methods in assessing population structure and habitat quality remains, if any, poorly tested. A first step to address this knowledge gap is to investigate whether the sonograms of avian vocalizations can be used for the recognition of individual birds.

We aimed to address this issue in a middle spotted woodpecker (Leiopicus medius) population inhabiting fragmented habitats as a case study. If woodpecker vocalizations proved to be useful for individual recognition, acoustic-based methods might perhaps be used in successive steps to quantify population structure and habitat quality..

METHODS

Study species and area

The middle spotted woodpecker (Leiopicus medius) is a territorial bird associated with old rough-bark deciduous forests that, instead of drumming, often communicates by vocalizations (Pasinelli 2003). The study area covers approximately 800 km2 in NW Spain (42º N, 5º W), where this woodpecker breeds in old-growth deciduous forests dominated by Quercus pyrenaica ("patches" hereafter). Habitat patches cover ~4% of the study area.

Population monitoring

As every spring since 2000, we monitored woodpecker occupancy and abundance by visiting the habitat patches (~20 ha/hour) multiple times during the (pre-)breeding seasons of 2017 and 2018. Using an endoscopy, we estimated reproductive parameters through regular visits to active

nests. In addition, we captured adults and fledglings to increase the number of individually colour-banded woodpeckers in subsequent seasons.

Bioacoustics

We recorded woodpecker calls during their peak of vocal activity in spring. To achieve this goal, we approached individuals and recorded their vocalizations for several minutes. We built sonograms from the rough recordings by using the Avisoft SASLab Pro software.

RESULTS

Population monitoring

We found territorial woodpeckers and floaters in 21 and 18 habitat patches, respectively. We assessed breeding success in 36 nests (26 of them with at least one fledgling), and several other reproductive parameters (e.g., mean clutch size = 5.06 eggs, range = 2-7; hatchling number = 3.59, 0-5; fledgling number in successful nests = 3.23, 1-5) in a subsample of those nests. In addition, we individually colour-banded 65 fledglings and 15 adults.

Bioacoustics

We identified and recorded mainly three types of vocalizations: rattle-, scolding- and kweek-calls (*sensu* Pasinelli 2003). Rattle-calls (Fig. 1) are the most-used vocalizations, perhaps with a territorial function (Pasinelli 2003). We observed scolding-calls (Fig. 2) often associated with territorial disputes, frequently in flight and sometimes accompanied of aggressive interactions with other conspecifics (see also Pasinelli 2003 and references therein). Kweek-calls (Fig. 3) were intensively-used by unmated floaters (Robles and Ciudad 2017), but also for communication between breeding partners under certain circumstances (e.g., shortly used after being disturbed nearby the nest) (see also Pasinelli 2003).

In 2017, we recorded vocalizations of ~79 individuals. Most vocalizations were rattle- and scolding-calls, whereas only a dozen of kweek-calls were recorded. In 2018, we recorded vocalizations of ~70 individuals, with an important addition of 23 kweek-calls. Visual inspections of the sonograms show high inter-individual variation for the three types of vocalizations (Fig. 1-3). Apparently, this may provide some support for the use of vocal activity as an individual signature. However, several issues prevent us of extracting solid conclusions on the use of vocalizations for individual recognition: (i) Because vocalizations were recorded only once for most individuals, we do not know the repeatability of vocalization structure within individuals along the (pre-)breeding season and between consecutive seasons (i.e., years); and (ii) we are still working in the development of mathematical algorithms that allow us to quantify and, thus, validate the inter-individual differences observed by visual inspections of sonograms.

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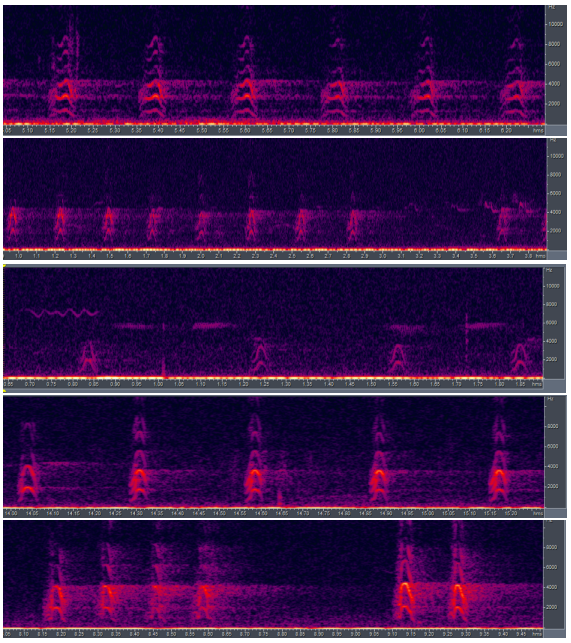


Figure 1. Example of sonograms of rattle-calls.

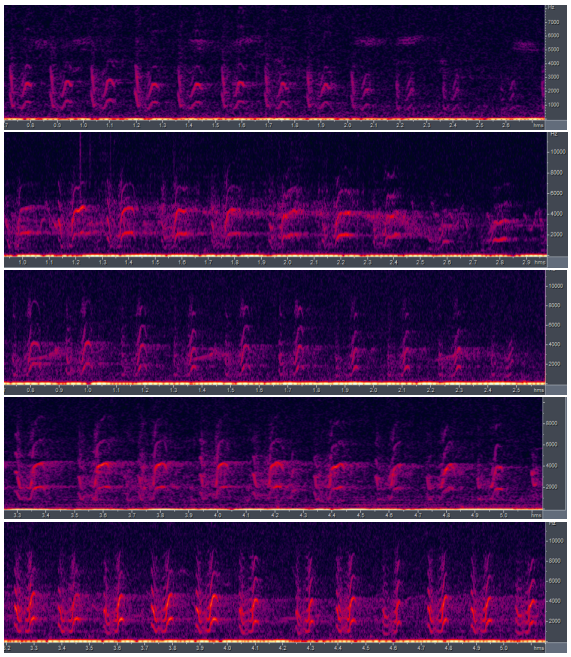
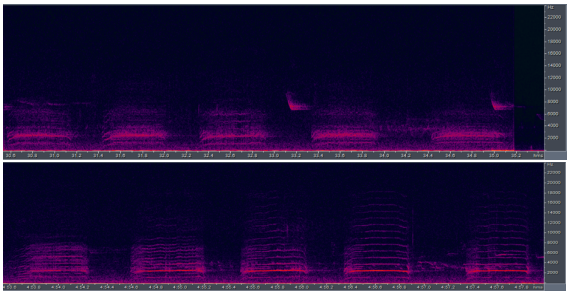


Figure 2. Example of sonograms of scoldings-calls.



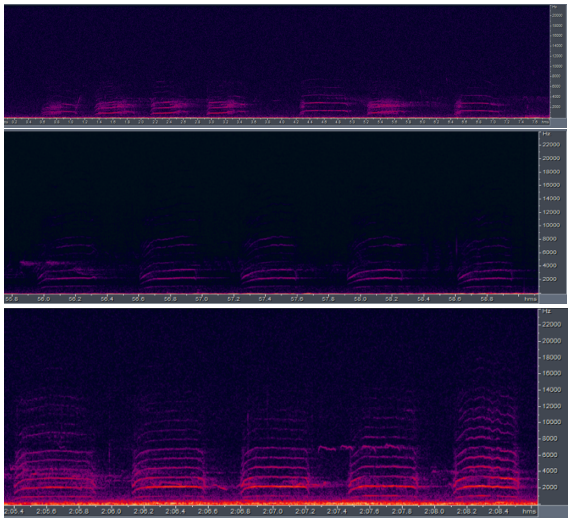


Figure 3. Example of sonograms of kweek-calls.

CONCLUSIONS

This project has served to open a promising research line on the potentiality of non-invasive acoustic-based methods to assess population structure and habitat quality in birds. The high inter-individual variation in woodpecker vocalizations found here is encouraging, but to fully

address the potential of acoustic-based methods for individual recognition, we plan to continue recording vocalizations in subsequent years. In this sense, the individual colour-banding of woodpeckers performed in this study will contribute to assess the repeatability of individual vocalizations in subsequent seasons.

We aim at setting up a long-term study that allows us characterizing the potentiality of acoustic-based methods in quantifying the longevity and lifetime reproductive outputs of territorial birds and floaters. This is particularly relevant because floaters may buffer the extinction risks of local populations by replacing the lost breeders (Robles and Ciudad 2017). The ultimate and most ambitious goal is to examine the effects of human-induced habitat changes on population structure and on the expected survival/reproductive outputs of individuals as estimated by acoustic-based methods.

Acknowledgements

I am very grateful to the British Ornithologists' Union (BOU) for awarding me one of their small research grants which gave me the opportunity to open this fascinating study on avian bioacoustics. Konrad Leniowski and Ewa Węgrzyn (Rzeszów University) initiated me in the field of bioacoustics and strongly helped by banding woodpeckers. Carlos Ciudad (Polytechnic University of Madrid) and Chano Robles greatly contributed to the huge task of monitoring the population and banding woodpeckers.

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