Song Variability and Singing Activity of the Red-breasted Flycatcher

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Introduction

The Red-breasted Flycatcher (*Ficedula parva)* is one of the less investigated bird species, especially in its song or diurnal and seasonal patterns of vocal activity. The main aim of this work is to describe basic features of the song and song types used by Red-breasted Flycatchers in Europe. Additionally, I gained detailed information about vocal activity by using a modern acoustic monitoring method.

Main Aims

1. **To monitor the population of the Red-breasted Flycatcher in the one Czech locality**
2. **To describe basic features of the song and song types**
3. **To find differences of song characteristics between young and older males**
4. **To describe diurnal and seasonal singing activity**
5. **To discover seasonility in song traits**
6. **To determine geographic variability of song**

Methods

Monitoring (2013-2014)

- Protected Landscape Area Jeseníky
- Determination of male's age (in the second-year / after second-year)

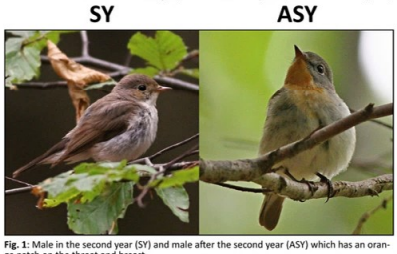


Fig. 1: Male in the second year (SY) and male after the second year (ASY) which has an orange patch on the throat and breast.

Recording of the Songs (2015-2016)

- 15 recorders DM-650 Olympus - automatic recording of seasonal activity and variability
  - five particular males (**= innovative approach**)
- Recorder Marantz PMD 661 + microphone Sennheiser MKH 70 - song characteristics (50 males)
- Recordings of the song of 170 males from abroad (93 authors) - geographic variability

Fig. 2: Recorders placed high in the trees to be closer to singing males.

Fig. 3: Recording of songs using a professional recorder with directional microphone.

Analysis (2015-2016)

- program setpack AMSrv and Raven Pro 1.4
- software SPSS ver. 16 and Statistica 12

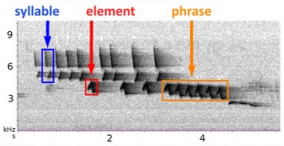


Fig. 4: Example of detailed analysis of song variant G in program Raven Pro 1.4. I measured 16 variables for each song in total.

area 2135 ha 2 747 hours 71 430 songs 19 countries 1 605 analysed songs

1 Monitoring

- Population density estimation in the research area 100-120 pairs
- **SY males nested in significantly lower territories**
- Use of new method - distinguishing males of the Red-breasted Flycatcher based on different song types

The new method revealed two times more males than classical monitorng.

2 Repertoire

- 3 variants of songs (**2 new described**)
  - basic song, **double song, quiet song**

Basic Song

- **described 14 types and 2 sub-types in the whole Europe**
- song type B is highly dominant in a population (dataset of 200 males)
- only 10 % of males use more than one type

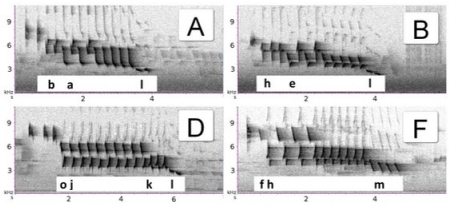


Fig. 5: Spectrograms of four most common song types in Europe. Upper case denote name of song type. Lower case denote types of elements.

- **ratio between two song types changes with breeding status of male**

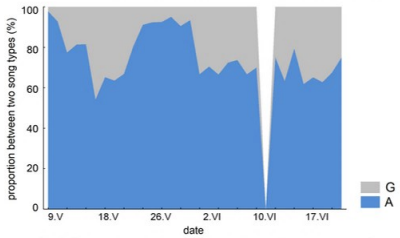


Fig. 6: The ratio of preferred song type A and the secondary song type G during breeding season of male in the second year on studied site.

Double Song

- **appeared only as a first and last songs of the day**
- unique elements for the variet of basic song at the end of a song
- **specific function?**

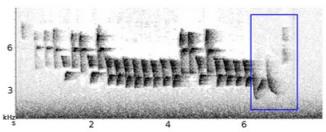


Fig. 7: Spectrogram of a double song with a unique ending (blue).

Quiet Song

- **substantially differ in spectral and temporal characteristics**
- rarely sung
- **completely different elements compared to the basic song, included imitation of other bird species**

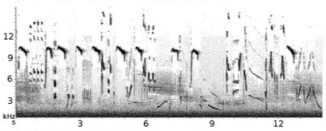


Fig. 8: Spectrogram of the quiet song.

3 Effect of Age on Song Characteristics

- Song of the Red-breasted Flycatcher is dependent on the age of male

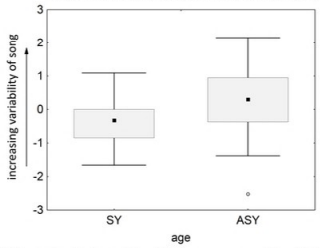


Fig. 9: The variability of song that represents the length of the song and the average number of syllables, depending on the age of the male.

(square = median; ends of the box = 25% and 75% quartiles, lines = 1.5 times the interquartile range; circle = outlier; asterisk = extreme value)

Older males had considerably longer songs with a higher number of syllables.

4 Diurnal and Seasonal Activity

- Variation in the number of produced songs between individudal males
- Males are prominently decreasing a production of song after mating

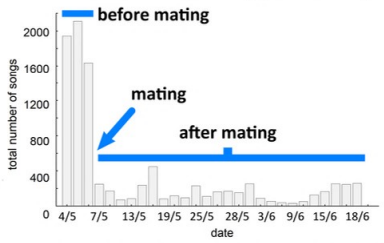


Fig. 10: Singing activity of a male (ASY) during a breeding season.

- **It is possible to distinguish four periods of diurnal activity during a season.**

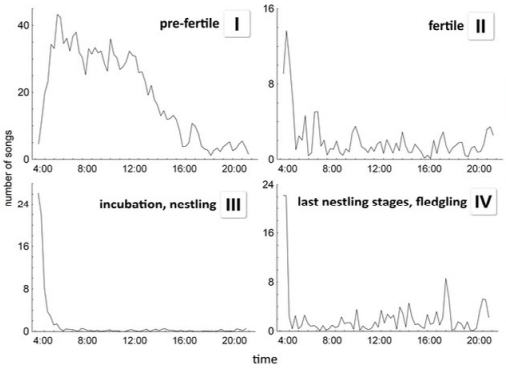


Fig. 11: Average singing activity of five males during the periods I.-IV. Period I. = first decade in May; period II. = second and third decade in May; period III. = first and second decade in June; period IV. = third decade in June and at the beginning of July. Time = time in 15 minute intervals, all songs were counted for each of these intervals.

After mating (AfMa) there is a significant shift of dawn chorus before sunrise.

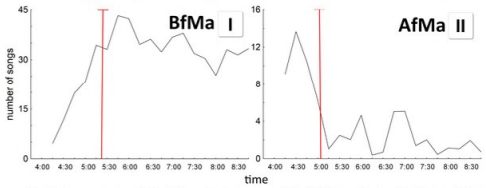
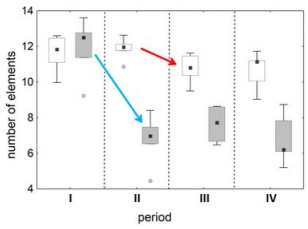


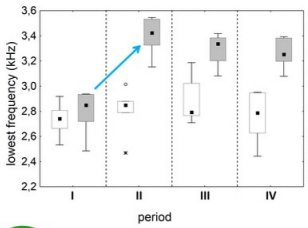
Fig. 12: Average singing activity of five males during the periods I. (before mating) and II. (after mating) in morning interval (for more see fig. 11). Red line represents an average time of sunrise for individual periods.

5 Variability of Morning and Day Song



I found no differences between morning songs and day songs during the first period (pre-breeding period).

Morning songs differ between the first two periods and the last two periods in number of elements (red arrow).



Day songs differ between the first period and the rest of periods in number of elements and lowest frequency (blue arrows).

Fig. 13, 14: Comparison of number of elements/lowest frequency of morning songs (white boxes) and day songs (grey boxes) during the four periods of the breeding cycle. For description of the graph see fig. 9.

6 Geographic Variability

- Although the Red-breasted Flycatchers use many song types, I found no differences in geographical distribution of these song types

Fig. 15: Sample from an interactive map that shows the distribution of types of song. All song types occur across the whole Europe. Individual types of songs are color coded.

The Red-breasted Flycatcher is a species that does not form dialects.

CONCLUSIONS

1. **New non-invasive method for estimation of dynamic changes of the population of RbFs**
   - opportunity to identify also an unmated males
2. **Comprehensive overview of vocal activity of one passerine species**
   - firstly described song types and 2 new variants of song in a whole Europe

   Innovative approach in the bioacoustic research
   - **seasonal acoustic monitoring of particular birds**
   - work with online acoustic databases
3. **Males after the second year have a significantly higher variability of songs than young males**
   - it seems that RbFs (probably as a close learner species) change length of songs during a life
4. **Singing activity of the RbF has the main role as a female attractant but also as a territory defence**

   Shift of the peak of dawn chorus after pairing
   - the trade-off between physical or singing defence of female
5. **Different characteristics of morning and day songs during a breeding season**
   - day songs lose a function of an indicator of male's quality after pairing
6. **Unusual geographic variability of songs**
   - no dialects despite the fact that males use different song types

This work has uncovered new knowledge about the Red-breasted Flycatcher's vocalization and bird vocalization in general. Results will be important for further research and will also help to specify monitoring methods, thereby contributing to superior bird species protection.

Acknowledgments

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Sources

Fig. 1-14: author - Ondřej Belfín
Fig. 15: https://www.google.com/maps/d/viewer?mid=18w748buNg1-TD4sLflEJCnVToYxc

Future Plans

- What is the function of the double song with end type elements?
- Are songs modified under the pressure of female preferences?
- How young males learn their song type?

- Publish current results
- **Create a project of citizen science**
  - **distribution and frequency of song types**

Website about this research ------