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# OBSERVATIONS ON SPECIES COMPOSITION AND BEHAVIORAL SPECIFICS ON MONITORED BIRD FEEDERS IN THE GREEN BELT OF FACULTY OF BIOLOGY, SOFIA UNIVERSITY. IMPROVING THE CONDITIONS FOR BIODIVERSITY IN THE AREA

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**Abstract:** The feeding of passerine birds in winter is a widespread practice in Western Europe, which gains popularity in Bulgaria. There are many consequent benefits, from the direct impact on the birds' survival during the cold months, to the opportunity to make interesting close observations, which could be used for scientific and/or educational purposes. In the last ten years (2005-2015) different types of bird feeders were situated in the green belt of the Faculty of Biology (Sofia University "St. Kliment Ohridski"), including the space in front of the student's club SKOREC, located in the Department of Zoology and Anthropology. During that period, a large amount of information concerning species presence and numbers, behavioural specifics, food selection, etc. was gathered from lecturers and students from the Faculty. In addition, in 2015 the club won a micro-grant project for improving the conditions for biodiversity in the researched Faculty green belt. The following work presents the results of the bird feeders monitoring and give details about the new measures for improving the area in relation to plant and animal biodiversity.

## INTRODUCTION

Due to the increasing urbanization at a global scale, the people are now disconnected from nature more than ever. Studies show that contact with nature is important to the human well-being (Davis et al., 2009). A very accessible way to get in touch with wildlife is setting up and maintaining a bird feeder. This allows the citizens to observe wild birds from a short distance, having the added benefit of increasing their environmental knowledge and awareness. Furthermore, providing supplementary feeding for birds, especially during the winter, may greatly enhance their chances of survival (Cannon, 1999).

It is estimated that millions of people set up bird feeders through the year (82 million in the US alone annually), roughly a 1/4 to 1/5 of the households (Fuller et al., 2008). In many countries (such as the United Kingdom and the US) these activities provide valuable information on the common and widely distributed species, utilized by specifically designed studies such as BirdWatch (Toms, 2003) and the Garden Bird Feeding Survey (Glue, 1982) and Wild Bird Indicator (Vickery et al. 2004). Correlation between the number of observations at bird feeders and the trends in population dynamics have been documented for a number of species (Lepage et al., 2002). These benefits can have long-term effects (Robb et al., 2008a) and increase productivity of the subsequent breeding season (Robb et al., 2008b). Another interesting aspect is studying bird behaviour at feeders. Relatively few studies have been performed on the questions how environmental factors and the presence of other species impact bird feeder visits by different species. (Jones & James Reynolds, 2008; Tvardíková & Fuchs, 2011; Zuckeberg et al., 2011).

In Bulgaria, there are currently no published papers on studies involving bird feeders. In this paper, we present and summarize the data obtained at the Faculty of Biology (Sofia University "St. Kliment Ohridski") during a period of 10 years. The intensity of observations was particularly high on the bird feeder situated at the window of the laboratory which hosts the Students Club for Education and Development with Ecological Centre (SKOREC). During the student's work in the laboratory, additional work for monitoring on the feeder was regularly executed. Particular attention has been paid to observe and analyse their behaviour.

## MATERIALS AND METHODS

Information for the present research was gathered from lecturers and students in the Faculty for ten-year period. The observations became regular since 2010 and the collected data (species, numbers, behavioural specifics, weather conditions, etc.) were stored in a special notebook in the club's laboratory and later transferred in Microsoft Excel tables. The statistical analysis was made using SigmaStat 3.5 and SigmaPlot 11.0 software. The number of observations,

gathered for all species on the bird feeder and in close proximity with a range of 36 meters (laser measured) is presented in table 1.

The measures taken for the biodiversity in the area included placing of bird boxes and planting of new trees and shrubs after scientific consultation with the respective departments of Zoology and Botany.

## RESULTS AND DISCUSSION

The commonest birds observed during the research were Great tit (*Parus major*), Blue tit (*Parus caeruleus*), Nuthatch (*Sitta europaea*), Common Finch (*Fringilla coelebs*) and Feral pigeon (*Columba livia domestica*). In some years, other species also visited the feeders - Hawfinch (*Coccothraustes coccothraustes*), Brambling (*Fringilla montifringilla*), Tree sparrow (*Passer montanus*) etc. (Table 1).

**Table 1.** Bird species, periods and number of observations on and near SKOREC bird feeder

| Species | First observation date | Last observation date | Total observation entries (n) | Maximal count (n) |
|---|---|---|---|---|
| Great tit (*Parus major*) | 22.01.2010 | 09.03.2015 | 247 | 21 |
| Eurasian nuthatch (*Sitta europaea*) | 22.01.2010 | 23.02.2015 | 143 | 3 |
| Common chaffinch (*Fringilla coelebs*) | 22.01.2010 | 09.03.2015 | 55 | 10 |
| Brambling (*Fringilla montifringilla*) | 22.01.2010 | 04.01.2011 | 25 | 10 |
| Eurasian sparrowhawk (*Accipiter nisus*) | 22.01.2010 | 08.02.2011 | 3 | 1 |
| Blue tit (*Parus caeruleus*) | 25.01.2010 | 09.03.2015 | 134 | 4 |
| Hawfinch (*Coccothraustes coccothraustes*) | 25.01.2010 | 27.12.2010 | 5 | 1 |
| Feral pigeon (*Columba livia domestica*) | 09.02.2010 | 09.03.2015 | 111 | 12 |
| Coal tit (*Parus ater*) | 17.02.2010 | 17.02.2010 | 1 | 1 |
| Eurasian wren (*Troglodytes troglodytes*) | 18.02.2010 | 18.02.2010 | 1 | 1 |
| European robin (*Erithacus rubecula*) | 18.02.2010 | 18.02.2010 | 1 | 1 |
| Eurasian magpie (*Pica pica*) | 08.03.2010 | 23.01.2015 | 9 | 2 |
| Common blackbird (*Turdus merula*) | 08.03.2010 | 08.03.2010 | 1 | 6 |
| House sparrow (*Passer domesticus*) | 15.12.2010 | 24.01.2015 | 2 | 5 |
| Eurasian jay (*Garrulus glandarius*) | 21.12.2010 | 09.01.2015 | 8 | 2 |
| Tree sparrow (*Passer montanus*) | 01.02.2011 | 09.03.2015 | 4 | 7 |
| European greenfinch (*Carduelis chloris*) | 12.03.2012 | 12.03.2012 | 1 | 1 |
| Hooded crow (*Corvus cornix*) | 23.11.2012 | 14.02.2015 | 4 | 6 |
| European goldfinch (*Carduelis carduelis*) | 26.01.2013 | 26.01.2013 | 1 | 1 |
| Long-tailed tit (*Aegithalos caudatus*) | 29.10.2014 | 29.10.2014 | 1 | 1 |
| Great spotted woodpecker (*Dendrocopos major*) | 20.11.2014 | 09.01.2015 | 2 | 1 |
| Lesser spotted woodpecker (*Dendrocopos minor*) | 09.01.2015 | 09.01.2015 | 1 | 1 |

On and around some of the other bird feeders positioned in the green belt of the faculty were observed other rarer species such as Hoopoe (*Upupa epops*), Grey-headed Woodpecker (*Picus canus*), Marsh Tit (*Poecile palustris*) and Eurasian Siskin (*Spinus spinus*). They are also expected to be observed on the most researched bird feeder, positioned in front of the window of the club SKOREC laboratory.

The most abundant species in the research are logically some of the commonest birds of the city of Sofia. Series of analysis were made concerning the effects of the environmental factors on the species presence. The results are analogical for all six commonest species, but for presentation purposes only those for *P. major* are presented.

For the commonest visitor (*P. major*) we observed correlation between the weather conditions and the number of individuals visiting the feeder (Figure 1). The lowest activity was counted during rain or fog, while the highest was recorded during snowfalls. This can be explained with the food sources being covered with snow, and so the need of bird feeders presence is more important for the wild animals. A slight increase of the average number of monitored individuals from cloudy to partly cloudy to sunny weather was also observed, although this increase can be a result of increasing standard errors for those weather conditions.

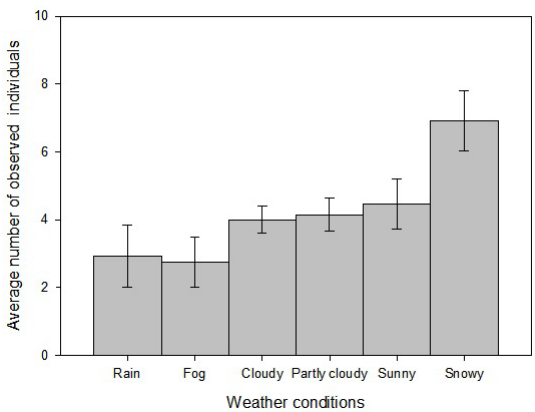


**Figure 1.** Number of individuals in relation to weather conditions for *Parus major*

Clear regression between *P. major* average numbers on the feeder and the temperature was observed (Figure 2 and Table 2) with correlation coefficient -0.126. The occurrence of the great tit was increased when the temperatures decrease. This can be also visualised with temperature intervals of 10°C (Figure 3). This correlation can be explained by the fact that homothermous animals need more food during cold periods to produce the needed heat for sustaining constant body temperature.

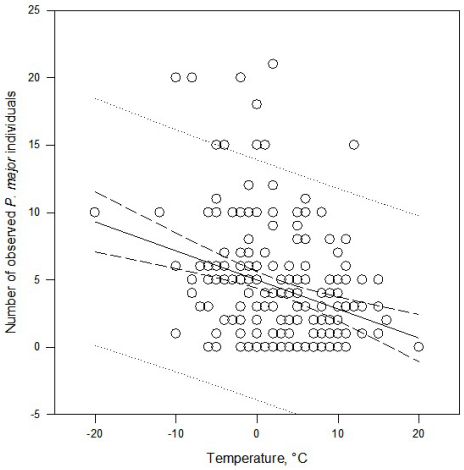


**Figure 2.** Linear regression analysis of the correlation between *Parus major* observations and the temperature

**Table 2.** Mathematical constants for the linear regression analysis, where A is the average number of observed *P. major* probability, and T is the temperature measured in degrees Celsius (°C)

| A = 4.994 - (0.216 * T) | | | | |
|---|---|---|---|---|
| | **Coefficient** | **Std. Error** | **t** | **P** |
| Constant | 4.994 | 0.313 | 15.979 | <0.001 |
| T | -0.216 | 0.0485 | -4.454 | <0.001 |

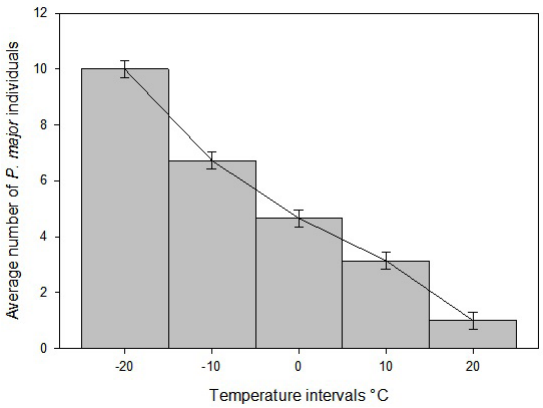


**Figure 3.** Dependence between the number of visiting individuals and the temperature intervals (with 10ºC range) for *Parus major*

The presence of *Parus major*is is also dependent on the month of the observation. From October to February the numbers are increasing starting with a mean of 1,238±0,330 and ending with a mean of 5,857±0,641. Then in March a decrease is observed by the average of the observed individuals being 4,718±0,816 (Figure 4). The decrease observed in the last month can be connected with the beginning of the mating season and that the food supplies are starting to increase and be more approachable for the passerines.

The average number of individuals visiting the bird feeder on yearly base is presented in Figure 5. There is a tendency of number decrease from 2009 to 2015, which could be connected with the increase in the average temperatures measured during the research (Figure 6).

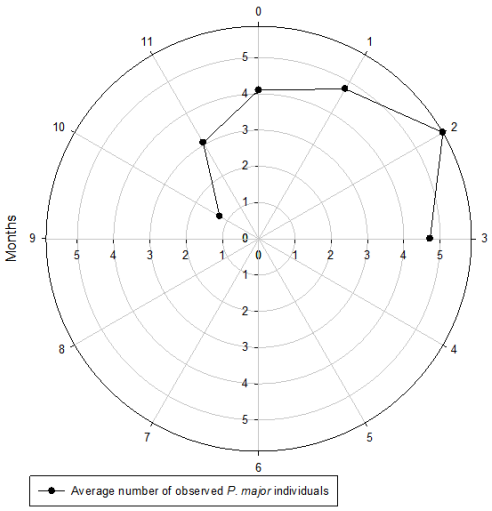


**Figure 4.** Average number of visiting *Parus major* on monthly base

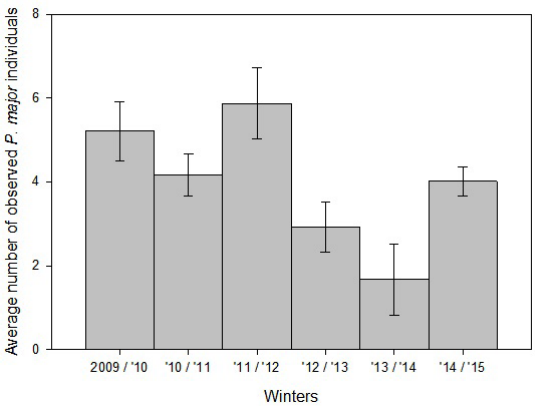


**Figure 5.** Average number of observed *Parus major* per winter season

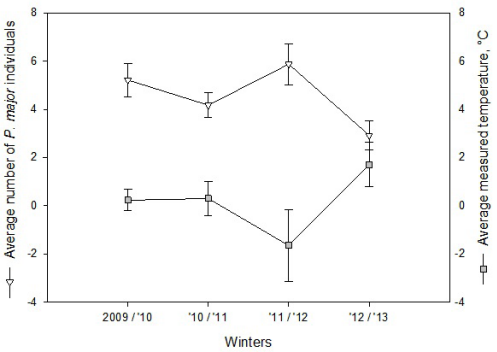


**Figure 6.**
Visualisation of the negative correlation between the average number of the individuals (with triangles) and the average measured temperature (with squares) for the winters from 2009/2010 to 2012/2013

The presence of the six most common birds on the feeders (presented as percentage of all individual observations) during the research period (from the winter of 2009/2010 to the winter of 2014/2015, excluding 2013/2014 because of the statistical insignificance of the collected data) is shown in Figure 7. The majority of species was showing stabile presence, excluding *C. livia domestica* which increased and *Fr. montifringilla* which decreased. It is possible that those results in theory could be correlated with the population trends of those birds (Lepage et al., 2002), but further research is needed. Those results can also be connected to the more frequent use of bird feeders in the Bulgarian households, which could have led to *Fr. montifringilla* individuals finding food in a closer area to their natural habitat, hence they have not been forced to search for food near the Faculty of Biology. This can also be supported with the fact that there are many picture documented cases of *Fr. montifringilla* visiting other urban bird feeders in Sofia during the research period in nonofficial online hobby birding groups.

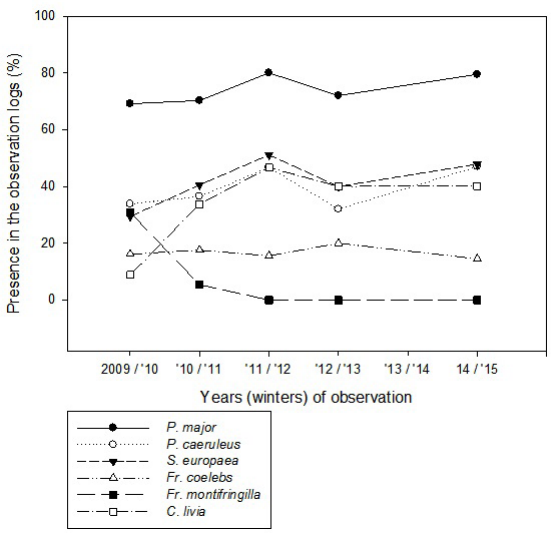


**Figure 7.**
Percentage of observed individuals for all individual observation logs for the six most common passerine birds during the research period

Analogically the presence of the six most common birds on the feeders is presented as a percentage of their presence per week (where the first week is in mid-October and week 24 in mid-March is the last one) during the research period in Figure 8. The tendencies here are almost the same as in Figure 7: most birds were observed with a stable presence during the research period, while *Fr. montifringilla* decreased and was last observed during the winter of 2010/2011, and *C. livia domestica* observations increased around four times.

When the two figures are compared, it can be seen that the commonest bird species observed on and around the bird feeder (*P. major*) was seen around 100% of the weeks, but is present in only about 70-80% of the observation logs. During some winters (2012/2013 for instance) some of the species (like *P. caeruleus*) were fairly common visitors, but during just a few weeks, which shows that they were using the feeder only in small periods. This can be a result of the higher measured temperatures during that winter, and/or the presence of an alternative bird feeder in a close proximity.

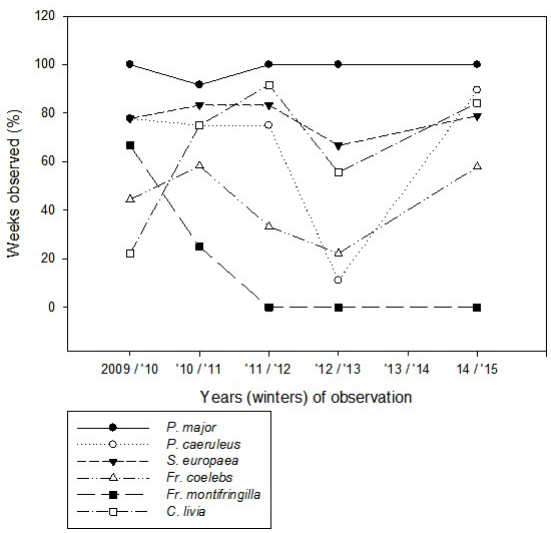


**Figure 8.** Presence of the six most common bird species of all the observed weeks (%) during the research period

The limited amount of food on SKOREC feeder was a reason for intensive interspecific and intraspecific conflicts, which were documented in some cases. This information could be used for creating of hierarchical tree of the species, visiting the feeding site.

In all observed cases the presence of *Columba livia domestica* was a negative factor for the presence of all passerine birds, excluding *Fringilla coelebs*. This could be explained by the fact the latter is not benefiting directly from the bird feeder, but from the seeds falling on the ground in larger quantities when the feral pigeons shake the feeder.

Among the most common visitors of the feeder, *Sitta europea* was observed to dominate over the other passerines. Although *Parus major* was the most numerous Parus species, we identified *P.caeruleus* to be more aggressive in the food competition.

Single intraspecific conflicts were documented for some of the rarely observed species - e.g. *Coccothraustes coccothraustes* guarding the bird feeder from *Fringilla montifringilla*.

In 2015 many biodiversity orientated measures were taken by SKOREC club in the area of the Faculty. New plant species (*Sorbus aucuparia*, *Ribes nigrum*, *Aronia*, *Corylus avellana* etc.) were imported with the idea to attract fruit-eating birds. New bird boxes and feeders were placed, as well as "insect hotels" and other new microhabitats, in order to improve the general biodiversity in the vicinity on the Faculty. These activities were supported by a micro grant from the NGO "For the Earth", after a national project contest, where the project "Skorec at the doorstep" developed from club SKOREC was granted. We expect that the improved environment in the area will attract new wildlife species, including birds, in the following years.

## CONCLUSIONS

Observations on the bird feeders is a valuable tool for gathering information on species presence and numbers and behavioural specifics of birds in the urban environment. The present research provides preliminary data for a bird feeder monitoring in the vicinity of the Faculty of Biology. The scale of the research should be enlarged by including more bird feeders and by intensifying the observation during late autumn to early spring periods.

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