Tawny owl (*Strix aluco)* and its variation in diet between years

By Casper Ekberg

Abstract

The tawny owl resides in temperate forests in Europe and mainly hunts rodents but can also hunt other animals like birds,invertebrates and bats.

In this study I examined how the diet of tawny owls varies during the span of 2018-2020, I also compared the diet found from nest boxes with footage obtained from cameras inside the nestboxes. The diet of the tawny owl can vary due to different reasons, other studies have shown that the diet is seasonal due to changes in snow cover and development of ground vegetation . Studies have also shown that different temperatures create different proportions of animals in the diet of the tawny owl. The biggest proportion of the tawny owl diet consists of mammals, more specified rodents which was shown in my study as well but the variation studied was only seen between the year 2019 and 2020. Surprising was how my result showed that birds were not the second most favoured prey item but instead a high proportion of invertebrates were found in the contents of the nestbox and no variation was found for invertebrates over the years. The lack of birds could be explained by different reasons but one is the lack of experience in identifying bones and therefore misjudging whether something is a bone of a mammal or a bird. Lastly the comparison between footage and the nest box contents showed that there was no difference in prey proportions between the two.

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Introduction

The Tawny owl usually resides in temperate forests in Europe and Asia (Petty S.J, 1997). They are nocturnal and hunt a variety of animals but mainly rodents, especially bank voles and wood mice (Petty. S.J, 1999). The consumption of main prey animals, such as these, is usually correlated with prey density which has been documented in various raptor species like the tawny owl(Václav. L, 2018). Although this is their main diet, tawny owls have been seen eating other species such as bats, amphibians, earthworms, beetles and other birds(Yehor.Y, 2017). The preference in diet can be seen as seasonal due to the abundance and availability of these prey animals which are driven by the changes in snow cover as well as the development of ground vegetation (Yehor.Y, 2017). The variability in prey composition can also be seen as an adaptation to the rodent populations, which fluctuates annually with peaks occurring at 3-5 year intervals in European forests (S.J Petty, 1999).

The change in prey density can also trigger different responses. Predators like the Tawny owl that have a main prey type that fluctuates often show a positive correlation between the density of the main prey and number of breeding pairs (Václav. L, 2018). Tawny owls lay their eggs around early spring and produce clutches of 3-5 eggs. The clutch size can vary within populations due to different circumstances like diet and main prey density(Václav. L, 2018).

In this project I examined whether the dominant prey type varies between the 3 years of data collection in a population of tawny owls in southern Sweden. I will also look if a special type of prey gives bigger and healthier clutches and lastly if there is a difference between the species found on nest-camera footage and the species found in the nest remains during the one of data collection.

The expectation is that the diet of the tawny owl during year 2019 will vary compared to the other two years of 2018 and 2020, due to anecdotal evidence from observations of prey in nest boxes indicating that rodents were in low availability in 2019 and tawny owls instead

would switch to mainly eating birds . Lastly I expect that there won't be a significant difference between the footage and the contents of the nestboxes due to a study where it showed that video was broadly consistent with other results (Steffens, K. 2011).

Method

Study area was located in southern Sweden in Revinge (55.73396037912981 , 13.466667072960114) where nest boxes were placed. These were checked once a week to determine the laying date and hatching date. The chicks were also weighed when they were around 20-31 days old using a Pesola spring scale and in the autumn all the contents were taken from these nestboxes. After the nest box contents were collected they were stored in a freezer for later analysis.

The contents were then analyzed and this was done by taking each nest box's contents and distributing it onto a box with a big flat surface. Then everything was carefully examined by straining some of the contents of the nestbox on a surface that was clean, to find bones,exoskeleton or feathers. This was done several times to ensure that nothing was missed. All of the findings were then identified and placed into different petri-dishes which represented different types of bones(e.g. [femur,humerus,pelvis, fibula, radio-ulna, bird bones]), if it couldn't be identified it was placed into an unidentified petri-dish. To help with identifying the bones a book was used (Yalden D.W. , 2009). The invertebrates were counted by separating them into legs, body and head. When all of the contents for the nest box had been identified and placed in separate petri-dishes they were counted and put into an excel sheet. This was repeated for all of the nest boxes and when that was done the unidentified bones were gone through again with the help of other already identified bones and books to try and identify them. Then the number of individuals was counted in each of three categories: mammal,bird and invertebrate. The minimum number of prey individuals was calculated according to the count of the most abundant bone or body part in each prey category (i.e. mammals, invertebrates and birds). The data for the nest box contents was later converted to proportions by counting the sum of all animals consumed by that nest box and

then dividing each animal type's representative amount by that total sum getting a proportionate value that could be used to compare the different years.

When the nest box contents were gathered and identified, footage of the nest boxes were analyzed. Footage was taken by placing cameras in nest boxes where chicks were between 7-21 days old. The angle of the camera was set so it could capture what the adults were carrying when entering the nest. To analyze this data and excel sheet was created were the different activities and what type of animal the tawny owls fed upon. The footage was looked through using VLC media player and paused frame by frame to be able to identify the animal which was being fed to the chicks. The data from this footage was later compared to the data of the nest contents to see if there was a difference between the contents of the nests and the footage.

The data of comparing the different years was analyzed by testing the normality distribution by converting each prey type's data (mammal, invertebrate and bird) into log10 and then creating a histogram for each prey type. Then I created three different ANOVA analyses for each prey type to test if there is a significant difference in diet between the years and post-hoc test to see where the difference was for that specific prey type. To analyze whether the footage and nest box contents differ 3 t-tests will be created, one for each of the three categories (mammal, invertebrate and bird) to see if there is a difference.

Results

The ANOVA statistical analysis test showed that there was a significant difference between the amount mammals consumed during the 3 years ($F_{2,13} = 4,717$ $p = 0,029$). The post hoc test showed that there was no difference between the mammals consumed during 2018 and 2019 or 2018 and 2020 but a difference was proven between 2019 and 2020 where less mammals were eaten during 2019 then 2020.

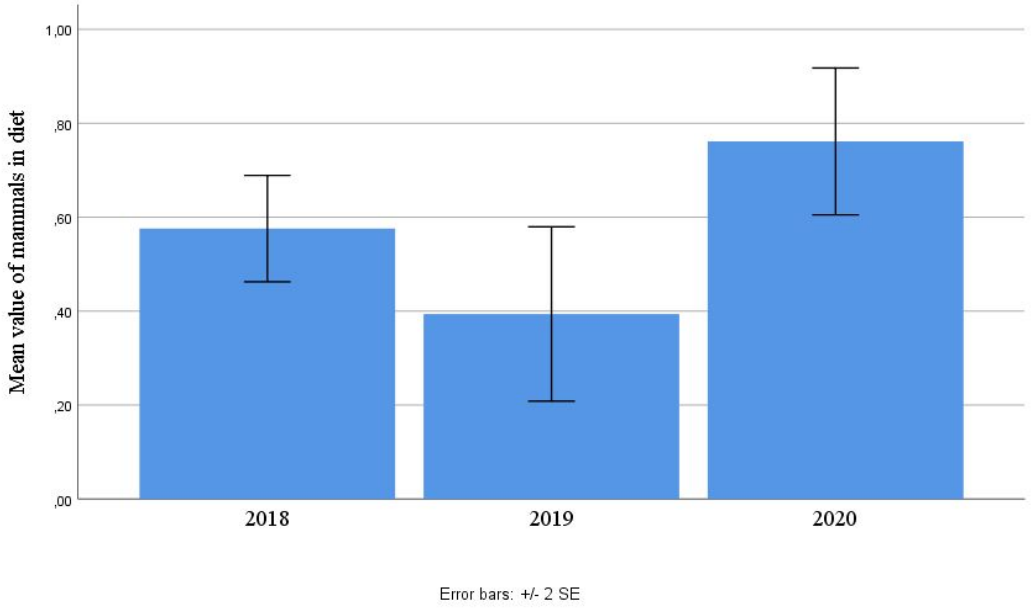

Figure 1 Mean proportion of mammals that was included in the diet of the tawny owls during year 2018-2020

There was a significant difference between the amount birds consumed during the 3 years ($F_{2,7}$ = 5,471 p = 0,037). The post hoc test showed that there was no difference between the proportion of birds consumed during 2018 and 2020 or 2019 and 2020 but a difference was proven between 2018 and 2019 where more birds were consumed during the year 2019.

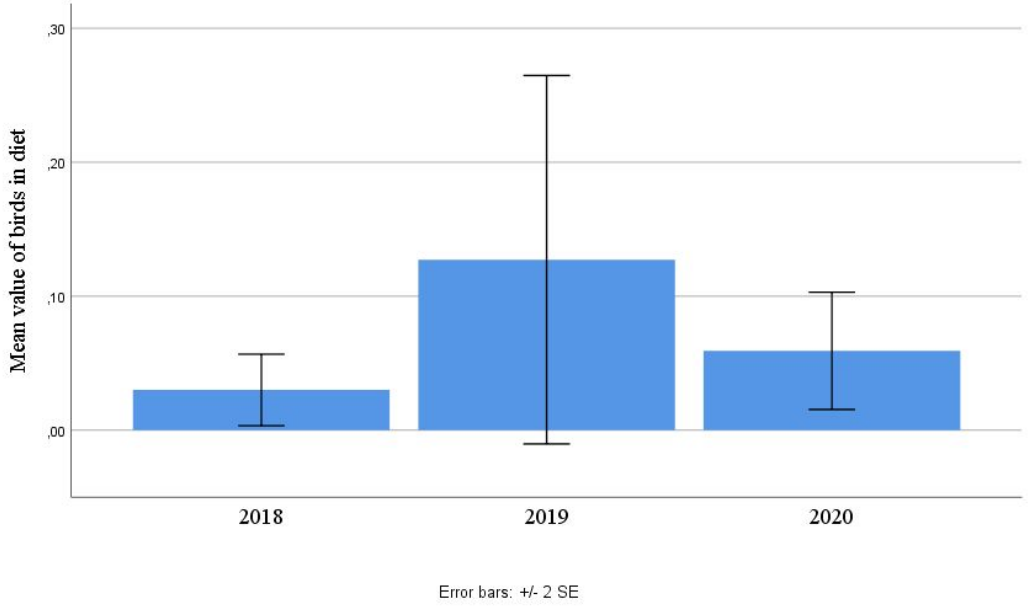

Figure 2 Mean proportion of bird that was included in the diet of the tawny owls during year 2018-2020

The ANOVA statistical analysis test showed that there was no difference in invertebrates consumed between the 3 years ($F_{2,12}$ = 3,400 p = 0,068).

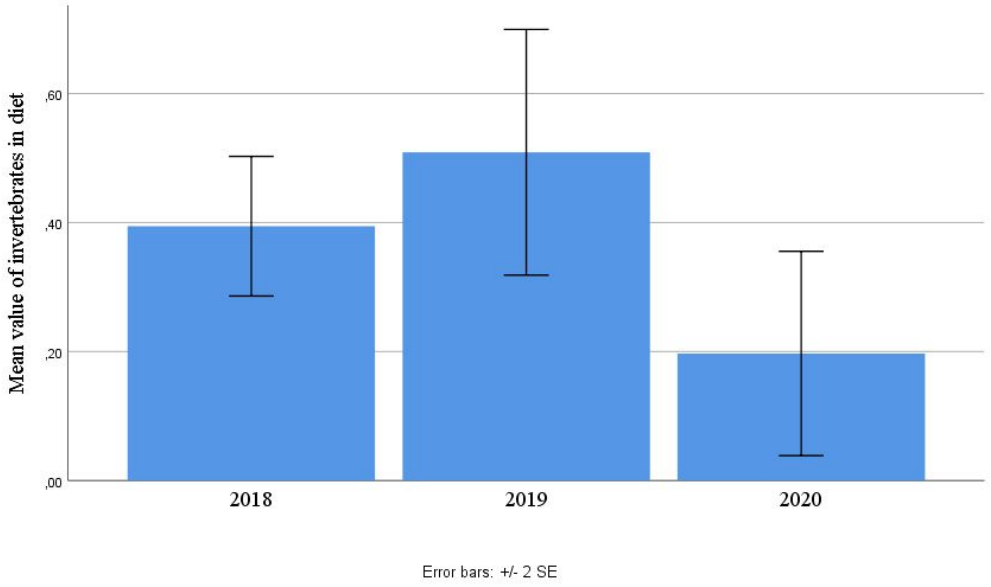

Figure 3 Mean proportion of invertebrates that was included in the diet of the tawny owls during year 2018-2020

The t-test showed that there was no significant difference between the footage and nest contents mammals (t_5 = -0,085 p = 0,935), birds (t_5 = 0,159 p = 0,880) and invertebrates(t_5 = 0,177 p = 0,867).

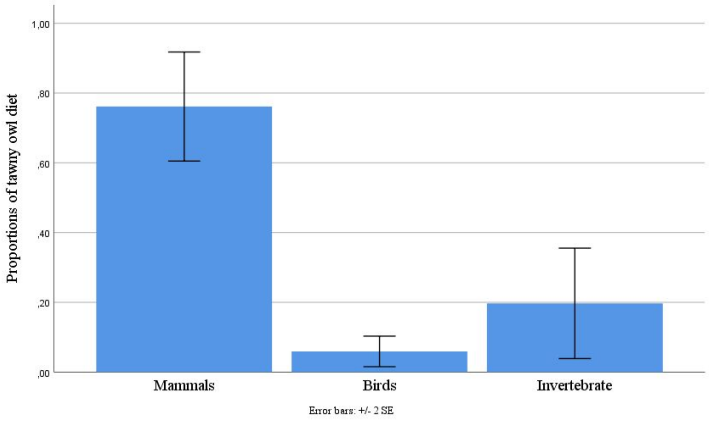

Figure 4 The mean proportion of each animal type in the diet of the tawny owl using the contents of the nest box during the year 2020

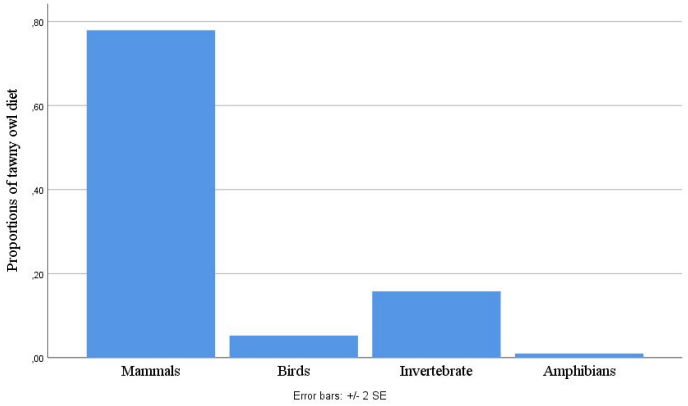

Figure 5 The mean proportion of each animal type in the diet of the tawny owl found using the footage during the year 2020

Discussion

In general, the result was similar to other studies in this field where mammals were the most abundant prey animal in the diet of the tawny owl (D. Anthony Kirk 1992). Although the proportion of invertebrates was surprising as it nearly resembled the proportions of mammals. One has to keep in mind that one mammal does not equal one invertebrate, proportions does not equal biomass and therefore the total biomass is greater for the mammals.

The results obtained through the data showed us that the hypothesis was incorrect in some aspects. There was no difference between the year 2018 and 2019 in mammals eaten, however we observed a difference between the year of 2019 and 2020. Anecdotal evidence from observations of prey in nest boxes indicated that rodents were in low availability in 2019 and therefore the thought was that tawny owls would change their diet to a more obtainable one of birds, which was not entirely true from my result. Looking at fig 1,2 and 3 we can see that they reduced the amount of mammals in the diet during year 2019, not

substantially but minor, and increased the proportion of birds and even invertebrates albeit not significantly but a little in their diet. This most likely due to the fluctuation of the rodent population that occurred during the year.
The proportions of birds were highest during year 2019 which was expected but not enough for it to be significantly different between 2018 and 2019 but instead 2019 and 2020. Overall there was a small proportion of birds that was included in the diet which is not aligned with other studies of the diet of tawny owls which had higher proportions of birds in the diet (D.Capazzi , 2000). This could be explained by different reasons one being that the results might have been skewed due to my lack of experience in identifying bones of the different prey items. This could be a problem where I might have been biased when seeing something that looked like a mammal femur but actually was a bird femur. The inexperience of identifying bones would therefore mostly affect the proportion of birds in the diet and might be a reason why there is a small proportion of birds in the diet. The lack of bird bones could also be due to bird bones breaking more easily than mammal bones because they are smaller and hollow inside. Although this might be the case for the nest content, when going through the footage from the cameras not many birds were observed either.

Another reason for the similarities in the diet between the years might be the temperature. According to J. Romanowski the diet of a tawny owl changes depending on the temperature. He studied whether diet changes from season to season and found that invertebrates , amphibians and birds are included in the diet more during warmer temperatures. Considering our result it could be that there wasn't a big temperature difference between the years and that might have gotten us a result where the portions of animals in the diet were more similar between years. I did find a difference between 2019 and 2020 for mammals and 2018 and 2019 for birds. This might show us that the temperature could have been slightly different during the year 2019 as well.

Looking at the footage compared to the nest box contents we see that there wasn’t any difference in proportions of animals in the diet which was predicted. Even though there was no difference in the test we can see in fig 5 that one amphibian was seen in the footage whilst no one was found in the nest contents. This could be due to several reasons, one mentioned earlier that I am inexperienced in identifying bones and that might be one reason there were no amphibians in the contents of the nest box. Another reason could be that the bones of the amphibian might have been thrown out of the nest by the owls or some other animal that

inhabited the nest box when the owls were gone. This thought could also be applied to other bones of birds or mammals, which could explain part of the results.

To conclude this study I would say that the fact that I obtained the same results from both methods is significant and means that these two methods could be viable to compare. For example if you have one study that goes through nest box contents and another that uses cameras and footage to identify the diet, they could be compared and analyzed without much insecurities. Also, if you want to start one of these studies the collection of nest box contents is cheaper and a less labour intensive method than footage, where electronics with large batteries are involved that are hard to install and expensive. If the cheaper and easier method of gathering data generates the same data, that is the better option for future studies.

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