Abstract

In this study, I investigated whether the feeding strategies of chicken (Gallus gallus domesticus) are in line with ideal free distribution. I hypothesized that the chicken would select the feeding strategies in the manner predicted by Ideal Free Distribution so that they would adopt strategies to maximize the net rate of food intake depending on the profitability of each patch. To be able to observe this, I conducted three different experimental treatments and gave them a choice between two food patches of different profitability.

I realized that in the absence of food, the chicken were averagely distributed on both the left and right sides of the control area, also, when patches of equal sizes are introduced, there was still even distribution in the area but increased clumping. On the contrary, when one of the patches was made more profitable, the chicken distributed themselves in an ideal free manner by clumping on the most profitable side. This pattern of distribution aids in maximum fitness for the individuals due to maximum resource intake.

Introduction

The distribution of food is one of the main factors influencing animal distribution. As such, the patch or location which offers the highest profitability will be foraged by an animal since it offers maximum benefit. When different locations have different profitability, the animals would distribute themselves between the locations to ensure each animal receives equal food intake. (Avgar et al., 2020) There should therefore be an equal proportion of resources for the animals in each location under these conditions. The situation leads to the development of an evolutionarily stable strategy such that individuals who fail to distribute themselves in an ideal manner incur costs of not getting the optimal number of resources and are therefore selected against (Milinski, 1987). This type of distribution is useful in the prediction of animals' dispersals between patches and is known as Ideal Free Distribution (IFD).

For IFD to be considered, the researcher has to make several assumptions on the behavior of the animals involved such as there should be no predation risk and the animals should only react to one factor in the environment which is food (Sirovnik et al., 2021). To ensure Ideal free distribution occurs effectively, all the animals clumped in a patch should access the same amount of food intake. Consequently, all resource guarding and competition must be eradicated to eliminate differing food intakes between animals hence a different distribution.

Over the years, there have been various reports of ideal free distribution in several animals such as ducks (Anas platyrhynchos), sticklebacks (Gasterosteus aculeatus) (Milinski, 1987), zooplankton (Daphnia hyaline x galeata) (Lampert et al., 2003), flamingoes (Phoenicopterus ruper), goldfish (Carassius auratus auratus) and tadpoles (Rana temporalis) (Veeranagoudar et al., 2004). To maximize their resource intake, all these animals have conformed to IFD due to different food distribution. However, there are other factors such as differences in competitive abilities and predation risk that affect their distributions (Sirovnik et al., 2021).

In this study, I investigated the effect of the difference in patch quality on the distribution of chicken (Gallus gallus domesticus), a species of domesticated chicken. The experiment tested whether or not chicken conformed to IFD by providing different quality patches on either side of the field. My predictions were, in the absence of food, the chicken would evenly distribute themselves relative to the sides of the field and evenly relative to each other. Secondly, I predicted that when the same quality patches are provided on each side of the field, the chicken would also distribute themselves evenly between the patches. Finally, I predicted that when provided different qualities of patches on either side of the field, then there would be an uneven distribution of the chicken with more clumping on the side with the high-quality patch (Lampert et al., 2003).

Methods

The chicken were tested in a 10ft x 20ft enclosure that consisted of different amounts of food. Each enclosure consisted of 7 chicken and the enclosure was divided by wood in the middle to create two patches. Observations for each treatment were recorded on each side every 20 seconds for five minutes. The chicken on the left side and right side were counted to determine the side that had more chicken. The chicken were observed during three treatments, no patch, even patch, and uneven patch

Treatment 1 (no patch). In this treatment, no food was provided for the chicken to understand the baseline data on distribution in the absence of food. I recorded the distribution of chicken on each side every 20 seconds and then determined the D-scores for each observation. The average D-score was then calculated to determine the level of distribution of the chicken.

Treatment 2 (even patch). In this treatment, two spatially distinct patches of equal quality were introduced to determine the change in their behavior from that in the absence of food. Equal amounts of food were placed on each side of the field and the distributions of chicken on each side were recorded every 20 seconds for five minutes. I then conducted a t-test to determine whether the difference in the average D-score between treatment 1 and treatment 2 was significant or not.

Treatment 3(uneven patch). In this treatment, three times as much food was introduced on one side of the field (left) compared to the other (right). The distribution of chicken on each side was recorded every 20 seconds for five minutes. After five minutes of observations and feeding, I switched the side receiving more food from left to right to test for side bias. I then conducted a t-test to whether the difference in the average D-score between treatment 3 and treatment 1 was significant or not.

Results

Treatment 1(no patch) There were seven chicken subjected to this treatment. On average, the chicken were evenly distributed on the left and right sides of the enclosure. The mean D-value for this treatment was 3.53. This represents a significantly even distribution as would be expected in ideal free distribution.

Treatment 2(even patch) On average, there were more chicken on the left side of the enclosure than on the right side. The mean D-value for this treatment was 3.93. This value indicated increased clumping probably since the chicken were using each other for communication. The difference in the D-score between treatment 2 and treatment 1 was insignificant. (Two-tailed t-test Dcrit = 2.145, Dabs = 0.4199, Dcrit > Dabs).

Treatment 3(uneven patch) On average, there were more chicken on the left enclosure in treatment 3a and more chicken on the right enclosure in treatment 3b. The mean D -value for this treatment was 6. The difference in the D-score between treatment 3 and treatment 1 was significant. (Two-tailed t-test Dcrit = 2.145. Dabs = 3.86, Dabs > Dcrit)

Discussion

The observed and recorded results suggest that the chicken conform to ideal free distribution. The chicken in this study conformed perfectly to the expectations I had set at the beginning of the experiment.

Under no food treatment, the chicken did not show a bias towards either side of the field. They were evenly distributed about each other. Other factors that would have caused clumping such as predatory threat were non-existent therefore without food present, the chicken did not have an incentive to clump in different patches (Sirovnik et al., 2021).

In the second treatment (even patch) the chicken distributed each other randomly about each other and did not indicate a bias towards either side of the field. The chicken conformed to IFD in this treatment and was clumped in two distinct patches that were evenly distributed in the field.

In the third treatment (uneven patch) the chicken indicated a bias towards the side of the enclosure with a high-quality patch in both trials. This led to clumping on the high food side indicating they changed their distribution in response to the uneven dispersal of quality. The chicken conformed to IDF in this treatment and supported my hypothesis that chicken can conform to ideal free distribution (Lampert et al., 2003).

This experiment examines the distribution of chicken under different treatments of food dispersal. The observed and recorded results of the study support the ideal free theory since the chicken conformed to IFD in all of the treatments. The chicken chose this strategy of distribution since it maximized their average food intake. Increasing their food intake would most probably maximize the chicken' lifetime fitness by aiding in survival and reproduction, therefore, putting a maximum number of resources and energy into the growth of their offspring (Sirovnik et al., 2021). The chicken were evenly distributed due to a lack of concerns for both predators and food. However, when the patches were introduced, the chicken clumped on high-quality patches conforming to ideal free distribution to increase their average food intake. The behavior of the chicken is adaptive since maximizing resource intake should aid in increasing their lifetime fitness (Veeranagoudar et al., 2004).

References

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