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# Ungulate preference and brood parasitism rates of the Brown-headed Cowbird (*Molothrus ater*)

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**Abstract**

Brown-headed Cowbirds (*Molothrus ater*) have been known to have a devastating effect on songbird conservation efforts in certain locations of certain mid-western areas of the United States. However, knowledge of cowbird distribution and threat is essential in concentrating conservation efforts in areas that are most effected. This study took place in Northwestern Montana, concentrated in the Moiese Valley and the National Bison Range National Wildlife Refuge. I observed Brown-headed Cowbird abundance with different grazer species: horses, cattle, and bison. I also studied cowbird parasitism rates through songbird nest searching. I found that Brown-headed Cowbird abundance was dependent on the number of grazers present. However, more measurements on the amount of available grazing land for each species would be necessary to determine a cowbird preference for grazer species. For Brown-headed Cowbird parasitsm rates, I only discovered 1 cowbird parasitized nest out of 36 located songbird nests. This study showed a minimal threat of Brown-headed Cowbird parasitsm on the survival of songbird species in this study area. Therefore, songbird conservation efforts in areas surrounding the National Bison Range National Wildlife Refuge and Moiese Valley should concentrate more on human disturbances and habitat degradation.

**Introduction**

Increasing Brown-headed Cowbird (*Molothrus ater*) abundance in many of North America’s grasslands can have a devastating effect on songbird populations (Mayfield, 1965; Sandercock et al., 2008). Habitat loss and degradation have also greatly contributed to the declining population of songbirds (Odell and Knight, 2001), but the presence of Brown-headed Cowbirds exacerbates the process. Serious focus is necessary for the conservation of songbirds’ delicate ecosystems. Parasitism pressure of cowbirds must be managed in order to ensure healthy environments for songbird populations.

As brood parasites, cowbirds place their eggs in nests where their chicks will be larger in size, and therefore more able to consume a larger percentage of the food. Songbird chicks fall victim to starvation and can be pushed out of the nest. Also, adult songbirds often abandon parasitized nests if it is early in the breeding season and they still have hope of creating a successful nest (Sandercock et al., 2008). Female sparrows are an excellent example of this defense mechanism to cowbird parasitism. However, in areas with low Brown-headed Cowbird abundance, field sparrows (*Spizella pusilla*) show little response to parasitism such as aggressive behavior to cowbird encounters, vigilant nest guarding, and abandoning the nest were observed (Burhans et al., 2001). Therefore, in areas where abundance is high, the Brown-headed Cowbird plays a major role in the success level of songbird’s nests. Their increased presence creates a volatile environment for passerines who are already under the pressure of habitat loss and degradation.

As brood parasites, cowbirds usually followed herds of bison (*Bison bison*) as they travelled prairie land. However, with the rapid decline in bison population, mainly due to mass exploitation from humans, Brown-headed Cowbirds have come to rely on cattle for their homerange choices (Goguen and Mathews, 2001). Unfortunately, cattle maintain the same grazing sites, unlike their migrating bison counterparts, providing an environment where constant parasitism pressure is possible. There are many factors involved in cowbird abundance. One of the most influential of these is habitat fragmentation. Brown-headed Cowbirds rely on open area ranges among cattle for foraging, forest edges for egg laying, and large trees for communal roosts (Chase et al., 2005). Forest edges provide female cowbirds with the best environment for the highest levels of success; for, the amount of eggs a cowbird is able to produce decreases with an increase in commuting distance between foraging and parasitizing sites (Curson and Mathews, 2003).

Though cowbirds have little to no effect on ungulates, their dependence on them is almost necessary for survival (Friedmann, 1929; Goguen and Mathews, 2001). Therefore, cowbirds are often found in habitats that support ungulate grazing. Brown-headed Cowbirds often feed in open habitats, where vegetation is short (Chase et al., 2005; Lowther, 1993). This kind of environment is provided by the grazing effects of large ungulates. These large mammals help reduce the height of vegetation, making it easier to spot invertebrates and potential nests to parasitze, as well as increase arthropod densities (Morris and Thompson, 1998). Acting as “beaters,” ungulates also flush arthropods as they graze. This action increases Brown-headed Cowbird foraging efficiency (Mayfield, 1965; Goguen and Mathews, 2001).

Historically, Brown-headed Cowbirds were absent in areas west of the Rocky Mountains Friedmann, 1929). This absence was based on the lack of bison grazing west of the Rockies. As bison numbers decreased in the Central Plains, Cowbirds began to rely on cattle grazing lands as foraging sites. As forests were diminished in the Central Plains and fragmentation became more of an issue, their homeranges started to expand to the north, so that Northern Plains of North America currently hold the highest densities of Brown-headed Cowbirds (Chase et al., 2005). I will hold my study in Northwestern Montana, an area bordering the Rocky Mountains which will allow me to observe the severity of cowbird abundance and parasitism on native songbirds of the area.

I will observe cowbird abundance in areas with three different forms of grazing pressure: cattle, horse, and bison. I predict that bison, cattle, and horses will have similar effects on vegetation in the area especially percent litter. Similarities in grazing effects have been previously studied (Goguen and Mathews, 2000; Morris and Thompson, 1998); however, horse grazing and its effect on Brown-headed Cowbird abundance is relatively unknown. Along with similar effects on vegetation, I expect there to be similar effects on invertebrates due to grazing between treatment sites. Since grazers are present in all Brown-headed Cowbird count sites, I predict that the vegetation and invertebrate abundance will be similar under all forms of grazing. Therefore, my first hypothesis is that an increased amount of individual grazers will increase the amount of invertebrate flushing, and will lead to an increase of Brown-headed Cowbird abundance in such sites. Since, farmers usually contain a larger amount of cattle or bison in grazing areas when compared to horses, I predict that the fewest number of cowbirds will be found in plots grazed by horses.

My second hypothesis is that there will be more Brown-headed Cowbirds found near grazers at sunset than at sunrise. Female Brown-headed Cowbirds often take part in breeding activities in the morning. These activities include parasitizing and social interactions, and have been found to occur along forest edges (Curson and Mathews, 2003). Forest edges generally take place where grazers are absent, due to the open range required for grazing. At sunset, females spend most of their time in open habitats as they engage primarily in feeding activity (Goguen et al., 2005). These feeding activities usually take place with grazer presence. Therefore, I predict that sunset cowbird counts will include both sexes, and thus be a larger and more accurate representation of the entire Brown-headed Cowbird population of the region (Goguen and Mathews, 2001).

My third, and final hypothesis is that there will be more parasitized nests in summer grazed plots than winter grazed plots. Northwestern Montana is known for its open grassland habitat. My prediction is that female cowbirds would want to minimize the energy that might be lost during greater commuting distances, such as the distances between foraging and parasitizing environments (Curson and Mathews, 2003); Cowbirds might parasitize where they forage based on the similarity of habitat type in the area, especially since forest edges are not abundant in the area.

Smith (2000) states that only isolated populations of a minimal number of specific species are under significant threat of Brown-headed Cowbird parasitism. By gaining insight into some of the determining factors for Brown-headed Cowbird abundance and parasitism rates, I plan to understand the most important factors to focus on when creating new songbird conservation efforts, especially in areas in Northwestern Montana where cowbirds are not native and their threat to songbirds is understudied.

## Materials and Methods

### *Study Site*

#### *Cowbird Abundance*

I conducted my Brown-headed Cowbird point counts on 15 plots: 5 bison grazed, 5 horse grazed, and 5 cattle grazed. These plots are distributed throughout the Moiese Valley and areas in and around the National Bison Range National Wildlife Refuge. All sites, except for one on the Bison Range, are owned by private land owners and irrigated at regular intrevals.

#### *Parasitism Rates*

I conducted my parasitism rate observations on the Flathead Reservation administered by the Confederated Salish and Kootenai Tribes (CSKT) in western Montana and the National Bison Range National Wildlife Refuge. These sites are located on the Upper South (2 plots), Lower South (1 plot) and the Southwest (3 plots) pastures of the Bison Range. The bison-grazed sites are located are located on Alexander Basin (3 plots) and Mission Creek (3 plots) pastures of the Bison Range. CSKT tribal land that is leased out to farmers will be used to observe cattle-grazed habit types (6 plots). Each plot is 6 hectacres (approx 14 acres) to ensure ample nest densities.

### *Brown-headed Cowbird Abundance Study*

#### *Brown-headed Cowbird Point Count*

To observe Brown-headed Cowbird abundance, I conducted 10-minute point counts twice at each plot. I performed these counts at dawn (6-8:30 am) and dusk (7-9:30 pm): times when Brown-headed Cowbird activity is greatest (Goguen et al., 2005). For each of these counts I also recorded wind speed (m/sec), temperature (°C), cloud cover, and number of grazers within the count area.

*Vegetation Measurements*

I collected vegetation measurements using a Robel Pole (Robel et al., 1970) and a daubenmire frame (Daubenmire, 1959). To better understand the density of vegetation, I took Robel pole measurements by recording visual obstruction four meters away from the center pole at a viewing height of 1 meter in the four cardinal directions. Since plant compostion can vary based on grazer (Towne et al., 2005), I also measured percent coverage at each site by looking at forb, shrub, litter, bare ground, and grass percent composition by using a 0.5x0.5 m daubenmire frame (Daubenmire, 1959). My aim was to take the average variation of grassland vegetation in each habitat type (Whalley and Hardy, 2000). Four Robel pole and daubenmire frame measurements were collected from each plot within each treatment. Collection sites within each plot were randomized by frisbee throw.

*Invertebrate Measurements*

I took invertebrate measurements within each study plot by sweeping with a standard terrestrial sweep net (38 cm diameter). I ran sweeps on two transects with 22 sweeps for each plot collection. Within these sweeps, I took the biomass and identified invertebrates to order preferred by Brown-headed Cowbird: Orthoptera, Lepidoptera, Hymenoptera, Hemiptera, Diptera, Coleoptera, Araneida, and Acarina (Ankney and Scott, 1980).

*Ungulate Measurements*

I measured the amount of ungulates within habitat type based on head count. Studies using ungulate presence as a dependent variable often use animal units to define the impact of ungulate feeding pressure (Ryle and Ogden, 1993). However, for this study I focused on head counts of the ungulates. This method best applied because impact of ungulate feeding pressure was not the main concern of cowbird preference, whereas the flushing of invertebrates by grazers and the availability for a possible perch site in the middle of an open field could be accounted for by head count.

*Brown-headed Cowbird Parasitism Rate Study*

*Brown-headed Cowbird Egg Count*

Nest searches were conducted in 5 cattle grazed sites, 5 bison grazed sites, and 5 winter-grazed sites. To do this, 5-ft. PVC pipes were held and swung in half circle rotations in order to disturb the top of the vegetation, while walking along parallel transects. Enough transects were walked in order to completely cover the entire plot (6 hectacres), which varied depending on the number of individuals conducting the sweep. Plots were searched twice throughout the summer. Nests were located by tracking a flushed bird. A UTM reading was taken using global positioning system (GPS; 3 m accuarcy) at each nest to ensure future revisitation. Flagging was placed six meters away from each nest to prevent possible predation threats and nest trampling. Parasitized nests were recorded and non-parasitized nests were revisited to observe possible parasitism after nest location.

**Analysis**

For my abundance study, I observed vegetation effect on Brown-headed Cowbird abundance by focusing on percent litter (Daubenmire, 1959) for each of the plots. The goal of this approach was to better understand grazing pressure based on differences in grazing species; such as, more percent litter would illustrate a decreased grazing pressure. I conducted an ANCOVA (SYSTAT, 2007) to see the effect of percent litter and grazer type on the abundance of Brown-headed Cowbirds. Since there was no significance of percent litter*grazer type interaction (p=0.79), I looked at the effects of both factors independently on Brown-headed Cowbird abundance with an ANOVA (SYSTAT, 2007). I also used an ANCOVA (SYSTAT, 2007) to observe the effects of insect biomass and grazer type on Brown-headed Cowbird abundance. There was not a significant interaction between insect biomass and grazer type (p=0.918). Therefore, I conducted an ANOVA (SYSTAT, 2007) on each individually to see insect biomass effect on cowbird abundance.

I conducted an ANCOVA (SYSTAT, 2007) to determine if time of day had an effect on the abundance of Brown-headed Cowbirds based on grazer type. I found that there was no interaction between grazer type and time (p=0.719). I removed the interaction term conducted an ANCOVA to see the effect of time of day on Brown-headed Cowbird abundance.

Based on significant findings for grazer type, I standardized for grazer density by taking Brown-headed Cowbird count/ number of grazers. I ran an ANOVA (SYSTAT, 2007) to determine if grazer type was significant on cowbird abundance when cowbird/grazer was taken into account.

**Results**

Environmental factors did not have a significant effect on Brown-headed Cowbird abundance when different grazing types were observed. Environmental factors for this study focused on percent litter (p=0.423; figure 1) and insect biomass (p=0.597; figure 2). Time of day also did not have a significant effect on Brown-headed Cowbird abundance when morning and evening counts were compared (p=0892; figure 3). Grazer type did have an effect on the number of cowbirds within a plot (p=0.004; figure 4). However, horses, bison, and cattle vary in herd size; horse plots hold fewer individuals than cattle and bison plots. Therefore, grazer density was accounted for by dividing the number of cowbirds counted in each plot by the number of grazers within that plot. Grazer type was not significant when cowbird/grazer was observed ($p=0.140$; figure 5). This shows that cowbirds illustate a preference for large amounts of grazers, but does not indicate a preference for species of grazer. To better understand if Brown-headed Cowbirds act on a preference for grazer species, the amount of land open for grazing within each plot would need to be accounted for.

Statistics were not run on parasitsm rate of Brown-headed Cowbirds. This is because only 1 of the 36 sparrow and meadowlark (*Sturnella neglecta*) nests were parasitzed (figure 6). Meadowlark and sparrow, specifically vesper (*Pooecetes gramineus*) and grasshoper (*Ammodramus savannarum*), were focused on because they were found in greatest abundance and are species that have been parasitized by Brown-headed Cowbirds (Burhans et al., 2001).

**Discussion**

I found that, though the abundance of Brown-headed Cowbirds seemed to depend on grazer type (figure 4), abundance of cowbirds was actual found to be dependent on the number of grazers present. Therefore, the reason for higher Brown-headed Cowbird counts in bison grazed sites was most likely due to the amount of grazers in the area, rather than the specific species of the grazers. This finding supports my first hypothesis that an increased amount of individual grazers present within a site will lead to an increase in cowbird abundance. This result could be due to the increased invertebrate flushing effect with greater grazer counts, or could be related to the increased perching availability, a cowbird behavior observed in the field during point counts.

In order to determine if grazer species had an effect on the abundance of Brown-headed Cowbirds, I would need to have taken measurements on the amount of land open to different species of grazers. This is required to determine the differences in grazers' social foraging behaviors. Literature supports the idea that horses, cattle, and bison portray differences in herd sizes and group movements (Christie, 2008; McHugh, 1958; Senft et al., 1985; Meagher, 1986). Bison are found to forage in ways that depend mainly on following the leadership of a specific adult cow (McHugh, 1958); this movement is usually a line-like movement where the herd moves as one (Meagher, 1986). This is different from cattle grazing patterns that are generally more individually decided on and dependent on relative quality and quantity of the vegetation foraged on (Senft et al., 1985). Apart from social foraging behaviors and differences in subherd possibilities, horses differ by the number of horses that are placed in a grazing plot. The most effective number of horses placed together in a given grazing plot is 4-10 individuals of the same sex (Christie, 2008), a much smaller number than most cattle and bison herds. For this study, I needed a deeper understanding of my individual study sites. Human planning generally provides horses with the smallest amount of grazing land, then cattle with the second greatest amount of grazing land, and finally bison with the largest amount. In order to determine if Brown-headed Cowbirds showed a preference for species of grazer, I would have needed information on the available amount of land available for the grazer, the amount of grazers in the area observed, and the count of cowbirds in that area.

I found that there was no significant effect on Brown-headed Cowbird abundance based on time of day (figure 3). Within each grazing type, the number of cowbirds observed in the 10 minute point count was almost the same at the morning hours (6-8:30 am) as the evening hours (7-9:30). This strengthened the argument from the first hypothesis that the number of grazers was the strongest factor influencing Brown-headed Cowbird abundance. Goguen and Mathews (2001) found that females forage in the morning, an unexpected behavior in prime cowbird conditions, when feeding environments are patchily distributed in western environments. Northwestern Montana, especially the area in this study, greatly consists of open ranches and agricultural sites. Therefore, it is unlikely that females would have foraged in the morning based on the distribution of feeding environments. In contrast, there are local patches of trees in the area, mostly around residential and riparian zones, that could have offered the patchy distribution that Goguen and Mathews (2001) referred to. However, forest edges, environments where female cowbirds prefer to parasitize nests (Chase et al., 2005), are not abundant in the sites focused on in this study. The lack of significance in time on cowbird abundance could be due to the cowbirds using grazing sites as both feeding and egg laying environments. This cowbird behavior would help females conserve energy; females would be able to focus more energy on egg production than on commuting between widely distributed environments. Curson and Mathews (2003) found that this conservation can effect Brown-headed Cowbird egg production up to 50%.

Based on this information, the third hypothesis may have been supported: there will be more parasitized nests in summer grazed plots than winter grazed plots. However, there was only one parasitized nest located in any of the 18 searched plots. The parasitized nest was located in a site grazed by bison (figure 6), but analysis was unable to be conducted based on the lack of findings. The low amount of parasitism could have related to the abandonment tendencies of sparrows as a defense mechanism against Brown-headed Cowbird parasitizm (Sandercock et al., 2008). The methods of the nest searching depended on flushing host species. If a nest was parasitized and abandoned, it would most likely have gone undetected. On the other hand, nest abandonment is most common in areas where cowbird abundance is high (Burhans et al., 2001). Burhans et al. (2001) discovered 2 Brown-headed Cowbird parasitized nests out of the 681 located field sparrow nests located in Pennsylvania, an area with relatively low cowbird abundance. Therefore, the low parastism rate found in this study could be due to an insignificant threat of cowbird presence on songbird conservation in Northwestern Montana. This supports the conclusions of Smith (2000), that issues with Brown-headed Cowbird abundance is specific and localized.

It is important to focus songbird conservation efforts where the greatest impacts are being made. In areas such as Northwestern Montana, songbird degradation is most likely due to human impact and habitat loss. Therefore, it would be more benefitial to focus funds, policy, and efforts into programs that regulate human activity and provide sanctuaries for species in jeopardy than to focus on minimizing cowbird parasitsm.

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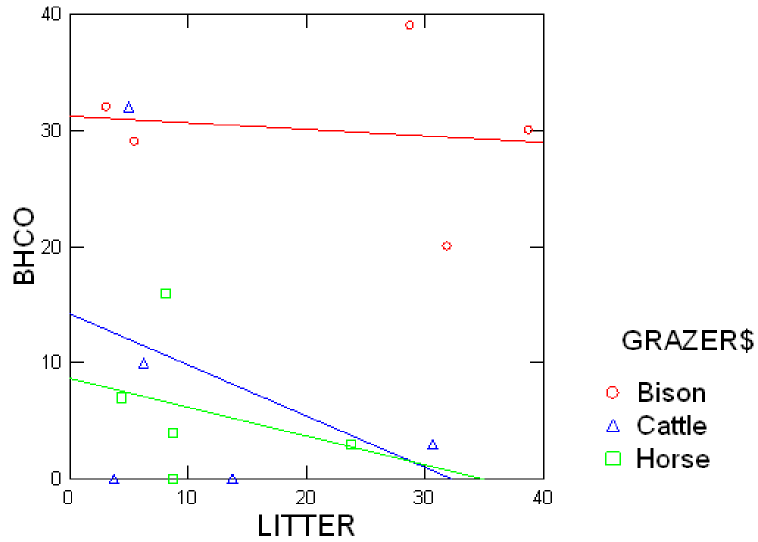


Figure 1. ANCOVA graph for effect of percent litter on the abundance of Brown-headed Cowbirds under three different grazing types: horse, cattle, and bison.

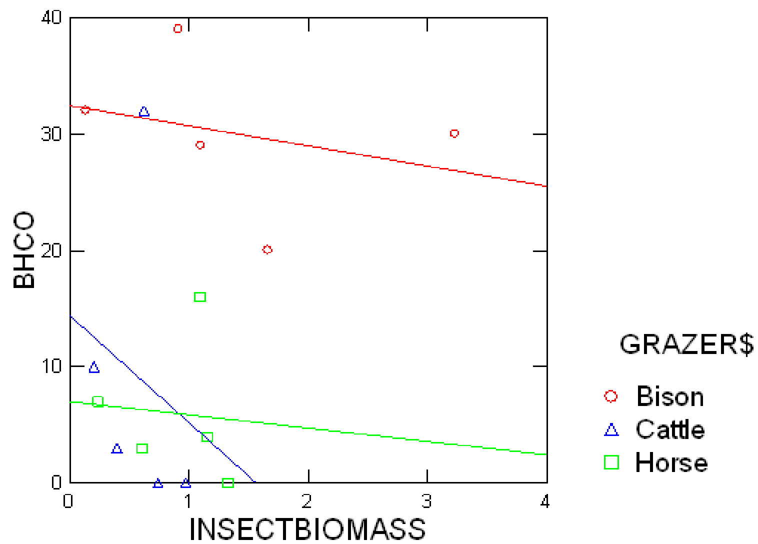


Figure 2. ANCOVA graph for effect of insect biomass on the abundance of Brown-headed Cowbirds under three different grazing types: horse, cattle, and bison.

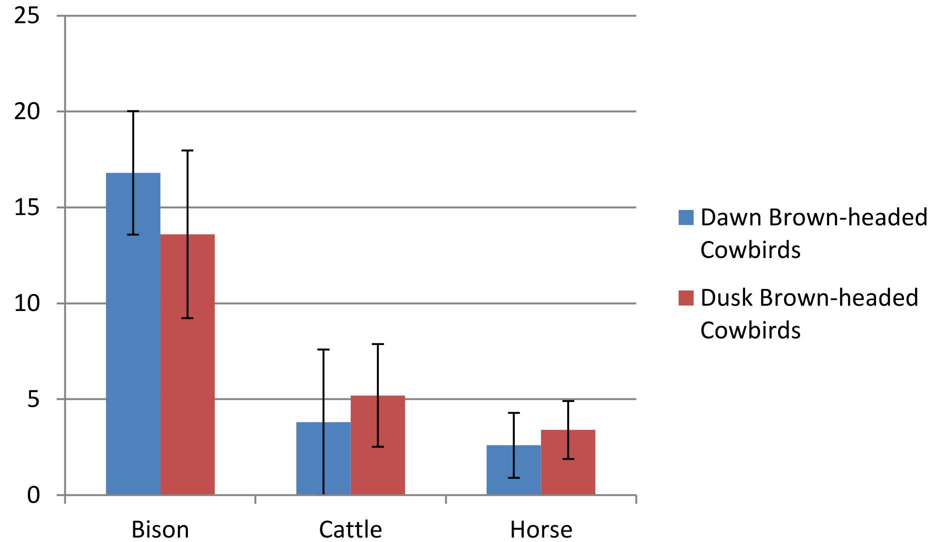


Figure 3. The effect of time of day on Brown-headed Cowbird abundance under different grazing types by comparing morning (6-8:30 am) and evening (7-9:30 pm) cowbird point counts.

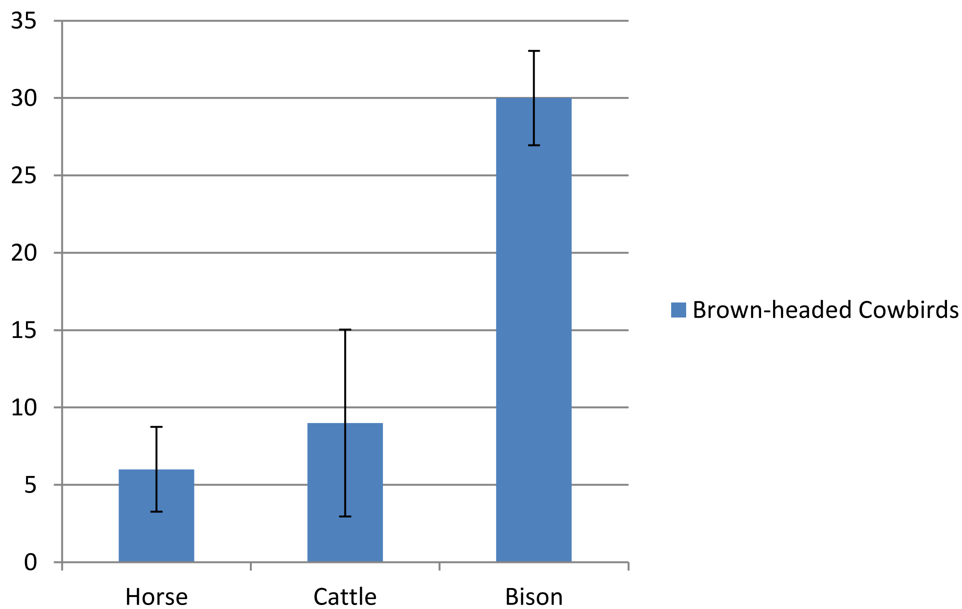


Figure 4. The effect of grazer type on the abundance of Brown-headed Cowbirds without the calculation for grazer density.

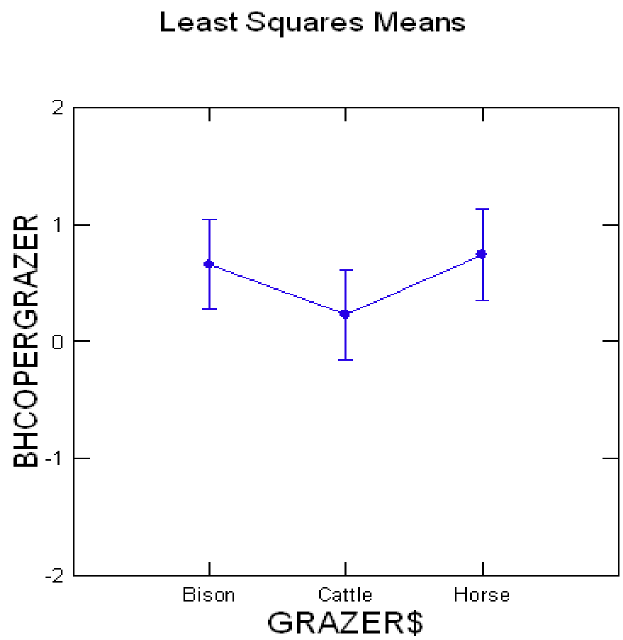


Figure 5. The effect of grazer type on the abundance of Brown-headed Cowbirds when grazer abundance is accommodated for (cowbird count/ number of grazers).

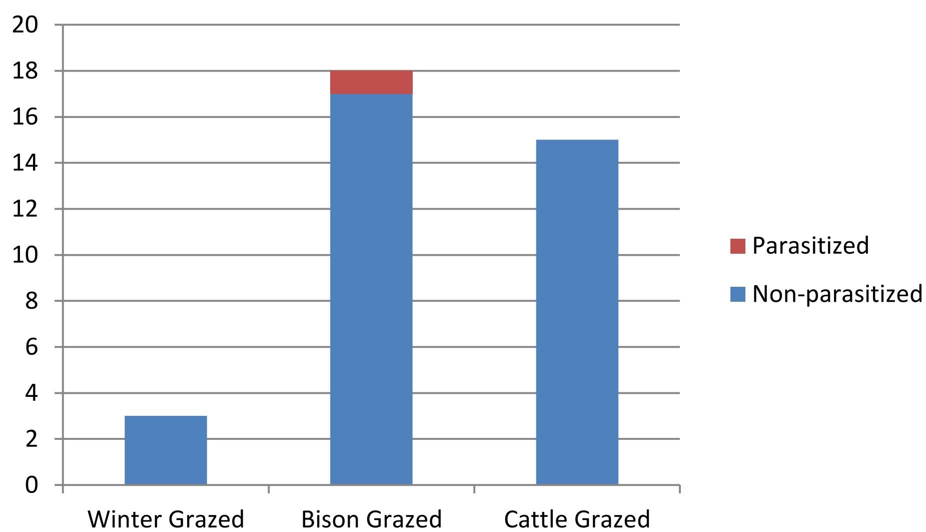


Figure 6. The amount of nest parasitized by Brown-headed Cowbirds under different grazing pressures and grazer type.