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East FOUNDATION

# Wildlife Use of Ivermectin Bait Sites on East Foundation's El Sauz Ranch, South Texas

A publication by Mathew Kramm IV, Mathew Kramm III, Tammi Johnson, Roel Lopez and Jewel Uzquiano

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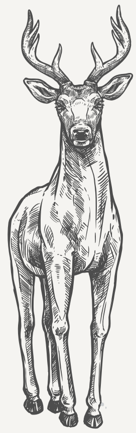

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# STUDY AREA

The East Foundation's mission is to "promote the advancement of land stewardship through ranching, science, and education". East Foundation operates six separate ranches across South Texas that exceed 80,937 ha, employing ranchers, scientists, and support personnel to achieve their goals and objectives relating to land stewardship. Wildlife management plays an integral part of rangeland sustainment by using experienced ranchers working in conjunction with wildlife managers and scientists. This study was conducted on the East Foundation El Sauz Ranch, that encompasses 11,082 ha, with most of the land located in Willacy County and the northern section of the ranch located in Kenedy County, Texas (Figure 1).

Vegetation cover types on the East Foundation El Sauz are comprised primarily of grasslands and shrublands, with small patches of woodlands, wetlands, and early seral plant communities. The topography is primarily level with some rolling hills (Beasom and Scifres 1977), with honey mesquite (*Prosopis glandulosa* var. *glandulosa*) overstory, accounting for over 70% of the woody plant density. Other woody species include huisache (*Acacia farnesiana*), spiny hackberry (*Celtis pallida*), lime pricklyash (*Zan thoxylumfagara*), and bluewood (*Condalia obovate*). The soil composition at El Sauz Ranch is primarily Delfina and Lozano sandy loam.

El Sauz Ranch is home to a variety of native and non-native wildlife species such as white-tailed deer (*Odocoileus virginianus*), bobcat (*Lynx rufus*), nilgai antelope (*Boselaphus tragocamelus*), and feral hogs (*Sus scrofa*). White-tailed deer were the primary target species of the study where annual survey data estimates white-tailed deer density to be approximately 1 deer/18 ha.

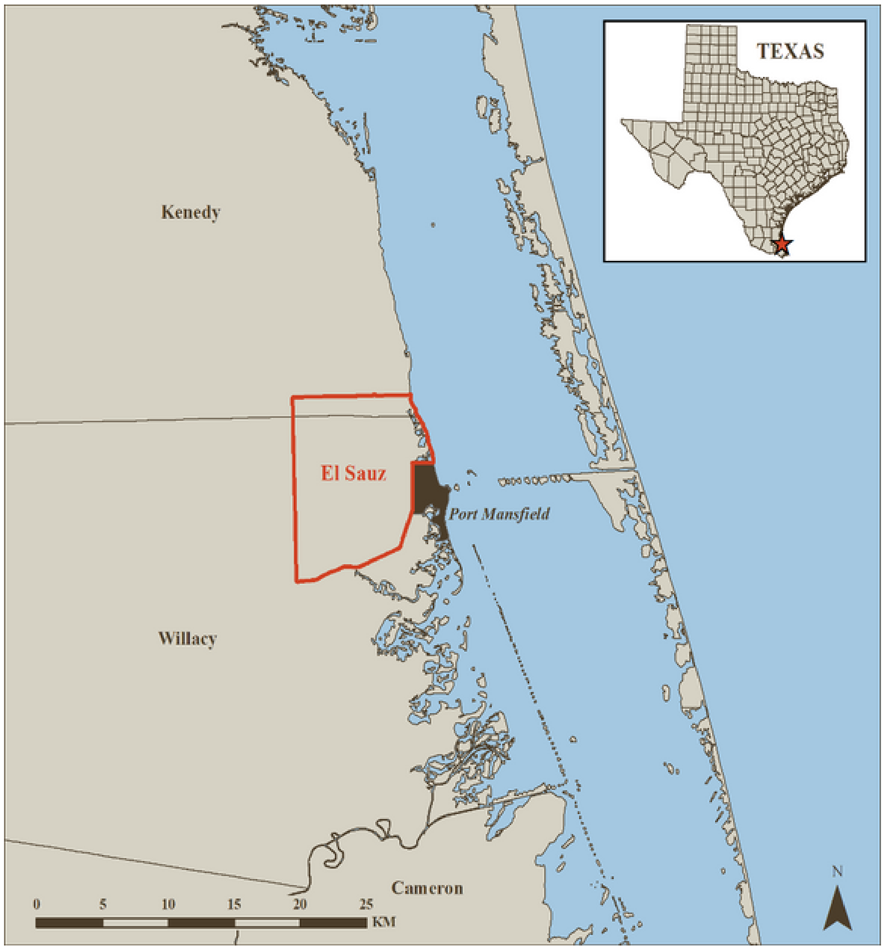



**Figure 1.**

Study area location of El Sauz Ranch and Port Mansfield in South Texas, 2020.

# SECTION 1: FEEDER USE AND BAIT CONSUMPTION

## INTRODUCTION

### Diseases and Oral Treatments

Numerous infectious diseases remain a viable threat to community and animal health in the United States and in many instances, free-ranging wildlife populations can serve important roles as hosts and reservoirs in the transmission cycle (Cross et al. 2007.) Wildlife can transmit disease without any influence by humans generally. While treating wildlife for diseases is challenging, current oral prophylactic treatments are readily available and have the potential to drastically reduce or even prevent diseases. Oral treatments to mitigate and treat infectious diseases have been used on a variety of wildlife and have proven to be a useful tool. Oral delivery has been used to deliver vaccines for plague in black-tailed prairie dogs (*Cynomys ludovicianus*) (Creekmore et al. 2002) and to control sarcoptic mange in American black bears (*Ursus americanus*) (Wick et al. 2019). Use of baiting can serve to increase the efficacy of these oral treatments and has found success in many wildlife populations.

Baiting strategies have been implemented in South Texas to vaccinate free ranging coyotes (*Canis latrans*) for rabies (Farry et al. 1998). While rabies vaccination baits are available for other animals such as the gray fox (*Urocyon cinereoargenteus*) and raccoons (*Procyon lotor*), they must be specifically tailored towards each individual species. Based on gray foxes' preferences, dog food as well as fish meal and lard were used for the base of the rabies vaccination feed (Steelman et al. 2000). Oral rabies vaccination for wildlife in the United States has shifted to the raccoon variant while still preventing any potential re-emergence of coyotes and gray fox (Slate et al. 2009). Oral vaccinations for tuberculosis in the Australian brushtail possum (*Trichosurus vulpecula*) have been used in the endemic regions of New Zealand to prevent transmission of bovine tuberculosis (Tompkins et al. 2009). While oral treatments of disease have been beneficial, they do not come without challenges. Wobeser (2002) lists a set of criteria that oral treatments must meet for wide-scale distribution on wildlife populations; 1) treatment must be efficient at treating or vaccinating for a specific disease or ailment and safe for non-target animals to inadvertently ingest without lasting detrimental effects, 2) drug treatment must be able to withstand diverse environmental conditions. Rapid breakdown of oral medication renders the process in wildlife populations useless.

Oral treatments have not only been effective for various wildlife species but have played an important role in cervid populations. Cervids have been treated with a wide variety of oral treatments for many different reasons. White-tailed deer have been orally administered encapsulated diethylstilbestrol with the intent to curb overpopulation (Matschke 1977). White-tailed deer also have been treated with melatonin orally to monitor circadian rhythms in males (Bubenik and Smith 1987). Finally, red deer (*Cervus elaphus*) have been treated with orally administered copper oxide wire particles in their youth to monitor growth rates (Wilson 1989).

## Deer Feeders and Ivermectin

In addition to the selected medication being considered for a given treatment, delivering the medication successfully is also important in a wildlife disease mitigation program. For some species like white-tailed deer, an effective oral delivery system can include gravity feeders or mechanically dispensed feed. The ability of the feeders to deliver supplemental feed in conjunction with toxicants or medicines is popular in management programs. One issue that may occur is the potential for non-target species such as raccoons, feral hogs, avian species and other wildlife to interfere and consume supplemental feed intended for deer (Cooper and Ginnett 2000, Rattan et al. 2010). Therefore, it is common practice to use exclusion fencing to minimize non-target species' access to the treated feed. A fenced enclosure provides protection from other animals such as feral hogs and coyotes whose presence could also potentially deter white-tailed deer visitation and feeder use. Another advantage of supplemental feed delivered through gravity or mechanical feeders is the option to manipulate the feed by adding protein pellets or flavor additives to increase feed attractiveness and nutrition.

Supplemental feed in combination with an acaricide such as ivermectin, can potentially serve to mitigate parasitic diseases by targeting arthropod vectors. Ivermectin is an antiparasitic agent that was introduced in the early 1980s and has been shown to be highly effective against arthropods such as cattle fever ticks (Campbell 1985). Using deer feeders that have ivermectin-treated corn can provide additional benefits to a wildlife disease program. For example, when white-tailed deer seek out treated corn in feeders as their primary form of nourishment this could reduce the need to travel in search of food, further reducing the potential for transmitting vectors and infectious diseases (Garner 2001).

The overall goal of this research was to assess feeder usage and ivermectin corn consumption from feeders on East Foundation El Sauz Ranch, a property which cattle fever ticks have never been found, in comparison to feeder usage in Port Mansfield where fever ticks have been documented in the past. The objective of this section is to assess feeder use and ivermectin treated corn (bait) consumption.

# METHODS

Data were collected from 18 feeder stations on East Foundation El Sauz Ranch targeting white-tailed deer between 9 April 2019 and 30 July 2020 (Figure 2). Feeders 227-230, 234, 236, 264 were accessible just off the entrance main road, while the remainder of the feeders were located within pasture centers. Deer feeders were maintained with shelled corn (both treated and untreated, depending on the time of year) throughout the period of study. Feeders were filled with ivermectin treated corn from March to July of each year and were either emptied or capped for the remainder of the year. In July 2019, ivermectin treated corn was removed to allow at least a 60-day withdrawal period prior to deer hunting season to ensure ivermectin residues in deer meat decrease to below the tolerance level (USDA APHIS 2016). Bait consumption was monitored through monthly checks of feeders and used to determine bait consumption trends over time.

In addition to the 18 feeders at East Foundation El Sauz, three feeders at Port Mansfield were monitored (Figure 2). All 21 feeders were Boss Buck™ gravity head feeders (GSM Outdoors, Grand Prairie, Texas), capable of holding 350-pounds of feed with three separate feed ports and were monitored with game cameras (Figure 9-10). Feed ports were at a 10-degree angle to allow for even distribution of corn and a drain hole to prevent any water from sitting in the feed (Figure 10).

Feeder use was monitored using infrared game cameras (Browning® Strike Force HD Pro Game Cameras, Morgan, Utah) due to their cost effectiveness in capturing photos in a variety of weather conditions (Brown and Gehrt 2009). Infrared camera technology has been implemented in wildlife studies to monitor activity for almost 50 years (Cutler and Swann 1999) and has been shown to provide quality monitoring data for wildlife research studies (Currie et al. 2020).

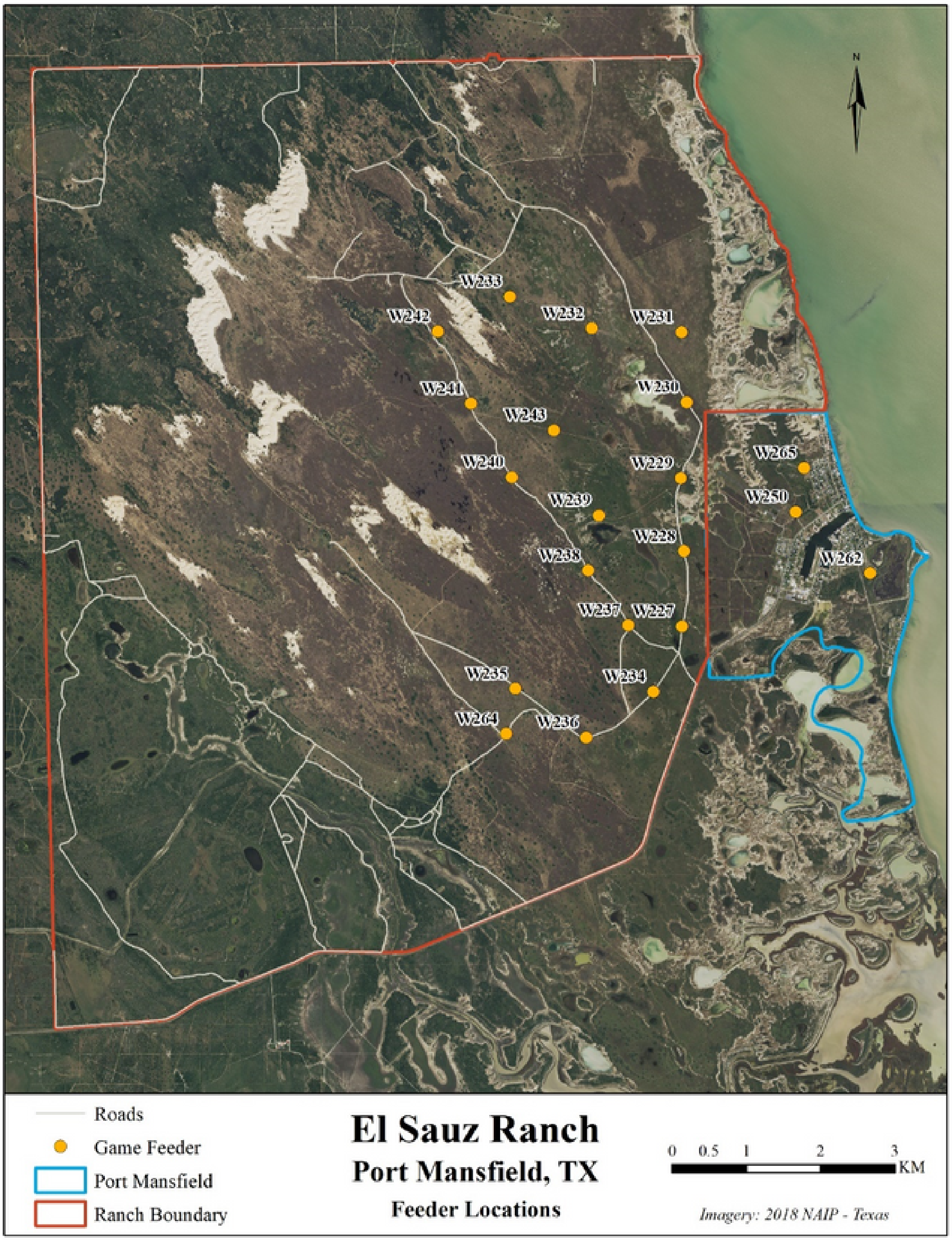



**Figure 2.** Property boundary of East Foundation El Sauz Ranch, South Texas (red) and Port Mansfield (blue) with numbered deer feeders, 2020.

# SECTION 1: FEEDER USE AND BAIT CONSUMPTION

## RESULTS

Ivermectin treated corn consumption was monitored March-July 2019 and March-July 2020. Corn consumption data from both years allowed for preliminary pre-baiting results at half the feeder stations on East Foundation El Sauz Ranch. Post hoc, deer feeders were categorized based on distance from property boundary to determine if there was differential use of feeders. Distance categories for the 18 feeders on East Foundation El Sauz Ranch were: near (<1.5 km), mid (1.5-2.5 km), and far (>2.5 km) from the property boundary (Table 1). Consumption data for 2020 showed higher consumption closer to the study area perimeter fence (Figure 17). Total corn consumed in 2019 was 8,835 pounds of treated corn combined between all distance regions. Treated corn consumption in 2020 totaled 12,865 pounds among the three distance regions (Figure 3). Treated corn consumption varied by category and year (Figures 4-5; Table 1). Ivermectin corn consumption was highest among the near feeders with a mean feeder consumption of 685 pounds in 2019 compared to 750 pounds in 2020. Mid feeders averaged 380 and 629 pounds in 2019 and 2020 respectively (Figures 6-7).

**Table 1.** Ivermectin corn consumption (pounds/kilograms/feeder) from 6 March – 10 July 2019 and 6 March – 30 July 2020 on East Foundation El Sauz Ranch. Feeders categorized by distance (km) to property boundary fence line.

| Feeder | Distance (km) | Distance Category* | Consumption (lbs/kg) | |
|---|---|---|---|---|
| | | | 2019 | 2020 |
| 228 | 0.3 | Near | 600 / 272 | 705 / 320 |
| 229 | 0.3 | Near | 650 / 295 | 975 / 442 |
| 230 | 0.3 | Near | 900 / 408 | 825 / 374 |
| 227 | 0.4 | Near | 850 / 385 | 725 / 329 |
| 234 | 0.5 | Near | 900 / 408 | 950 / 431 |
| 237 | 1.0 | Near | 470 / 213 | 550 / 250 |
| 231 | 1.1 | Near | 400 / 181 | 645 / 293 |
| 236 | 1.3 | Near | 830 / 376 | 470 / 213 |
| 239 | 1.4 | Near | 560 / 254 | 900 / 408 |
| 238 | 1.6 | Mid | 575 / 261 | 1000 / 454 |
| 243 | 1.8 | Mid | 175 / 80 | 700 / 318 |
| 232 | 1.9 | Mid | 50 / 22 | 570 / 259 |
| 264 | 2.2 | Mid | 750 / 340 | 400 / 181 |
| 235 | 2.3 | Mid | 350 / 159 | 475 / 215 |
| 240 | 2.6 | Far | 0 / 0 | 675 / 306 |
| 233 | 3 | Far | 200 / 91 | 900 / 408 |
| 241 | 3.2 | Far | 225 / 102 | 700 / 318 |
| 242 | 3.7 | Far | 350 / 159 | 700 / 318 |

*Feeders categorized by distance (km) to East Foundation El Sauz property boundary fence line. Distance categories: Near (<1.5 km), Mid (1.5–2.5 km), Far (>2.5 km).

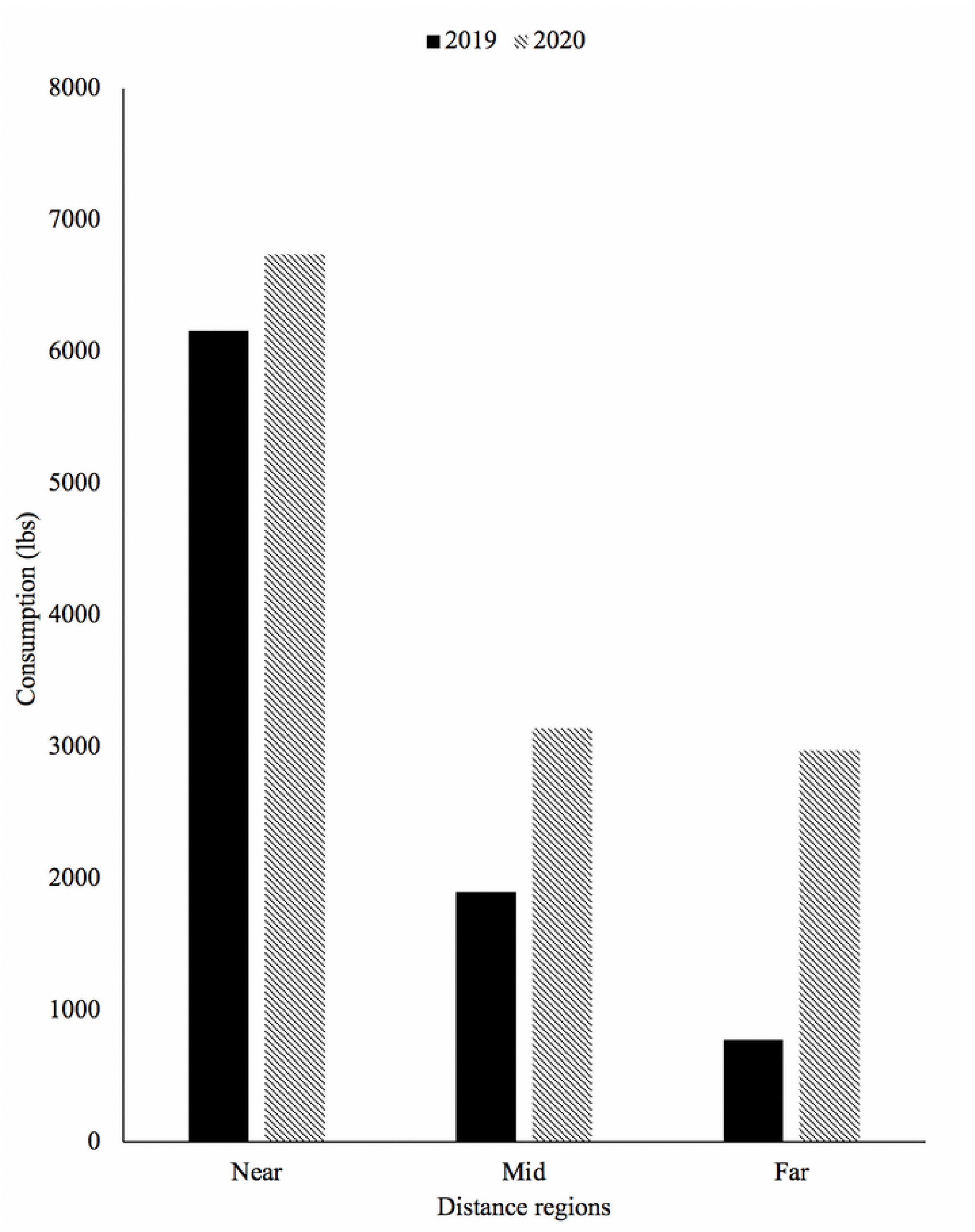



**Figure 3.** Ivermectin corn consumption by feeder, 2019 and 2020. East Foundation El Sauz Ranch.

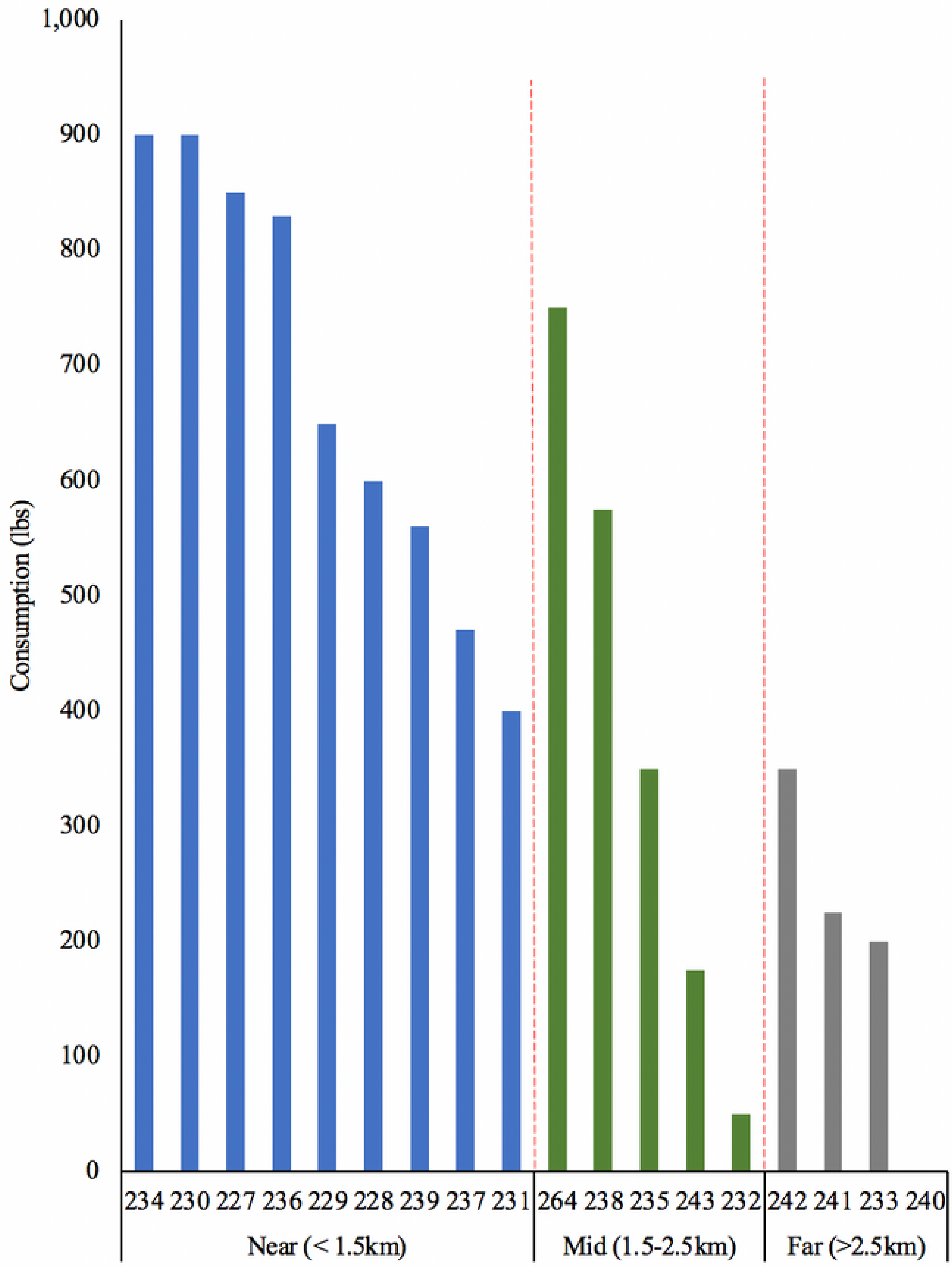



**Figure 4.** Total corn consumption (pounds/feeder) categorized by distance to property fence line, East Foundation El Sauz Ranch, 6 March – 10 July 2019.

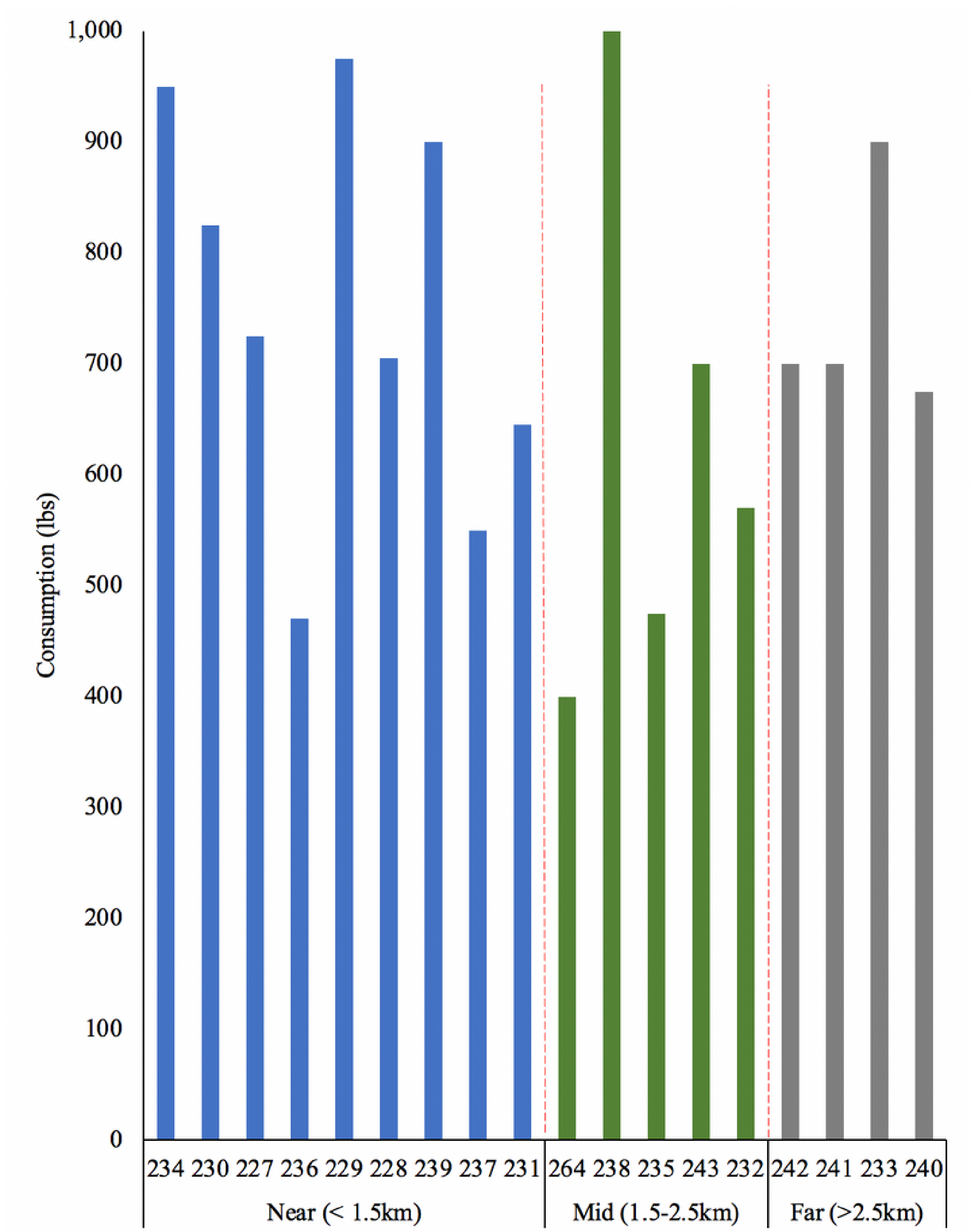



**Figure 5.** Total corn consumption (pounds/feeder) categorized by distance to property fence line, East Foundation El Sauz Ranch, 6 March – 22 July 2020.

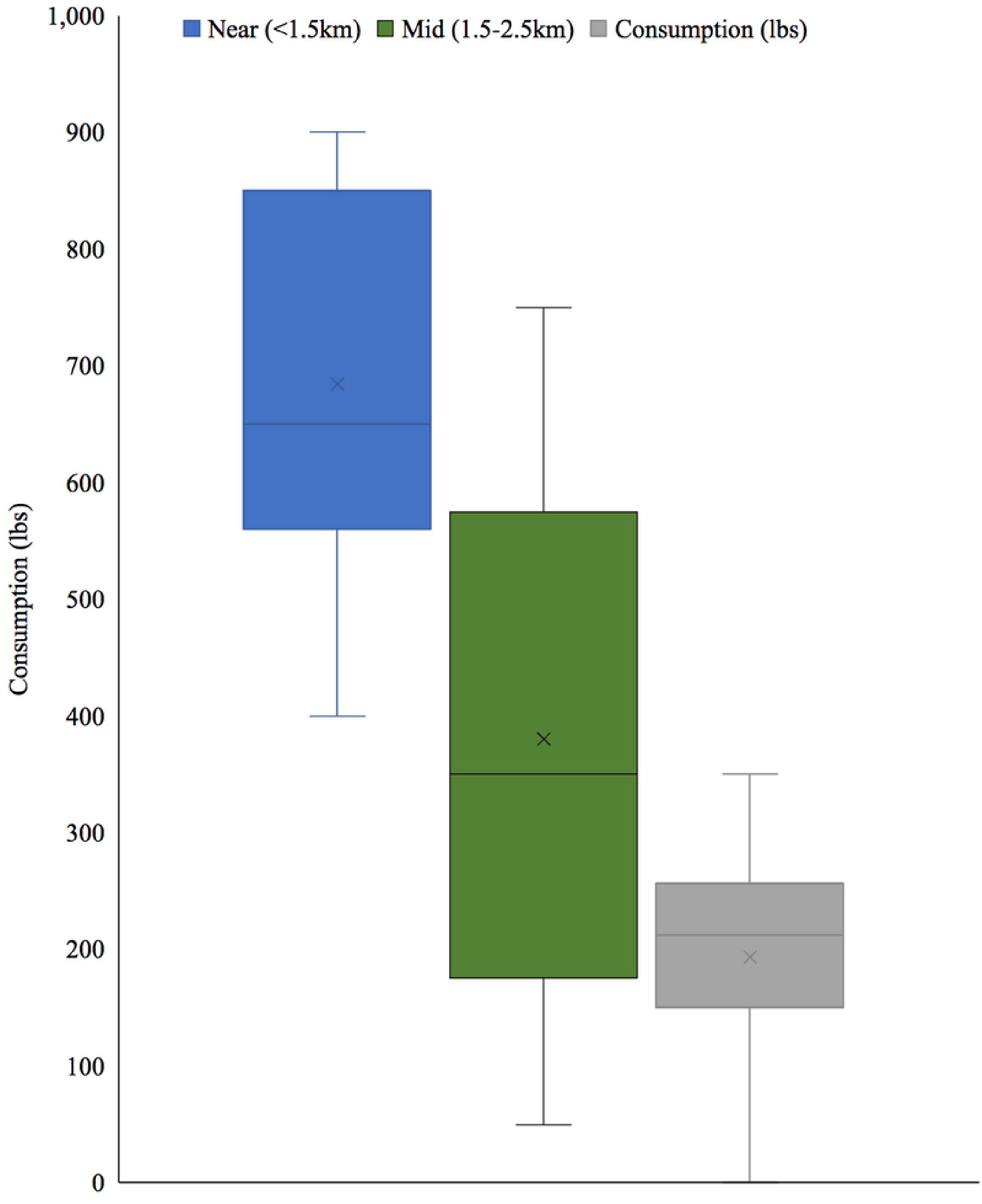



**Figure 6.** Box plot of total feed consumption grouped by feeder distance, East Foundation El Sauz Ranch, 6 March 2019 – 10 July 2019.

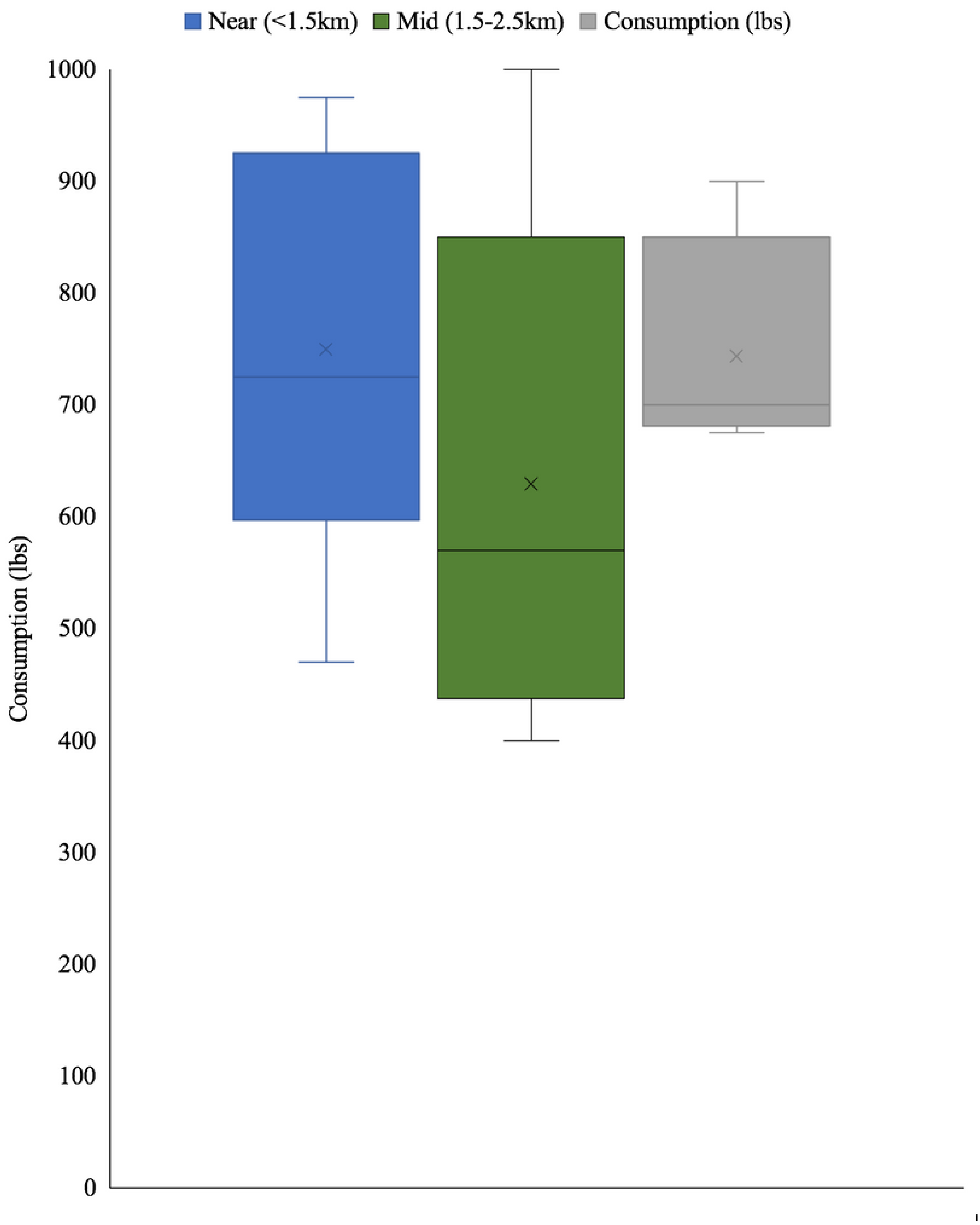



**Figure 7.** Box plot of total feed consumption grouped by feeder distance, East Foundation El Sauz Ranch, 6 March 2020 – 22 July 2020.

# SECTION 1: FEEDER USE AND BAIT CONSUMPTION

## DISCUSSION

Previous research has shown that deer do not spend as much time in open areas compared to areas with natural cover in close proximity when utilizing feeding stations (Miller et al. 2003). For this study most of the white-tailed deer visitations were located at feeding stations with high visibility and little to no nearby cover. Despite the location of feeding stations, all feeders were visited by deer. This could potentially be due to the remoteness of the study area and the limited daily vehicle traffic that occurs there. As a result, deer may be more comfortable in feeding in open areas. In comparison, feeders further inland had more natural cover in close proximity to feeder stations but had less visitations, which contrasts what Miller et al. (2003) reported. Feeder camera photos showed that larger male deer were seen feeding more often than females, which has been shown by others (Pound et al. 1996, Currie 2013, Currie et al. 2020). Behavioral differences between sex and age classes suggest that older males would likely capitalize on food resources. On several occasions, there were images of males sparring over space in the fenced feeder areas (Figure 8). This differential feeder use is notable and could result in the level of treatment between the sexes to differ due to differential access to treated corn.

**Figure 8.** Male deer sparring inside feeder enclosure, Port Mansfield, 2020.

# SECTION 2: FEEDER VISITATION BY SPECIES

## INTRODUCTION

### Case Study: Cattle Fever and Ticks

Cattle fever or bovine babesiosis is an infectious disease caused by protozoan parasites of the genus *Babesia*, specifically *Babesia bigemina* and *B. bovis*. In cattle, infection is generally accompanied by fever, respiratory complications, hemoglobinuria, and anemia and can cause mortality rates up to 90% in naïve cattle (Smith and Kilborne. 1893). Bovine babesiosis is vectored by the cattle tick (*Rhipicephalus annulatus*) and southern cattle tick (*Rhipicephalus microplus)*, as well as the Australian cattle tick, *Rhipicephalus australis*. In South Texas, the tick vector has the potential infest and migrate on a range of wild and domestic mammals such as white-tailed deer, cattle, and other ungulates including nilgai antelope (George et al. 2002, Lohmeyer et al. 2018). The disease was considered eradicated from the U.S. by 1943, primarily via the elimination of vectors (*R. microplus* and *R. annulatus*). Eradication was achieved largely by efforts of the cattle fever tick eradication program (CFTEP) implemented by the United States Department of Agriculture (USDA) and the Texas Animal Health Commission in 1907 (Graham and Hourrigan 1977). As a result of the program, the tick eradication quarantine area (TEQA) was established and still exists in Texas at its border with Mexico where both the tick vector and babesiosis parasites are endemic. The TEQA is a buffer zone that ranges in width from one quarter mile to 10 miles and extends for approximately 500 miles along the southern Texas/Mexico border to prevent the reestablishment of fever ticks. Despite continued enforcement in the TEQA, there have been re-infestations beyond the TEQA due to ticks being resistant to pesticides as well as changes in land use and alternative host species that can readily move out of the TEQA (Busch et al. 2014, Lohmeyer et al. 2018). The USDA Animal and Plant Health Inspection Service estimates that a resurgence of these ticks could have an economic impact exceeding $3 billion today (USDA 2018).

While cattle are the primary hosts for cattle fever ticks, Graham et al. (1972), found mammals such as deer, nilgai, and raccoons may serve as viable hosts, though they weren't preferred to their preferred primary cattle host due to their ability to reach and mechanically remove ticks. This conclusion was substantiated by Cooksey et al. (1989) when she examined the contrasts between cattle and white-tailed deer as alternate hosts for cattle fever ticks. The study proposed that grooming techniques of white-tailed deer decreased the likelihood of these ticks to obtain a blood meal and complete engorgement. White-tailed deer may be suitable hosts for the fever tick, but cattle are preferred by the arthropod due to higher probability of completing the life cycle with minimal interruption from the host animal. Both R*hipicephalus annulatus* and *R. microplus* have been identified on white-tailed deer and other ungulates (Cooksey et al. 1989, Cantu et al. 2007). Further, nilgai antelope establishment in south Texas has complicated the mitigation of cattle fever ticks, as there are currently few USDA Cattle Fever Tick Eradication Program (CFTEP) approved methods for treatment on Nilgai antelope (Lohmeyer et al. 2018).

Treatment of hosts, such as white-tailed deer, and the expansion of cattle fever ticks has been mitigated by effective uses of acaricide treated corn. Use of ivermectin treated corn has been shown to be an effective method to the treatment of wildlife populations including, free-ranging and confined white-tailed deer, in minimizing tick infestations (Pound et al. 1996, Currie et al. 2020, Rand et al. 2000). These studies concluded that feeding deer with ivermectin treated corn was effective in interrupting and/or reducing all life stages of ticks. Studies indicate treating white-tailed deer populations with ivermectin in co-inhabited areas with cattle should be considered as white-tailed deer can serve as a host and/or aid in transport of cattle fever ticks to other ungulates species, making eradication difficult (Kistner and Hayes 1970, Bram et al. 2002).

There is a constant threat of tick infestations in South Texas due to close proximity to Mexico where cattle fever ticks are endemic and there exists a high potential for animal migration across the Texas border (Racelis et al. 2012). With increased acaricide resistance, tick density could remain high and increase the potential for infesting suitable hosts (Busch et al. 2014). In a recent study by Rodríguez-Vivas et al. (2013), *R. microplus* was determined to be the most economically important species of tick in Mexico. A year later, Rodríguez-Vivas et al. (2014) determined ivermectin resistant populations of *R. microplus* were identified in Mexico and Central America. Cattle fever tick population resistance to acaricides has been documented outside of the TEQA (Busch et al. 2014). De Waal and Combrink (2006) discussed the effectiveness of different tick control treatments and concluded that the use of acaricides was the most cost-effective treatment for cattle fever ticks. Gravity feeders designed to deliver acaricide treated corn to white-tailed deer have the potential to mitigate both arthropods and wildlife diseases.

The objective of this section was to determine feeder visitation frequency by species.

## METHODS

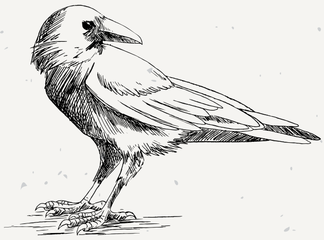
Since the development of infrared motion triggered cameras, images that were once difficult to capture or observe in certain environmental conditions can now be readily obtained (Cutler and Swann 1999). Motion triggered camera images were captured using Browning® Strike Force HD Pro Game Cameras (Browning, Morgan, Utah) allowing for both day and nighttime images, set at 10-minute intervals between each capture event to minimize duplications and maintain independence between photo captures. All cameras were zip-tied to the surrounding fence enclosing each feeder station, and each camera was set three feet off the ground to capture images of white-tailed deer and other wildlife species (Figure 10). The game cameras were set at each feeder location throughout the duration of the study (Figure 2).

**Figure 9.** Browning Strike Force HD Pro trail camera used at East Foundation El Sauz Ranch, 2020.

**Figure 10.** Deer feeder with exclusionary fence at East Foundation El Sauz Ranch, 2020.

Game cameras were unaffected by weather conditions with a few exceptions where some images were hazy due to heavy fog conditions. Throughout the 15-month study, weather conditions were mostly consistent with occasional rainfall that rarely impacted game cameras. Occasionally, game cameras would be disturbed by wildlife entering and exiting the enclosure. Images were classified into groups by animal and/or species. Species groups consisted of birds, feral hogs, raccoons, deer, and other (i.e., coyote, cattle, and nilgai). Each animal group was classified as "in" or "out" depending on whether the image captured the specific animal inside or outside feeder enclosures. Deer photo assignments were more specific with classifications of male, female, or an unknown gender, while still allowing for inside and outside differentiation. "Other" encompassed any animal that was not a species group choice. These consisted primarily of coyote, cattle, and nilgai.

# SECTION 2: FEEDER USE AND BAIT CONSUMPTION



## RESULTS

Species observations from the 18 feeders on East Foundation El Sauz Ranch revealed most visitations were by raccoons, birds, and male deer. Raccoons had over 15,000 visitations (Table 2) followed by various avian species (13,006 visitations) observed on or inside the feeder enclosure throughout the study. Male deer were observed more than six times more often at the feeder stations than female deer (Figures 11-13). Male deer had 11,956 visitations inside the feeder enclosures compared to 1,900 female deer visitations (Figure 15, Table 2). In contrast, species visitations at Port Mansfield feeders were primarily avian species and white-tailed deer (Table 2). At Port Mansfield, there were 2,951 buck visitations and 1,378 doe visitations inside the feeder enclosures (Figure 14). Visitations by distance groups saw near and far feeders with the most visitations while mid feeder distance group was the least visited by wildlife (Figure 11). Non-targets made up most observed visitations on East Foundation El Sauz Ranch (Figure 16). The "other" group of observations had less than 40 observations inside the feeder enclosure that were primarily coyote and bobcat. Other visitations outside the enclosure were mainly cattle, feral hogs, and nilgai antelope. Feral hogs were seen at a relatively high rate at Port Mansfield feeders due to a breech in the fence enclosure at one feeder site, which allowed for large groups to come inside the feeder enclosure. While observations for groups such as raccoons, white-tailed deer, and avian species were extremely high, it is important to note the density of these species is not reflected through the observations taken at 10-minute intervals. Instead, camera data should be viewed as an index to population numbers and are relative in nature. Some species often spent over 10 minutes while feeding, which likely resulted in multiple photos of the same individual.

**Table 2.** Total wildlife observations (n, inside/outside exclusionary fence) on East Foundation El Sauz Ranch and Port Mansfield feeders, 9 April 2019 – 30 July 2020.

| Common Name | Scientific Name/Group | El Sauz (N= 18) | | Port Mansfield (N = 3) | |
|---|---|---|---|---|---|
| | | In | Out | In | Out |
| Bird | Avian | 13,006 | 247 | 2,729 | 0 |
| Female Deer | *Odocoileus virginianus* | 1,900 | 238 | 1,378 | 3 |
| Male Deer | *Odocoileus virginianus* | 11,956 | 656 | 2,951 | 17 |
| Deer Unknown | *Odocoileus virginianus* | 93 | 156 | 1,152 | 7 |
| Hog | Suidae | 1 | 243 | 824 | 0 |
| Other* | Other | 38 | 645 | 26 | 49 |
| Raccoon | *Procyon lotor* | 15,163 | 23 | 240 | 0 |

*Includes observations of nilgai, bobcat, domestic cat, and coyote.

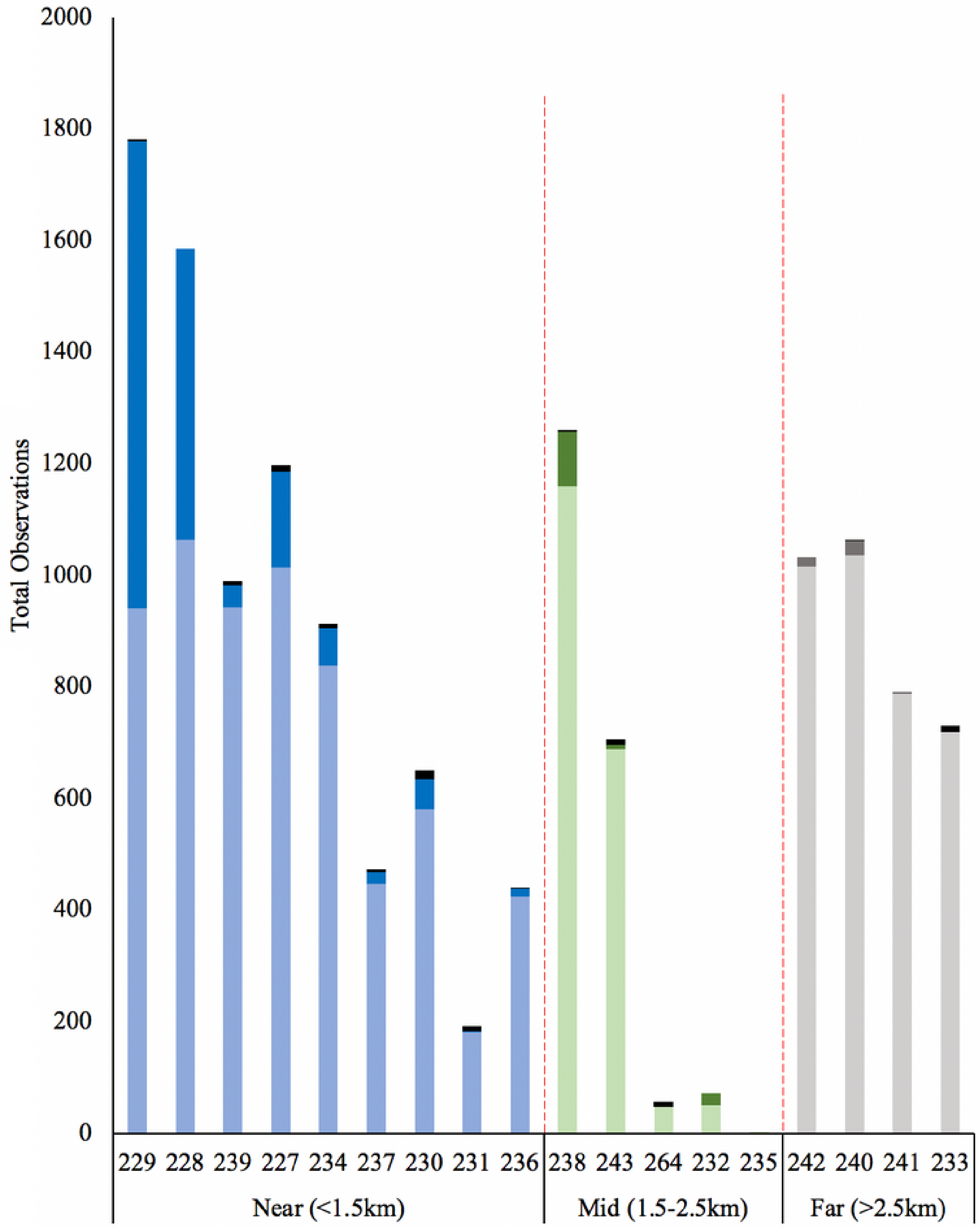



**Figure 11.** Total white-tailed deer observations inside exclusionary fencing by feeder (n = 18), gender (male = light shade, female = dark shade, unknown = black), and distance group (near, mid, and far,), East Foundation El Sauz Ranch, 9 April 2019 – 30 July 2020.

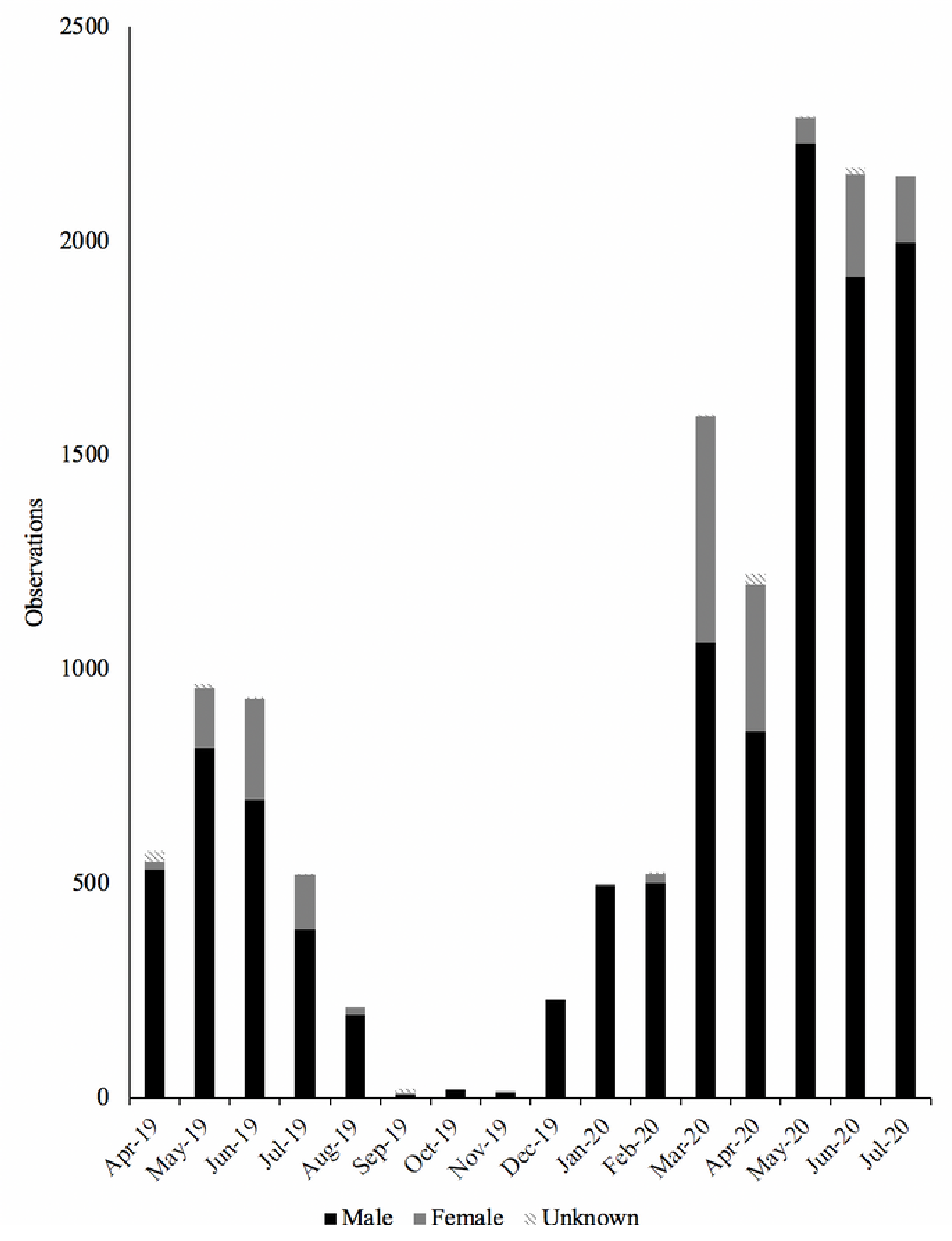



**Figure 12.** Deer observations by gender on East Foundation El Sauz Ranch, 9 April 2019 – 30 July 2020.

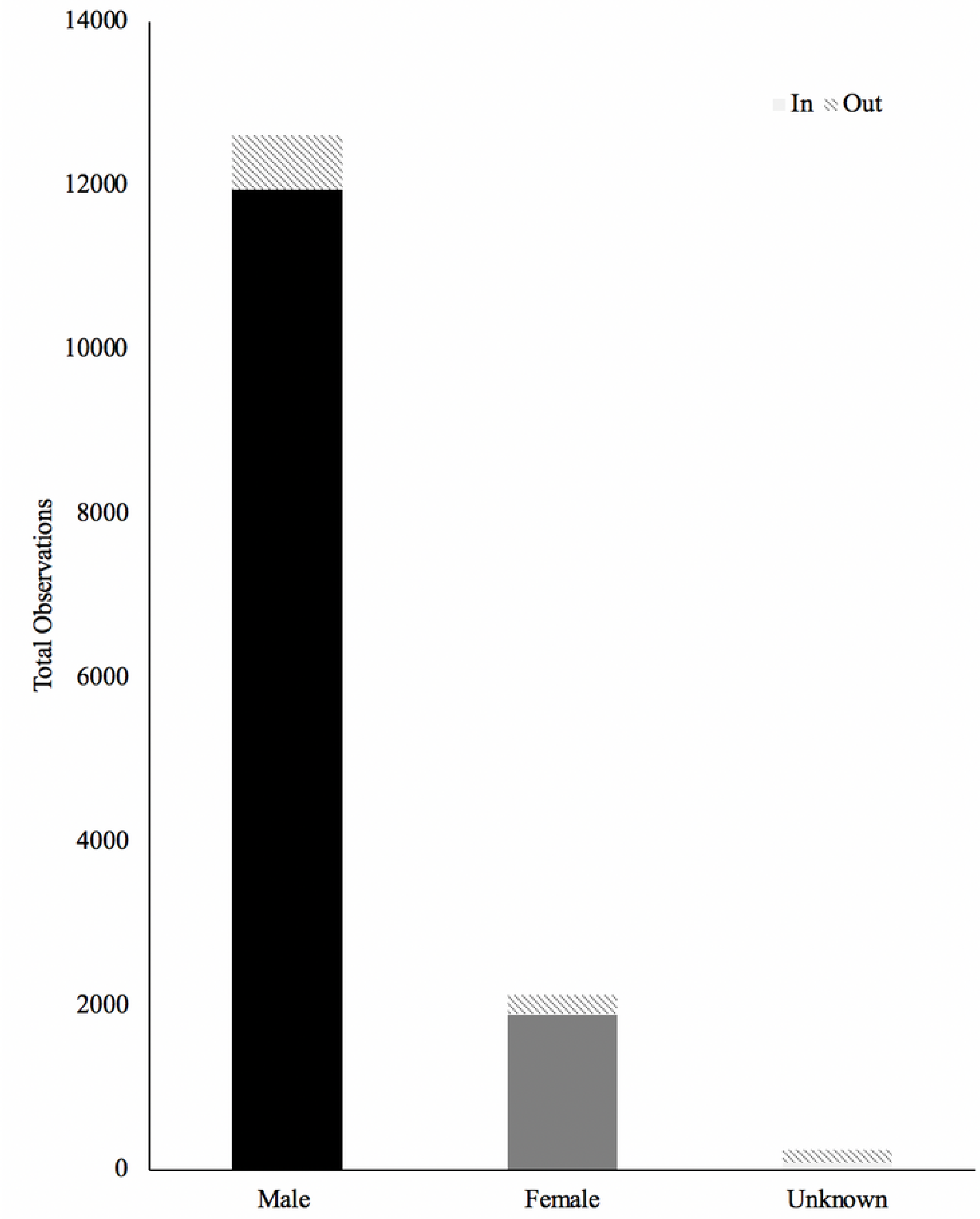



**Figure 13.** Total white-tailed deer observations (n, inside/outside exclusionary fencing), East Foundation El Sauz Ranch, 9 April 2019 – 30 July 2020.

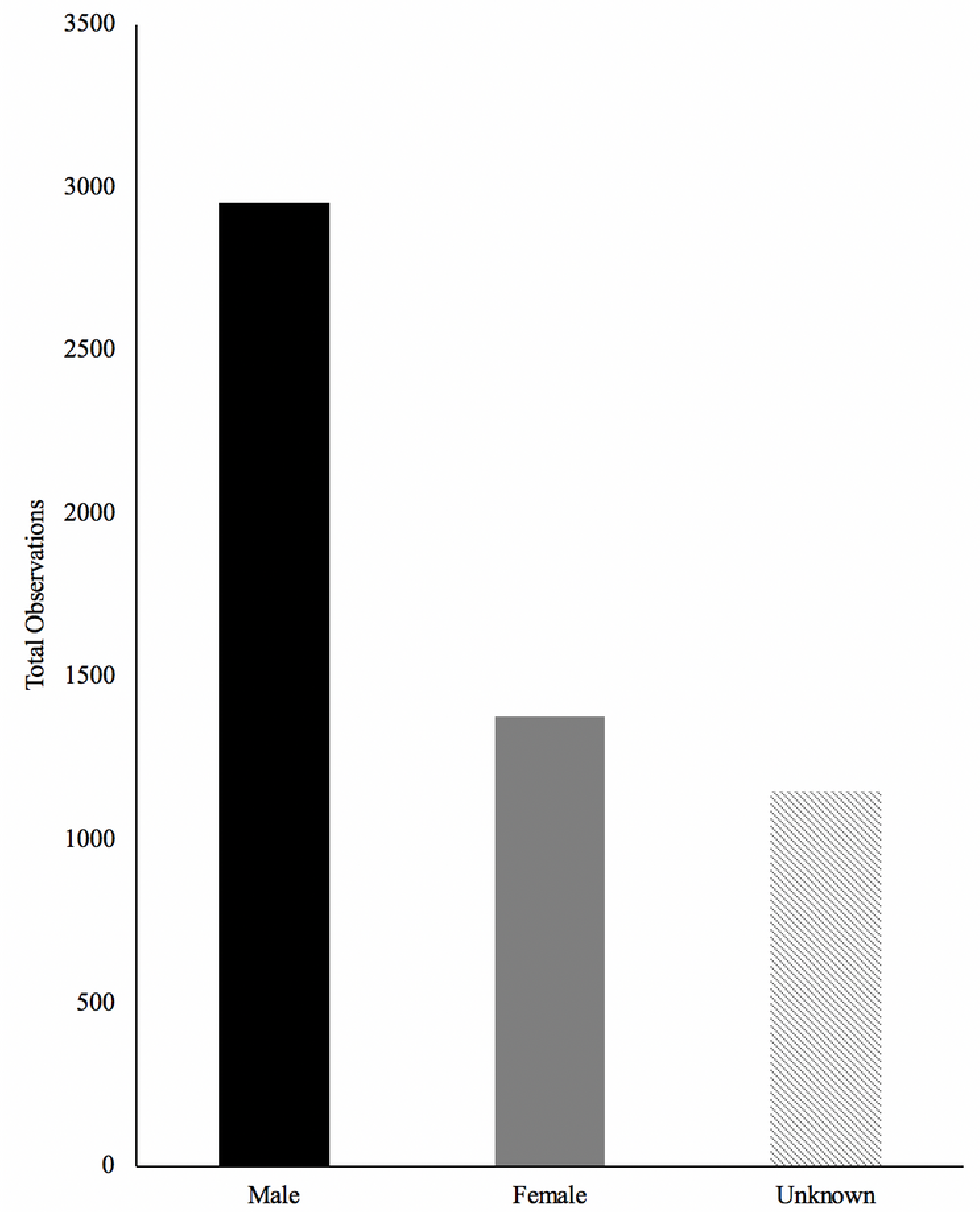



**Figure 14.** Port Mansfield total white-tailed deer feeder visitation inside feeder enclosure (n = 3), 9 April 2019 – 30 July 2020.

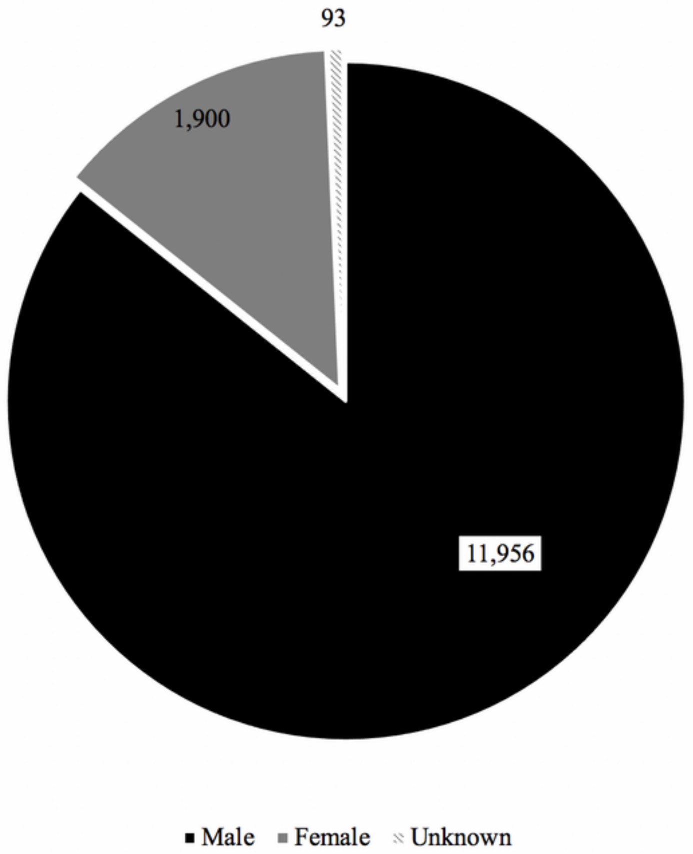



**Figure 15.** White-tailed deer observations by gender, East Foundation El Sauz Ranch, 9 April 2019 – 30 July 2020.

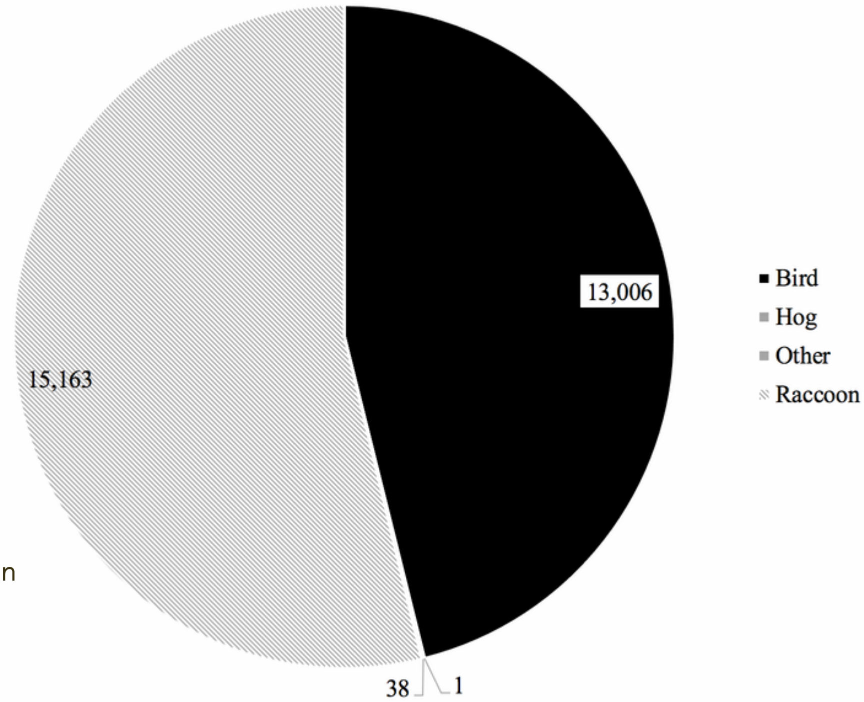



**Figure 16.** Non-target wildlife observations, East Foundation El Sauz Ranch, 9 April 2019 – 30 July 2020.

# SECTION 2: FEEDER VISITATION BY SPECIES

## DISCUSSION

As previously mentioned, one issue that constantly arose was non-target species observations inside the feeder enclosures. Species visitations at feeders on East Foundation El Sauz Ranch were dominated by raccoons, white-tailed deer, and birds (Figures 15-16). Cooper and Ginnett (2000) and Rattan et al. (2010) confirmed that along with feeders comes the chance of non-targets consuming corn instead of deer. While the fencing around the feeder excluded larger non-target species such as feral hogs and cattle, other species such as raccoons were able to easily bypass the fence (Figures 21-24). Several camera photos illustrated that groups of raccoons would spend many nighttime hours feeding at these stations (Figure 24), while deer mainly visited the feeders individually and did not appear to stay as long as raccoons (Figure 22). It was not unusual to see various species of wildlife feeding together within the enclosure to consume corn (Figure 23). It should also be noted that many of these non-targets were not simply eating corn spillage from the feeder but instead were actively accessing the feeder (e.g., raccoons, coyote, Figures 23-24). On rare occasions bobcats were also sighted within the enclosure but not captured consuming corn (Figure 21). The presence of bobcats could be attributed to the presence of prey base such as rodents, which were also observed anecdotally via several photos (i.e., eye shines, not quantified due to difficulty in knowing numbers) throughout the study.

# SECTION 3: EFFICACY OF PRE-BAITING

## INTRODUCTION

### Pre-Baiting and Supplemental Use

There are many benefits to pre-baiting depending on overall wildlife management goals. Pre-baiting at specific locations used in conjunction with drop nets has been successful in the capture of wildlife (Silvy et al. 2020). Pre-baiting for increased white-tailed deer visitation has been documented in multiple ways, include the use of salt blocks as an attractant during summer months or shelled corn during summer months as a supplement or in the fall as an attractant for increased hunting success (Morgan and Dusek 1992, Naugle et al. 1995). In contrast, Edalgo and Anderson (2007) concluded that pre-baiting for small mammals did not contribute or improve capture success. Similarly, Barrett et al. (2008) examined various corn baits and determined no difference in large mammal capture success when using clover traps. The use of pre-baiting to increase the effectiveness of oral delivery treatments is poorly understood and requires further assessment. The objective of this section is to determine the efficacy of pre-baiting to increase ivermectin corn consumption rates.

## METHODS

Texas Animal Health Commission (TAHC) was responsible for the delivery and removal of ivermectin treated corn to all 18 feeders on East Foundation El Sauz Ranch during the months of March—July 2019 and 2020. From August through February, the feeders on East Foundation El Sauz Ranch were emptied or capped to prevent access to ivermectin treated corn. Ivermectin treated corn was removed to allow at least a 60 day withdrawl period prior to deer hunting season to ensure ivermectin residues in deer decreased to below the tolerance level (USDA APHIS 2016).Emptied feeders allowed for pre-baiting to assess visitation rates. In December 2019, pre-baiting was conducted at four feeders (239, 241, 242, 243) with 150 pounds of untreated corn for that month. In January 2020, nine feeders were pre-baited (233, 235, 237, 238, 239, 240, 241, 242, 243), four from the previous list and an additional five new feeders. All feeders were filled with 100 pounds of untreated corn. The first four feeders (239, 241, 242, 243) received 250 pounds of untreated corn in total.

# SECTION 3: EFFICACY OF PRE-BAITING

## RESULTS

Ivermectin corn consumption data (Table 1; Figure 17) suggests that pre-baiting had a positive effect on consumption levels. When pre-baiting was initiated, wildlife were able to find the feeders that had corn within a 24-hour period. Ivermectin corn consumption was higher in 2020, following pre-baiting, than in 2019 (Figures 17-18). High consumption feeders were primarily along the ranch boundary in 2019, however, feeders further inland on the property saw higher increases in ivermectin corn consumption in 2020 following implementation of pre-baiting (Figure 17). Pre-baited feeders made up the entirety of the far distance region, which was considered interior (Figure 18). Near distance feeders saw a slight increase in ivermectin corn consumption of 585 pounds. Near feeder's total ivermectin corn consumption for 2019 was 6,160 pounds and 6,745 pounds for 2020. Mid distance feeders saw an increase ivermectin corn consumption of 1,245 pounds between 2019 and 2020. Mean ivermectin corn consumption for mid feeders in 2019 was 380 pounds of treated corn while 2020 mid distance mean consumption was 630 pounds per feeder. Far distance feeders saw the largest increase with almost four times the amount of ivermectin corn consumed in 2020. Ivermectin corn consumption in far feeders in 2019 was 775 pounds compared to 2,975 pounds in 2020. Far feeder mean consumption was 193 pounds in 2019 compared to 709 in 2020 (Figure 6-7). Pre-baited feeders showed an increase in total wildlife visitations during the month of April for both years (Figure 19). Observations for all wildlife increased after pre-baiting was implemented (Figure 20).

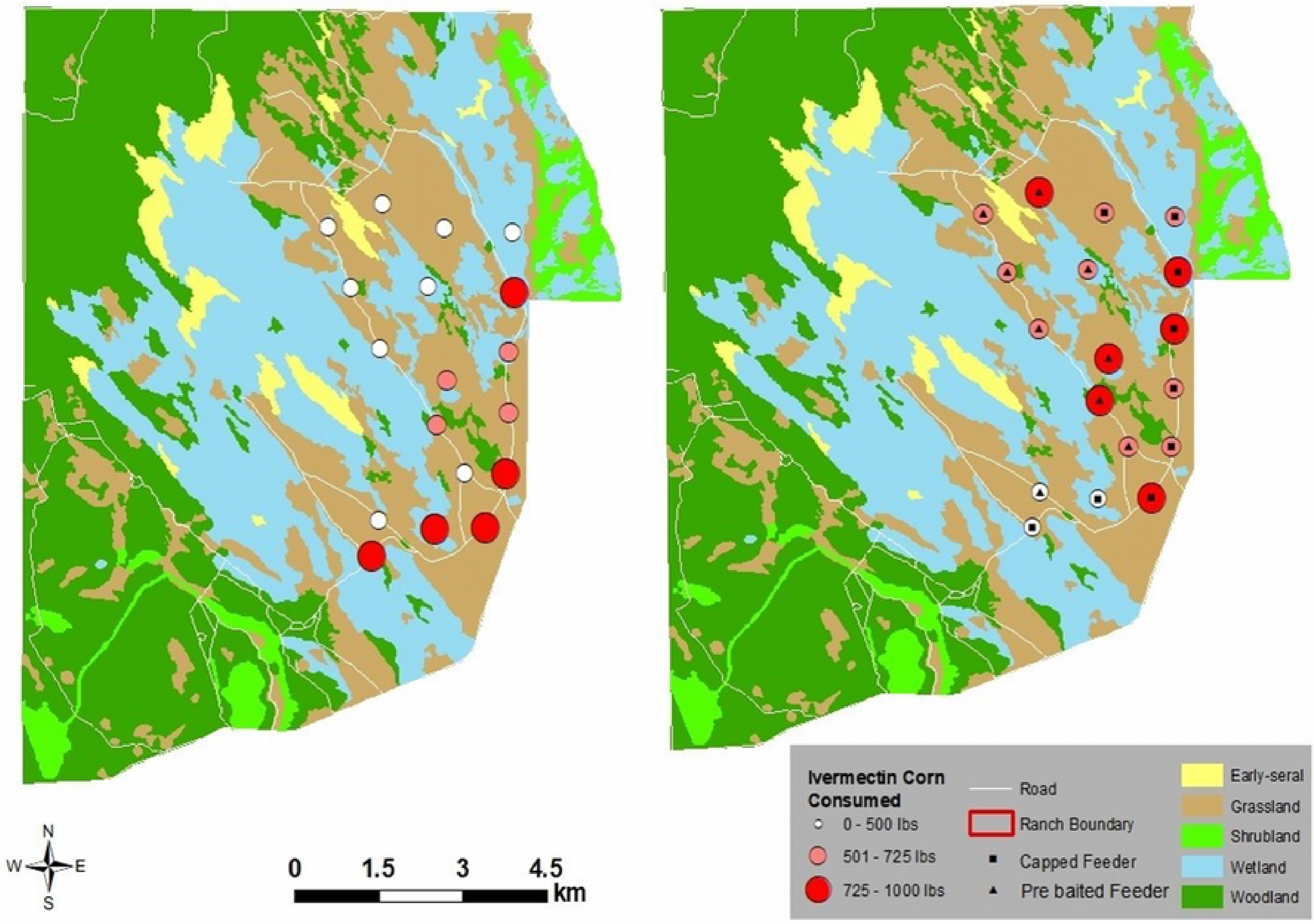



**Figure 17.** Ivermectin corn consumption by feeder, 2019 (left) and 2020 (right). East Foundation El Sauz Ranch.

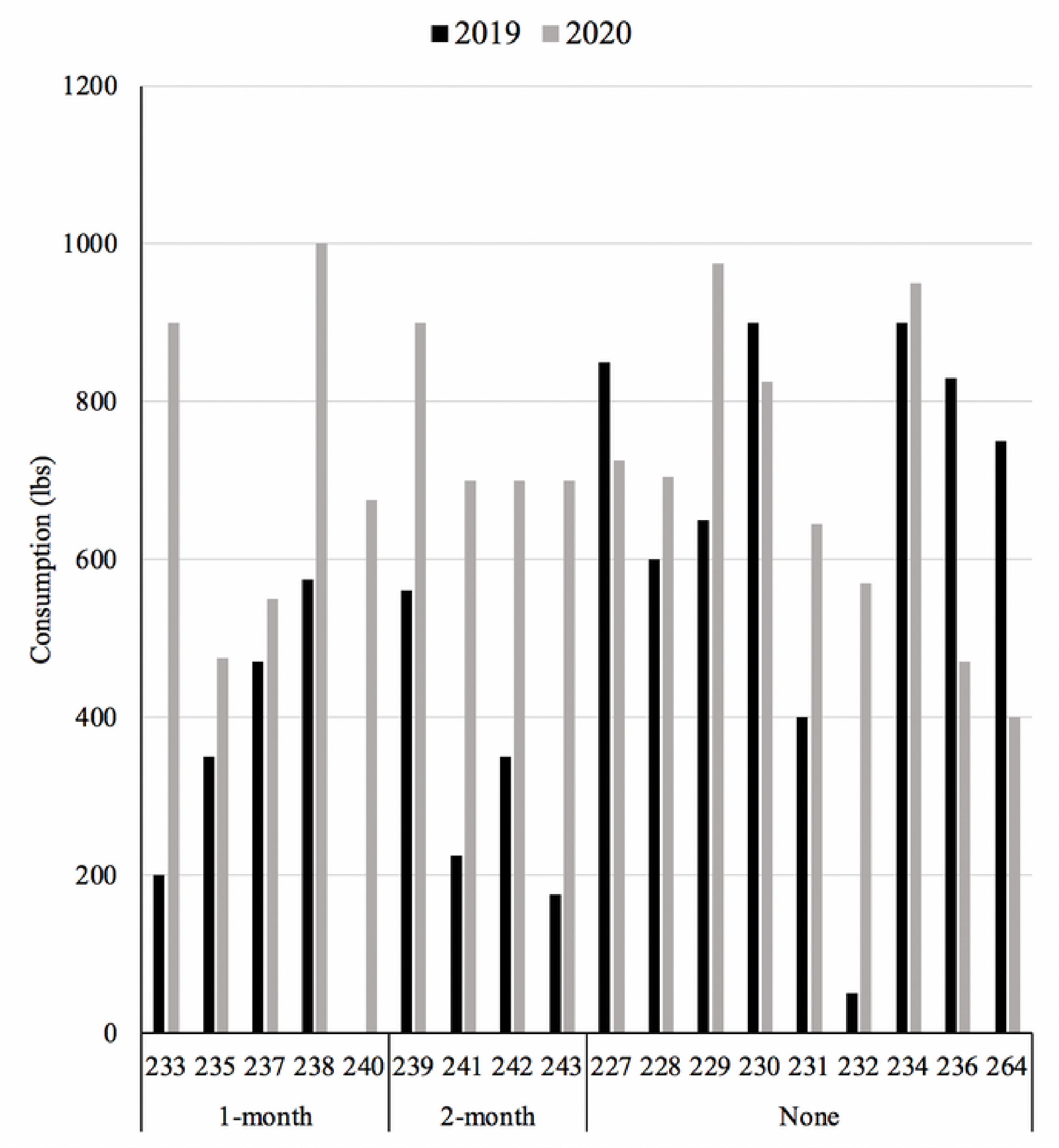
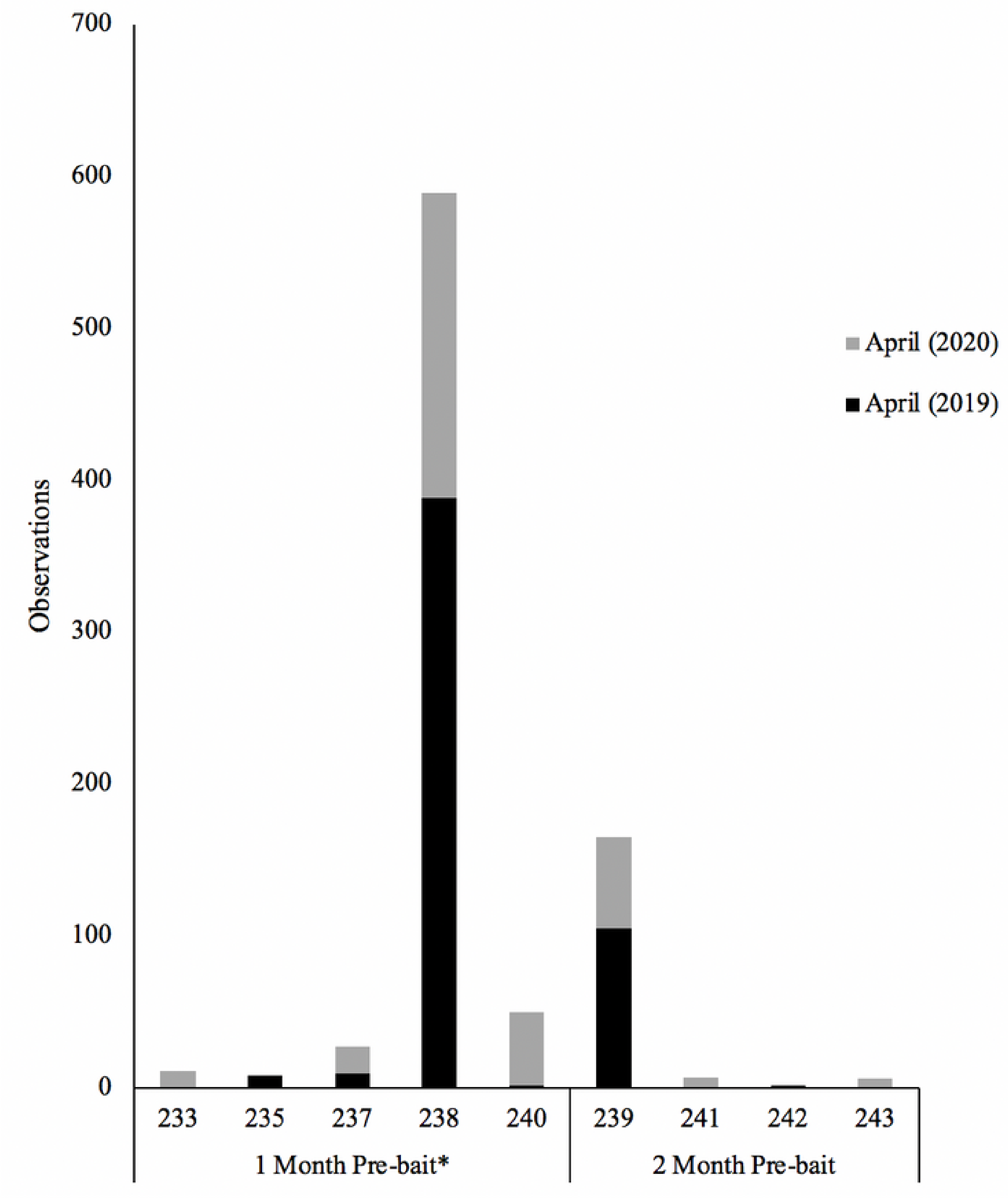



**Figure 18.** Pre-baited vs non pre-baited feeder consumption, East Foundation El Sauz Ranch, March – July for 2019 and 2020.




*One-month pre-baited feeders received 100 pounds of untreated on 21 January 2020. Two-month pre-baited feeders received 250 pounds of untreated corn on 5 December 2019 and 21 January 2020

**Figure 19.** Pre-baited feeder observations on East Foundation El Sauz Ranch, April 2019 and 2020.

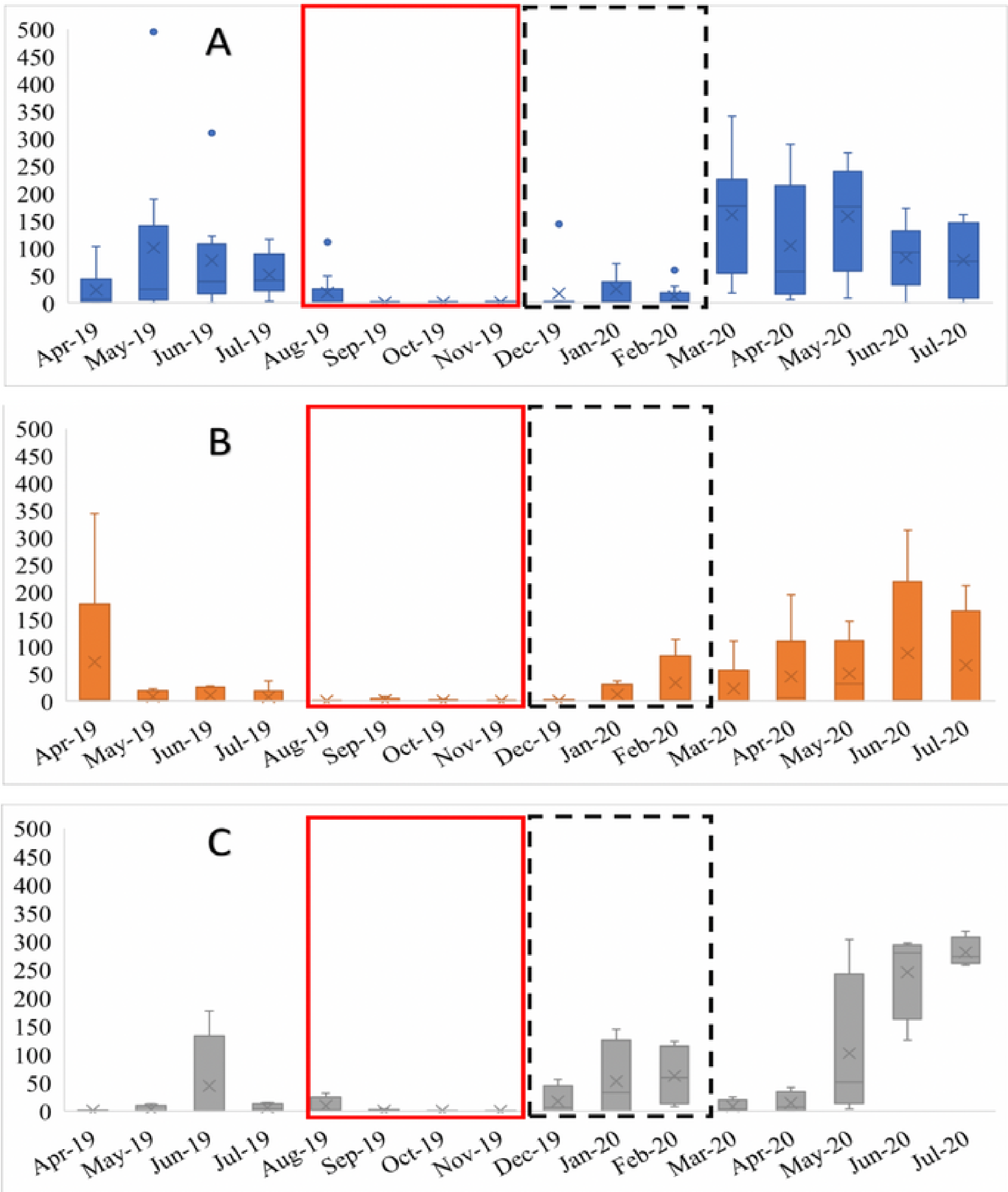



**Figure 20.** White-tailed deer observations inside feeder enclosures by distance categories on East Foundation El Sauz Ranch. "A" (near feeders.) "B" (mid feeders.) "C" (far feeders.) Red boxed months (No ivermectin treated corn in feeders/empty/capped) March – July (Ivermectin corn in feeders). Dashed boxed months (feeders were pre-baited/empty/capped.)

**Figure 21.** Representative photos of bobcats (Lynx rufus) inside deer feeder at East Foundation El Sauz Ranch, 2020.

**Figure 22.** Representative photos of white-tailed deer inside deer feeder at East Foundation El Sauz Ranch, 2020.

**Figure 23.** Representative photos of coyotes inside deer feeder at East Foundation El Sauz Ranch, 2020.

**Figure 24.** Representative photos of raccoons inside deer feeder at East Foundation El Sauz Ranch, 2020.

**Figure 25.** Representative photos of birds inside deer feeder at East Foundation El Sauz Ranch, 2020.

# SECTION 3: EFFICACY OF PRE-BAITING

## DISCUSSION

Pre-baiting of deer feeders resulted in an increase of feeder visitation rates and ivermectin treated corn. Other studies suggest an increase in both visitations and consumption rates may be attributed to pre-baiting. For example, Kilpatrick and Stober (2002) observed that white-tailed deer did not seek bait sites outside of their traditional home ranges. Study results suggest that providing a time period (i.e., pre-baiting) for deer to locate and actively use deer feeders can improve the efficacy of a wildlife disease preventative program. As previously mentioned, East Foundation El Sauz Ranch is currently cattle fever tick free; the use of deer feeders on the property are currently being used as a mechanism for preventing ticks from establishing on the property. Due to the nature of having ivermectin treated corn use by species that are hunted and likely could be consumed (e.g., white-tailed deer), the current practice is to close off or empty the feeders of ivermectin corn during the hunting season. Once the hunting season is completed, use of ivermectin treated corn resumes. Because pre-baiting increases visitation rates, maintaining feeders with untreated corn can serve to increase the efficacy of the preventative strategy for cattle fever tick when delivery of treated corn resumes. In other words, results of the study show that pre-baiting feeders with corn in the absence of ivermectin-treated corn increases the consumption of ivermectin treated corn and could be beneficial to mitigating the potentially devastating impacts of cattle fever ticks in the southern United States.

# SECTION 4: CONCLUSIONS AND MANAGEMENT IMPLICATIONS

The goal of this project was to assess feeder usage and ivermectin corn consumption via oral delivery. There are several key recommendations or implications that can be used by the East Foundation and others interested in mitigating the impacts of cattle fever ticks. In the case of the East foundation, they are currently cattle fever tick free and can implement some of these recommendations as a mechanism for continuing to be tick free.

## 1 Continue Feeder Use

This study found that use of deer feeders an effective means in delivering ivermectin to white-tailed deer on East Foundation El Sauz Ranch. White-tailed deer were one of the primary users of deer feeders and readily accessed ivermectin treated corn throughout the year when available. Deer feeder types used in this study and the use of enclosure fencing served to improve the efficacy of oral delivery to target species.

## 2 Differential Feeder Use

One finding in this study was the differential use of deer feeders between sex- and age-classes of white-tailed deer. Due to behavioral differences for these various groups, this is to be expected. The differential access to treated corn however could result in differential levels of treatments between these groups. In other words, adult males may have a higher percentage of treatment compared to yearling females. One recommendation in minimizing this differential feeder use is to increase the number of feeders, which would likely reduce competition for what could be a limited resource.

## 3 Management of Non-targets

A number of non-target species were observed in this study using deer feeders with ivermectin treated corn. Several practices were put in place to minimize the access of non-targets to treated corn to include the feeder type (i.e., gravity fed) and the use of enclosure fencing. Both of these practices should continue. In addition, the access of feed by raccoons by climbing the feeder legs could be minimized by the placement of "predator will guards" commonly used for example on wood duck boxes. Minimizing feed access by avian species (i.e., they are primarily feeding on spillage) is likely minimal but managers should be aware that game birds such as mourning doves and wild turkey may be treated with ivermectin similar to white-tailed deer. Removal of ivermectin prior to and during the hunting season should mitigate for these impacts.

## 4 Use of Pre-baiting

Study results found that pre-baiting increased the use of deer feeder use. Intuitively, this result is not surprising though has not been documented prior to this study. In an effort to maintain feeder use throughout the year, it is recommended that untreated corn be placed in feeders as a strategy to "restart" access to ivermectin corn once the hunting season is over. This would allow target white-tailed deer to be acclimated and using deer feeders throughout the year.

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# APPENDIX A.

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# LITERATURE CITED


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# APPENDIX B.

## List of Figures and Tables

# Wildlife Use of Ivermectin Bait Sites on East Foundation's El Sauz Ranch, South Texas