RIO GRANDE WILD TURKEY DIETS IN THE TEXAS PANHANDLE

by

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ABSTRACT

Many diet studies have been conducted throughout the range of the wild turkey (*Meleagris gallopavo*) and have described wild turkeys as opportunistic. However, only a few diet studies have been conducted on the Rio Grande wild turkey (*M. g. intermedia*) in Texas and none have been conducted in the Texas Panhandle. Our objectives were to determine seasonal and annual diets of wild turkeys in the Texas Panhandle. We conducted our study on 3 study sites, Gene Howe Wildlife Management Area, Matador Wildlife Management Area, and private lands surrounding the Salt Fork of the Red River. We harvested 70 birds, 35 male and 35 female, from all the study sites over 4 seasons. We analyzed crop contents to determine diet. We removed, dried, and examined samples macroscopically to identify plants (to species) and insects (to order) eaten.

Hackberries (*Celtis* spp.) (24.7%), domestic peanuts (10.7%), woolybucket bumelia (*Bumelia lanuginosa*) (9.6%), corn (8.2%), Chickasaw plum (*Prunus angustifolia*) fruit (6.9%), and grasshoppers (6.1%) were all important components of the annual diet by volume. Annually, hackberries were found in the greatest frequency (62.9%) followed by beetles (55.7%), grass vegetation (47.1%), and grasshoppers (44.3%). Winter diets were composed primarily of hackberries (56.4%), peanuts (14.1%), and western wheatgrass (*Agropyron smithii*) (10.5%). Spring diets consisted primarily of peanuts (41.6%), dense-flower bladderpod (*Lesquerella densiflora*) (24.6%), and grasses (11.4%). Summer diets were dominated by Chickasaw plum fruit (28.1%), grasshoppers (20.0%), and western soapberry (*Sapindus drummondii*) fruit (19.2%). Finally, the most abundant foods during the autumn were woolybucket bumelia (32.1%),

hackberry (18.7%), corn (16.9%), and western ragweed (*Ambrosia psilostachyia*) (7.3%).

We found no significant differences between foods consumed by male or female wild turkeys. We found that animal matter was consumed most during summer ($P = 0.0004$), mast was consumed least during spring ($P = 0.0065$), and miscellaneous items were consumed in greater amounts in the winter ($P = 0.0011$). We also found that anthropogenic food was consumed the most at the Salt Fork study area ($P < 0.0001$), mast was consumed the least at the Salt Fork study area ($P = 0.0067$), and miscellaneous items were consumed in the greatest amounts at the Matador study area ($P = 0.0022$).

Wildlife managers can use this information to evaluate wild turkey habitat for management planning. Future research should focus on determining the effect of food sources on wild turkey population dynamics, movement, and distribution, especially the role of anthropogenic foods on these parameters.

Chapter I is a comprehensive review of literature relating to wild turkey history, ecology and diet. In the first part, I outline the history of the wild turkey in North America, the differences between the subspecies, and basic habitat associations of the Rio Grande wild turkey. In the second part, I compare and contrast different methods for determining diet, and review what previous diet studies on wild turkeys have found. The intent of the first chapter is to give a more complete background than is possible in the second chapter. Chapter II describes that study that I conducted on Rio Grande wild turkeys in the Texas Panhandle to assess their diet. This chapter is intended to be submitted to the Southwestern Naturalist journal and is formatted in accordance with their policies.

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CHAPTER I

INTRODUCTION

The wild turkey (*Meleagris gallopavo*) was once found across the United States in 39 different states (Kennamer et al., 1992). As settlers moved west, turkey populations began disappearing due to unregulated harvest and deforestation. Populations were at their lowest in the early 20th century, and by 1920 had been eliminated from 18 of the original 39 (Kennamer et al., 1992).

Populations remained very low until after World War II. Biologists also attempted to restock populations from pen-raised birds. Those efforts largely failed for various reasons, but primarily the lack of normal social behaviors (Kennamer et al., 1992). As forest stands began to regenerate and wild turkey habitat expanded, turkeys began to make a comeback (Kennamer et al., 1992). When trapping techniques such as cannon and rocket nets improved, relocation became a viable option for wild turkey conservation. In 1990, population estimates ranged from 3.4 to 3.5 million birds (Kennamer and Kennamer, 1990). Today the wild turkey can be found in every state except Alaska, and has huntable populations that extend throughout and beyond its native range (Kennamer et al., 1992).

Five subspecies of wild turkey occur in the United States: the Eastern wild turkey (*M.g. silvestris*), the Florida wild turkey (*M.g. Osceola*), Merriam's wild turkey (*M.g. merriami*), Gould's wild turkey (*M.g. mexicana*), and the Rio Grande wild turkey (*M.g. intermedia*). The Rio Grande wild turkey can be distinguished from the other sub-species by buffy or tan tips on their retrices. Eastern and Florida wild turkeys have brown tips,

and Merriam's and Gould's wild turkeys have white tips (Beasom and Wilson, 1992).

Before settlement, Rio Grande populations in Kansas, Oklahoma, and Texas were estimated at 1.5 million birds (Schorger, 1966). Populations reached their lowest numbers between 1928 and 1940 when they numbered around 100,000 and only occurred in Texas (Beasom and Wilson, 1992). Efforts were taken to help the turkey recover. Legislation was enacted beginning in 1881, and informal refuges were established by landowners who voluntarily stopped hunting. In addition, restocking efforts were initiated with the first known occurrence in Texas in 1924 (Beasom and Wilson, 1992). In Oklahoma restocking efforts began in 1948, and 1 year later birds began to appear naturally (Beasom and Wilson, 1992). Rio Grande wild turkeys began to naturally disperse into Kansas in the late 1950s, and transplantation efforts began in 1959. In 1992, Rio Grande wild turkeys numbered more than 630,000 and had been restored to all parts of their former range (Kennamer et al., 1992).

The preferred habitat of the Rio Grande wild turkey varies, but as with all the subspecies they are associated with stands of trees which they use for roosting (Beasom and Wilson, 1992). The Texas Panhandle is primarily plains grassland and brushland. Therefore, turkey habitat is limited to areas in or near riparian areas, where they have access to trees.

To effectively manage turkey populations it is important to understand their food habits (Hurst, 1992). This information may help us understand limits increase in Rio Grande wild turkey numbers or range. Wild turkey feeding is described as opportunistic and nomadic (Glover and Bailey, 1949; Litton, 1977; Korschgen, 1967; Adams, 1987;

Laudenslager and Flake, 1987; Hengel, 1990).

Previous food habits studies have involved examining fecal samples (Dalke et al., 1942; Glover and Bailey, 1949; Exum et al., 1987; Rumble and Anderson, 1996; Wakeling and Rogers, 1996; Wakeling and Rogers, 1998; York and Schemintz, 2003), crops and/or gizzards (Meanley, 1956; Barwick et al., 1973; Hamrick and Davis, 1971; Litton, 1977; Tabatabai and Kennedy, 1984; Laudenslager and Flake, 1987), or both (Quinton and Montei, 1977). Hurst (1992) claims using crops to be the best, but there are still problems with this method. First, it's destructive, requiring the harvesting of animals. Second, it has been suggested that turkeys may be able to shift soft mast or soft bodied insects into the gizzard ahead of more difficultly digested foods (Stringer, 1977). Studies on waterfowl have shown that gizzard analysis can also underestimate hard foods and overestimate soft foods (Bartonek and Hickey, 1969; Swanson and Bartonek, 1970; Briggs et al., 1985). Sedinger (1986) found that the proventriculus contained a higher percentage of seeds than the esophagus which he attributed to backflow from the gizzard into the proventriculus. He also found that the esophagus contained more insects than the proventriculus.

Fecal analysis is a non-destructive method to assess bird diets, but it underestimates hard mast (Rumble and Anderson, 1993) and diets with high shrub content (Holechek and Valdez, 1985), which will cause a corresponding overestimation of other food items. Also, some forbs are underestimated in fecal analysis because either they don't survive sample preparation, the epidermis doesn't separate properly, or they are altered during digestion (Samuel and Howard, 1983). Third, observer bias can play a large role if the

observer does not have adequate training (Holechek et al., 1982; Holechek and Valdez, 1985). Finally, choice of methodological approach can have some effect on proper estimation. Sample preparation technique (Holechek, 1982), slide and frequency observation numbers (Holechek and Vavra, 1981), magnification level (Holechek and Valdez, 1985), and calculation procedure (Holechek and Gross, 1982) can all have such an effect.

Diet composition varies by season and year. It has been proposed that seasonal variations in diet occur as different foods become available (Dalke et al., 1942; Glover and Bailey, 1949; Hengel, 1990), and annual variations can occur when mast crops fail (Quinton and Montei, 1977; Laudenslager and Flake, 1987). York and Schmenitz (2003) found juniper (*Juniperus deppeana*) and manzanita (*Arctostaphylos pungens*) to be the most important food during all seasons in Gould's wild turkeys. Furthermore, Glover and Bailey (1949) found grasses to be of some importance in every month except April, but other components of the diets varied by season.

During autumn hard mast and seeds are important components of turkey diets (Dalke et al., 1942; Glover and Bailey, 1949; Beck and Beck, 1955; Litton, 1977; Exum et al., 1987; Hengel, 1990). Laudenslager and Flake (1987) found that grasshoppers (Orthoptera) and oats were important in the diet of Merriam's and Rio Grande wild turkeys in the autumn of 1984, but in 1985 acorns were important. This difference was attributed to the failure of the acorn crop in 1984. Similarly, Quinton and Montei (1977) found that Woolybucket bumelia (*Bumelia lanuginosa*) berries and pecan mast were important, but were replaced in the diet with prickly pear (*Opuntia* spp.) fruit and

arthropods when the mast crop failed in 1972.

Winter diets have been shown to be more variable among studies than other seasons, but also fewer studies have examined winter diets. Some studies have found similar diets in winter and autumn (Dalke et al., 1942; Glover and Bailey, 1949; Beck and Beck, 1955; Hengel, 1990). Other studies have shown a shift away from mast. Exum et al. (1987) found a shift towards food plots (chufa) and green vegetation. Similarly, Litton (1977) saw a shift away from mast towards grasses and forbs.

During spring, insects begin to become available, and concurrently begin showing up in turkey diets. Litton (1977) and Exum et al. (1987) both found that insects were an important aspect of spring turkey diets. Beck and Beck (1955) found that insects were the most important spring food in Rio Grande wild turkeys in southern Texas. Tabatabai and Kennedy (1984) found that insects were a small part of the diet by percent volume, but a top three dietary component by frequency of occurrence. Other studies have found grass to be an important part of the turkey diet during the spring (Dalke et al., 1949; Litton, 1977; Hengel, 1990; Rumble and Anderson, 1996).

Summer is a season that is also underrepresented in the literature. Most studies have found grass to be important during summer (Dalke et al., 1942; Glover and Bailey, 1949; Hamrick and Davis, 1971; Litton, 1977; Exum et al., 1987; Hengel, 1990; Rumble and Anderson, 1996; Wakeling and Rogers, 1998), as well as insects (Dalke et al., 1942; Hamrick and Davis, 1971; Litton, 1977; Exum et al., 1987; Rumble and Anderson, 1996). The one exception to this was Beck and Beck (1955) who found that hackberry (*Celtis pallida*) and mesquite (*Prosopis juliflora*) fruits were the most important food

components of summer.

Previous studies suggested that supplemental feeding may be useful in maintaining turkey populations (Stoddard, 1963; Gardner and Arner, 1968; Austin and Degraff, 1975; Nguyen et al., 2003) while Thomas et al.(1973) found the effect to be debatable . Supplemental food may have been especially useful for overwinter survival during severe winters (Porter et al., 1980), or for keeping wild turkeys on the winter range during harsh winters (Ramsey and Taylor, 1942; Taylor, 1943). Supplemental feeding has been shown to increase wild turkey productivity by allowing more hens to initiate nests, and increasing the length of the nesting period (Pattee and Beasom, 1979). Cooper and Ginnett (2000) found that supplemental deer (*Odocoileus* spp.) feeding might increase predation on turkey nests. Supplemental food can take on various forms including feeders for target and non-target species, hunting bait, food plots, and cattle feeding operations.

Several studies found supplemental food as a component of turkey diets. Exum et al. (1987) found that chufa plots comprised 32% and 34% (autumn and winter, respectively) of the diet in Eastern wild turkeys in years when plots were planted. Glover and Bailey (1949) found that oats and corn accounted for 21.5% and 16.2%, respectively, of the diet in Eastern wild turkeys. They attributed these foods to supplemental feeding because agricultural fields were not locally available to these turkeys. Quinton and Montei (1977) found that grain sorghum was the number one food item, comprising 86% of the diet, in the spring for Rio Grande wild turkeys in north-central Texas. It is important to note that they obtained their crops from hunters so the grain sorghum may have come from baited

sites. Finally, Beck and Beck (1955) found that cottonseed cake from cattle feeding operations was the single most important food item in the autumn and winter diets of Rio Grande wild turkeys in southern Texas.

We initiated a study on the diets of Rio Grande wild turkeys in the Texas Panhandle due to the regional variability demonstrated in previous studies on wild turkey diets and the lack of a similar diet study in our region. The objectives of our study were to: 1) assess annual and seasonal diets; and 2) evaluate the extent of use of anthropogenic foods. Chapter II contains descriptive summaries of annual and seasonal diets, and statistical comparisons among study sites, season, and sex.

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CHAPTER II

RIO GRANDE WILD TURKEY DIETS IN THE TEXAS PANHANDLE

ABSTRACT-- The purpose of this study was to evaluate annual and seasonal diets of Rio Grande wild turkeys (*Meleagris gallopavo intermedia*) in the Texas Panhandle, and assess use of anthropogenic foods. We harvested 70 (35 females: 35 males) wild turkeys from three study sites in the Texas Panhandle during four seasons. Annually, hackberries (*Celtis* spp.), peanuts, and wooly bucket bumelia (*Bumelia lanuginosa*) were ranked highest by volume. Whereas peanuts, dense-flower bladderpod (*Lesquerella densiflora*), and grass vegetation ranked high by volume for spring, Chickasaw plum (*Prunus angustifolia*) fruit, grasshopper, and western soapberry (*Sapindus drummondii*) fruit ranked high by volume for summer. During autumn, wooly bucket bumelia fruit, hackberries, and corn ranked high by volume, and hackberries, peanuts, and western wheatgrass (*Agropyron smithii*) ranked high in winter. While we didn't measure availability, all foods appeared to be consumed based on seasonal availability. Consumption of anthropogenic foods varied between 7 and 43% depending upon season. We found no differences between sexes. For season, we found statistical differences for animal, mast and miscellaneous foods. However, we found differences for anthropogenic, mast, and miscellaneous foods among study sites. Despite an abundance of undesirable species such as Russian olive (*Elaeagnus angustifolia*), honey mesquite (*Prosopis glandulosa*) and salt-cedar (*Tamarix chinensis*), wild turkeys did not consume any part of these plants

RESUMEN-- El propósito de este estudio fue de documentar la dieta del guajolote

silvestre Río Grande durante el año y evaluar el uso de alimentos de origen antropogénico en la región del Panhandle de Texas. Colectamos 70 guajolotes silvestres (35 hembras y 35 machos) en tres áreas de estudio durante cuatro temporadas del año en el Panhandle de Texas. Los frutos de palo blanco (*Celtis* spp.), cacahuate y frutos de coma (*Bumelia lanuginosa*) fueron los mas importantes por volumen al año. Cacahuate, mostaza silvestre (*Lesquerella densiflora*) y gramíneas fueron importantes por volumen en la primavera, mientras que en el verano los frutos del ciruelo silvestre (*Prunus angustifolia*), del jaboncillo (*Sapindus drummondii*) y chapulines fueron importantes por su volumen. Los frutos de coma, palo blanco y maíz fueron importantes en el otoño, mientras que los frutos de coma, cacahuate y triguillo corto (*Agropyron smithii*) lo fueron en el invierno. Aunque no estimamos su disponibilidad, todos los alimentos parecieron ser consumidos en base a su disponibilidad en las diferentes temporadas del año. El consumo de alimentos de origen antropogénico vario entre el 7 y 43% dependiendo de la temporada. No se encontraron diferencias entre los sexos. Los alimentos de origen animal se consumieron mayormente durante el verano, frutos y semillas se consumieron en menor grado durante la primavera y alimentos misceláneos se consumieron en mayor cantidad durante el otoño e invierno. Los alimentos de origen antropogénico se consumieron mayormente en el área de estudio de Salt Fork, mientras que los alimentos misceláneos se consumieron principalmente en el área de estudio de Matador. A pesar de la abundancia de especies indeseables como el árbol del paraíso (*Elaeagnus angustifolia*), mezquite dulce (*Prosopis glandulosa*) y el pino salado (*Tamarix chinensis*), los guajolotes silvestres no consumieron ninguna parte de estas plantas.

INTRODUCTION--Wild turkeys (*Meleagris gallopavo*) have been described as nomadic opportunistic feeders (Glover and Bailey, 1949; Litton, 1977; Korschgen, 1967; Adams, 1987; Laudenslager and Flake, 1987; Hengel, 1990). Previous studies have shown that wild turkey diets changed as different types of food items became seasonally available. If this is true, we could predict that green vegetation and insects would be consumed in higher quantities in the spring and summer when those items are more available. Conversely, hard mast and seeds would be consumed in higher quantities in the autumn and winter when green vegetation and insects are not as widely available.

Several studies have indicated that food from anthropogenic sources such as food plots, cattle feeding, and wildlife feeding and baiting were a part of wild turkey diets. Exum et al. (1987) found that in years when Chufa plots were planted it comprised 32% of the autumn diet and 34% of the winter diet of Eastern wild turkeys in southern Alabama (*M. g. silvestris*). Glover and Bailey (1949) found that oats and corn accounted for 21.5% and 16.2%, respectively, of the Eastern wild turkey diet in southeastern West Virginia. Quinton and Montei (1977) found that grain sorghum was the number one food item, comprising 86% of the spring diet of hunter harvested Rio Grande wild turkeys (*M. g. intermedia*) in north-central Texas. Beck and Beck (1955) found that cottonseed cake from cattle feeding operation was the single most important food item in the autumn and winter diet in Rio Grande wild turkeys in southern Texas.

Previous research from southern and central Texas is available, but none is available from the Texas Panhandle. We initiated a study in August 2005 to: 1) assess

seasonal and annual diets of Rio Grande wild turkeys in the Texas Panhandle and, 2) evaluate the use of foods from anthropogenic sources.

METHODS--*Study Area*-- We conducted our study on 3 study areas in the Texas Panhandle. All sites were characterized by narrow riparian corridors with adjacent upland grasslands and brushlands. The dominant land use on all study sites was cattle production. However, both dryland and irrigated agriculture occurred on all study areas in limited quantities.

The northernmost study site was located in Hemphill County and was centered on the 2,358 ha Gene Howe Wildlife Management Area with additional access to approximately 11,000 ha of surrounding private lands. The main riparian corridor on this study area was the Canadian River which flowed west to east through the center of the study area. In addition to cattle production, oil and gas production was frequent across the landscape. Hemphill County was characterized as a dry-steppe climate and averages 52.1 cm of precipitation annually. It was not uncommon to go 2 to 3 weeks without precipitation, and a month without rainfall was recorded. Average growing season lasted 204 days (Hall, 2005). Dominant grasses included little bluestem (*Schizachyrium scoparium*), gramma species (*Bouteloua* spp.), and dropseed (*Sporobolus cryptandrus*). Dominant forbs included western ragweed (*Ambrosia psilostachya*), camphorweed (*Heterotheca subaxilaris*), and silverleaf nightshade (*Solanum elacagnifolium*). Dominant woody vegetation included cottonwoods (*Populus deltoides*), hackberry (*Celtis sp.*), Chickasaw plum (*Prunus angustifolia*), and sand sagebrush (*Artemisia filifolia*). Russian olive (*Elaeagnus angustifolia*), salt cedar (*Tamarix chinensis*), and button willow

(*Cephalanthus occidentalis*) are also common.

The Salt Fork study area was the central study site and was located in Donley and Collingsworth Counties along the Salt Fork of the Red River, which runs west to east through the center of the study area. This study area consisted of approximately 20,000 ha of private lands. The climate of the Salt Fork study area was characterized as dry-steppe with mild winters. Most precipitation occurred from April through October, and annual precipitation averaged 54.65 cm. The growing season averaged 206 days (Hall, 2005). Dominant grasses included little bluestem gramma species, and western wheatgrass (*Agropyron smithii*). Dominant forbs on the area included broom snakeweed (*Gutierrezia sarothrae*), Indian Blanket (*Gaillardia puchella*), and Aster species (family Asteracaeae). Dominant woody vegetation included cottonwoods, honey mesquite (*Prosopis glandulosa*), black locust (*Robinia pseudoacacia*), and salt cedar.

The southern most study area was located in Cottle County, and was centered on the Matador Wildlife Management Area. The study area included the Matador WMA, which was approximately 11,406 ha, and its surrounding private land. The Pease River flowed west to east through the study area. The climate of Cottle County was characterized by dry winters and hot summers. Average rainfall was 56.24 cm, but this was highly variable by month and year. The average growing season was 219 days (Hall, 2005). Dominant grasses included purple three-awn (*Aristida purpurea*), dropseed, Japanese brome (*Bromus japonicus*), plains bristle grass (*Setaria leucopila*), and gramma species. Dominant forbs included silver-leaf nightshade, western ragweed, and Indian blanket (*Gaillardia pulchella*). Dominant woody vegetation included honey mesquite ,

redberry juniper (*Juniperus pinchotti*), hackberry, salt cedar and cottonwood. Prickly pear (*Opuntia phaeacantha*) and plains yucca (*Yucca glauca*) are also common.

Data Collection and Analysis--We harvested turkeys during 4 predetermined seasons based on seasonal changes in the plant community: summer (June to August), autumn (September to November), winter (December to February), and spring (March to May). We attempted to collect 6 turkeys per season (3 males: 3 females) from each study site for a total of 72 birds. We harvested birds using 0.22 caliber magnum rifles for distances between 18 and 45 meters, and 12-gauge shotguns for distances less than 18 meters.

Previous data (M. C. Wallace et al., unpubl. report, Texas Tech University, Lubbock, Texas) indicated that turkeys feed during mornings and afternoons. We collected samples after 12:00 noon to maximize the amount of food a bird had consumed samples. Immediately following collection, we tied the digestive tract off at the junctions of the esophagus and proventriculus, and gizzard and intestines (Swanson and Bartonek 1970). We then removed the digestive tract, separated it by upper (esophagus and crop), middle (proventriculus and gizzard) and lower (intestine, caeca, and cloaca) sections, and preserved them by submersion in 10% formalin solution to halt post-mortem digestion (Bartonek and Hickey, 1969; Swanson and Bartonek, 1970).

We emptied and combined the contents the crop and esophagus of each turkey and allowed them to dry for 12 to 24 hours. We then sorted the samples macroscopically to species level for plant material and to class level for animal material. Once sorted, we measured the volume of each food item using water displacement, and identified each

food item. We summarized the data by aggregate volume, aggregate percentage, and frequency of occurrence for each season as well as annually (Martin et al., 1946; Swanson et al., 1974). We then reclassified our 86 food items into categories before analyzing our study site, season, and sex variables. Our categories were: animal, which included all insects and snails; anthropogenic, which included all foods originating from human sources; forb vegetation and seeds, grass vegetation and seeds; mast, which includes both soft and hard mast; and, miscellaneous, which included items classified as debris and rock. Debris were primarily items we determined to be picked up in the process of feeding on other foods. These included leaf litter, sticks, and dirt. Rock were small pebbles the birds had consumed to replenish the grit in their gizzard. We used analysis of variance (ANOVA) to test for differences among categories.

RESULTS--We obtained 72 samples (Table 2.1), but 2 samples were discarded due to sample degradation. Hackberries (*Celtis* spp.) were consumed in the greatest volume (24.7%)(Table 2.2) and were the second most frequently consumed (Table 2.3) food item (64.3%) across all study sites. Other grass, which consisted of grass leaves that were not able to be identified, ranked second by frequency (71.4%) but was ranked low for aggregate volume with only 4.9%. Domestic peanuts were ranked second by volume (10.7%), but were not consumed as frequently (10.0%) as other important food items. The third most frequently consumed food item was beetles (55.7%). However, beetles were low for aggregate volume (0.6%). Other food items that comprised >1 percent of the diet by volume were: woolybucket bumelia (*Bumelia lanuginosa*) (9.6%), corn (*Zea mays*) (8.2%), Chickasaw plum (*Prunus angustifolia*) fruit (6.9%), grasshoppers (6.1%),

western soapberry (*Sapindus drummondii*) fruit (5.6%), western wheatgrass (*Agropyron smithii*) seeds and vegetation (3.8%), dense-flower bladderpod (*Lesquerella densiflora*) seeds (3.4%), shinnery oak (*Quercus havardii*) acorns (2.5%), western ragweed (*Ambrosia psilostachya*) seeds and vegetation (2.2%), grain sorghum (*Sorghum bicolor*) (2.0%), locusts (1.8%), pelletized game feed (1.3%), and sand dropseed (*Sporobolus cryptandrus*) seeds and vegetation (1.1%).

During winter season, hackberries (56.4%), peanuts (14.1%), and western wheatgrass (10.5%) were the most consumed food by volume. Sorghum (5.3%), other grass (4.9%), and corn (4.2%) were also consumed in significant volumes during winter. Hackberries were the most frequently consumed food item (75.0%) during winter followed by other grass (70.0%), western wheatgrass (70.0%), beetles (40.0%), rocks (40.0%), and western soapberry (35.0%).

During spring, peanuts were consumed in the greatest volume (41.9%) although only consumed at the Salt Fork study site. Dense-flower bladderpod (24.7%) comprised a large portion of the spring diet, but was not consumed in any other season, and only at the Matador study site. In addition, other grasses contributed 10.7% to the spring diet by volume. The most frequently consumed foods during the spring were other grasses (88.9%), hackberries (50.0%), beetles (50.0%), rock (33.3%), and skunkbrush sumac (33.3%).

The primary food by volume during the summer was Chickasaw plum fruit (28.1%). Summer was the only season in which Chickasaw plum fruits were consumed in measurable quantities. Grasshoppers (20.0%) and western soapberry fruit (19.2%)

were also consumed in large volume during summer. Shinnery oak acorns (9.8%), locusts (7.5%), and corn (7.1%) were also consumed. The most frequently eaten food items during summer were grasshoppers (89.5%), beetles (73.7%), hackberries (47.4%),, western soapberry fruit (47.4%), and Chickasaw plums (47.4%).

The most abundant food by volume found in the autumn diet was woolybucket bumelia (32.1%), but this was only found at one study site. Other important foods by volume were hackberry (18.7%), corn (16.9%), and western ragweed (7.3%). Other grass (86.7%) was the most frequently consumed food during the autumn followed by hackberries (80.0%), and western ragweed (80.0%).

Diet composition between sexes did not differ ($P > 0.05$). However, animal matter was greater ($P = 0.0004$) during winter and mast ($P = 0.0065$) was less in spring. Also, miscellaneous items were greater ($P = 0.0011$) during winter than during spring and summer, but the same as autumn Miscellaneous items were the same in autumn, spring and summer. Diet composition between study sites differed for anthropogenic, mast, and miscellaneous categories. Anthropogenic sources were greater ($P < 0.0001$) at the Salt Fork study site, mast was less ($P = 0.0067$) at the Salt Fork study site, and miscellaneous items were greater ($P = 0.0022$) at the Matador study site.

DISCUSSION-- Our sampling was done concurrently with studies involving radio-transmittered Rio Grande wild turkeys at each study area. However, we could not harvest birds from flocks containing radio-collared animals without potentially disrupting the telemetered birds. Once we located suitable flocks, we harvested the turkeys with little complication.

Some of the foods that ranked highly in the annual diet may not be as important as their percentage suggests. For example, woolybucket bumelia ranked third with 9.6% of the annual diet for all study sites, seasonally it was 32.1% of the autumn diet, trace amounts of the winter diet, and not eaten in other seasons. Additionally, it was only found at the Matador study site, and was in every sample from the autumn season and 2 from the winter season. Woolybucket bumelia may be an important food for wild turkeys seasonally in some areas. Similarly, dense-flower bladderpod ranked tenth with 3.4% of the annual diet, but was only found in one sample from the spring from the Matador study site. Most likely wild turkeys in this region do not consume dense-flower bladderpod on a regular basis. It may not be widely available and, when they do find it, they consume as much as possible. Finally, Chickasaw plum was another food item that was consumed in this fashion. It ranked fifth annually with 6.9% of the diet, but was mostly consumed during summer (28.1%). It differed from the previous 2 examples as it was found in at least one sample from all study sites.

Conversely, beetles were consumed frequently, but resulted in relatively small volumes. Beetles ranked third annually by frequency with 55.7% of the samples containing beetles, but only comprised 0.6% of the annual diet by volume. When beetles were consumed they were not in a measurable quantity (>0.1%) in a single sample. However, they appeared in measurable quantities in every season. Likely beetles are a more important portion of Rio Grande wild turkey diets than the volume consumed suggested. This could be a factor of their small body size, and relative sparseness when compared to something like grass seeds that can be consumed by the dozens.

More volume of animal matter was consumed during summer than any of the other seasons. This was expected as other studies have found insects to be important during the summer (Litton, 1977; Kennamer et al., 1980; Exum et al., 1987). Gallinaceous birds target insects for their high protein content so it is no surprise they are consumed the most in seasons when they are the most abundant. Mast was consumed in the lowest amounts during the spring, and in statistically equal amounts in the rest of the seasons. Most mast producing trees and shrubs on our study areas do not produce fruit until late summer or early autumn (Vines, 1994). Much of that fruit will be consumed by wildlife during the late summer, autumn and winter, and very little would be left for spring consumption. Additionally, some soft mast such as wild plums do not persist long in the environment before rotting, so those items would also not be available in the spring. Miscellaneous items were consumed more during winter than spring or summer, but statistically equal to autumn. Autumn was statistically the same as all other seasons. Even though there was a statistical difference for miscellaneous foods in different seasons there was no biological difference. These items were not consumed for nutritional reasons and were a by product of foraging other food items. Furthermore, they were usually found in quantities to small to measure. When we were able to be measure them, they averaged 0.38 mL ($n = 24$) per sample.

The higher consumption of anthropogenic food at the Salt Fork study site can be explained largely by the agricultural production of peanuts at that site, an activity not found at either the Gene Howe or Matador study sites. Peanuts comprised over 50% of the anthropogenic foods consumed at the Salt Fork, and 47% of the anthropogenic foods

at all sites combined. The Salt Fork study site was the only study site that was composed entirely of private land where wildlife baiting and feeding were common. Much of the difference not explained by peanuts can be seen in higher levels of corn and sorghum consumption which is typically used as bait or feed for wildlife. Sorghum was only found in samples at the Salt Fork. Corn was found at all study sites, but always in quantities smaller than 2 ml, except at the Salt Fork where turkeys consistently consumed ≥ 50 ml of corn.

For seasonal diets, we found that the dominant foods in the spring were peanuts, bladder pod leaves and fruit, grass vegetation and hackberries. Only one previous study has recorded high amounts of anthropogenic foods in the spring diet. Quinton and Montei (1977) had a high percentage of grain sorghum in the spring diet. However, they collected crops from hunters so the sorghum may have come from bait used to harvest the birds. The peanuts in our samples were from agricultural fields. In addition, Exum et al. (1987) found large amounts of chufa from food plots in the spring diet. Previous studies conducted in the winter recorded grass seeds (Quinton and Montei, 1977; Kennamer et al., 1980; Hengel, 1990; Rumble and Anderson, 1996) or vegetation (Beck and Beck, 1955; Litton, 1977; Tabatabai and Kennedy, 1984; Wakeling and Rogers, 1996) as one of the most common spring foods. Some studies (Kennamer et al., 1980; Exum et al., 1987; Rumble and Anderson, 1996) combined forb vegetation with grass, and found all green vegetation to be important during spring. Some previous studies (Meanley, 1955; Quinton and Montei, 1977; Litton, 1977; Kennamer et al., 1980; Tabatabai and Kennedy, 1984; Rumble and Anderson, 1996; Wakeling and Rogers, 1996) have also found

significant amounts of mast. Only a few studies have had large amounts of forbs (Hengel, 1990; Rumble and Anderson, 1996) in the spring diet. While we found very few insects in the spring diet, other studies have found insects to be important (Beck and Beck, 1955; Exum et al., 1977; Kennamer et al., 1980; Beck and Beck, 1955).

The most abundant foods we found in the summer diet were hackberry, grasshoppers, soapberry, acorns, locust, and corn. Many other studies have found mast to be a significant portion of the spring diet (Meanley, 1955; Beck and Beck, 1955; Litton, 1977; Kennamer et al., 1980; Exum et al., 1987; Wakeling and Rogers, 1996). The 2 studies in Texas with summer data found hackberries to be of importance during the summer (Beck and Beck, 1955; Litton, 1977). Only a few studies found insects important (Kennamer et al., 1980; Exum et al., 1987; Rumble and Anderson, 1996). No other studies have found significant amounts of anthropogenic food in summer diets. Many studies have found green vegetation, either grass or forbs or both, in summer turkey diets (Litton, 1977; Kennamer et al., 1980; Exum et al., 1987; Rumble and Anderson, 1996; Wakeling and Rogers, 1998).

During the autumn we found woolybucket bumelia, hackberries, corn and ragweed to be important sources of food. With the exception of Kennamer et al. (1980) who found all green vegetation to be important during the autumn, no other studies have found forbs to be an important autumn food. Conversely, several studies have found grass to be important (Litton, 1977; Quinton and Montei, 1977; Kennamer et al., 1980; Rumble and Anderson, 1996), while we did not. Similarly, some studies found insects in significant amounts in autumn diets (Beck and Beck, 1955; Litton, 1977; Quinton and

Montei, 1977; Kennamer et al., 1980; Exum et al., 1987), while we did not. The 3 previous studies on Rio Grande wild turkeys that were located in Texas all found mast to be an important part of the autumn diet (Beck and Beck, 1955; Litton, 1977; Quinton and Montei, 1977) as well as several studies from other parts of the country on various sub-species (Kennamer et al., 1980; Exum et al., 1987; Laudenslager and Flake, 1987; Hengel, 1990). Beck and Beck (1955) was the only other study that found anthropogenic food to be a significant part of the autumn diet. This was from cattle feeding operations while our source was from feeding deer.

We found important winter foods to include hackberries, peanuts, grass, and grain sorghum. Mast was commonly found as an important winter food item (Meanley, 1955; Kennamer et al., 1980; Exum et al., 1987; Hengel, 1990; Rumble and Anderson, 1996; Wakeling and Rogers, 1996). Also, it was not uncommon for anthropogenic foods to be an important part of the winter diet (Beck and Beck, 1955; Exum et al., 1987; Hengel, 1990; Rumble and Anderson, 1996). Several other studies (Appendix I) have also found grass in winter diets (Meanly, 1955; Exum et al., 1987; Hengel, 1990; Rumble and Anderson, 1996; Wakeling and Rogers, 1996). Finally, while we found very few insects in winter samples, while 2 studies have found significant amounts of insects in winter samples (Kennamer et al., 1980; Exum et al., 1987).

MANAGEMENT IMPLICATIONS--Despite the abundance of Russian olive, a non-native plant thought to be valuable for wildlife food, it was not consumed at any of our study sites. In addition, neither salt cedar, another non-native, nor honey mesquite were consumed despite each being common on at least two of our study sites. These three

species are widely controlled in the Texas Panhandle, and continuing to do so should have no negative effect on Rio Grande wild turkey diets in this region. However, hackberry, Chickasaw plum, and western soapberry are not always protected from overspray while trying to eradicate other brush and forb species. When possible, managers should take special precautions to protect these species as they may be an important food for wild turkeys.

Our findings indicated that in some areas Rio Grande wild turkey diets contain as much as 43% of foods from anthropogenic sources depending upon the season. Future research should focus on determining the affect of foods from anthropogenic sources on population dynamics, movements within suitable habitat, and population distribution across the landscape. This knowledge would allow managers to better understand how human activities are affecting wild turkey population, and demonstrate how use or disuse of supplemental feeding could be used to achieve management goals.

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Table 2.1. Number of Rio Grande wild turkeys collected at three study sites in Texas, August 2005 to May 2006.

Study Area	Sex	Summer	Autumn	Winter	Spring	Total
Gene Howe	Male	3	2	3	3	22
	Female	3	2	3	3	
Matador	Male	3	3	4*	3	23
	Female	3	3	3	3	
Salt Fork	Male	4	3	3	3	25
	Female	3	2	4	3	

*Two samples were excluded from data analysis

Table 2.2. Annual and seasonal diet composition by aggregate volume of Rio Grande wild turkeys at three study sites in Texas, August 2005 to May 2006

		Aggregate Volume (%)				
Common Name	Order/*Scientific name*	Autumn	Spring	Summer	Winter	Annual
Hackberry	*Celtis reticulata*	18.7	7.3	0.8	56.4	24.7
Peanut	*Arachus hypogea*	1.1	41.9	0.0	14.1	10.7
Woolybucket bumelia	*Bumelia lanuginosa*	32.1	0.0	0.0	t	9.6
Corn	*Zea mays*	16.9	0.8	7.1	4.2	8.2
Chickasaw plum	*Prunus angustifolia*	0.0	0.0	28.1	t	6.9
Grasshopper	Orthoptera	4.2	t	20.0	t	6.1
Western soapberry	*Sapindus drummondii*	1.7	1.7	19.2	0.4	5.6
Other grass		5.2	10.7	0.7	5.2	4.9
Western wheatgrass	*Agropyron smithii*	0.5	2.3	0.1	10.5	3.8
Dense-flower bladderpod	*Lesquerella densiflora*	0.0	24.7	0.0	0.0	3.4
Shinnery oak	*Quercus havardii*	0.0	0.4	9.8	0.0	2.5
Western ragweed	*Ambrosia psilostachya*	7.3	t	0.0	0.2	2.2
Sorghum	*Sorghum bicolor*	1.1	t	0.0	5.3	2.0
Locust	Homoptera	0.0	0.0	7.5	0.0	1.8
Game feed		3.5	0.0	0.0	0.9	1.3
Sand dropseed	*Sporobolus cryptandrus*	3.4	0.0	0.3	0.1	1.1
Prickly pear	*Opuntia lindheimeri*	0.8	t	1.3	0.6	0.7
Beetle	Coleoptera	0.4	2.3	0.7	0.1	0.6
Virginia wildrye	*Elymus virginicus*	0.0	0.0	2.0	0.0	0.5
Red mulberry	*Morus rubra*	0.0	3.2	0.0	0.0	0.4
Skunkbrush sumac	*Rhus aromatica*	0.0	2.8	0.2	0.0	0.4
Bermuda grass	*Cynodon dactylon*	0.9	0.0	0.3	0.2	0.4
Winter wheat	*Triticum aestivum*	t	0.0	0.0	0.9	0.3
Poison ivy fruit	*Toxicodendron radicans*	0.8	0.0	0.0	0.0	0.2
Debris		0.2	t	t	0.3	0.2
Sagewort	*Artemisia ludoviciana*	0.4	t	0.1	t	0.1
Knotroot bristlegrass	*Setaria geniculata*	0.0	t	0.6	0.0	0.1

Table 2.2. Continued.

Common Name	Order/*Scientific name*	Aggregate Volume (%)				
		Autumn	Spring	Summer	Winter	Annual
Redberry juniper	*Juniperus pinchotii*	t	0.5	0.0	0.2	0.1
Hooded windmillgrass	*Chloris cucullata*	0.3	0.0	0.0	0.0	0.1
Japanese chess	*Bromus japonicus*	0.0	0.0	0.3	t	0.1
Rock		0.0	0.1	t	0.2	0.1
Ant	Hymenoptera	t	t	0.3	t	0.1
Rescue grass	*Bromus cothardicus*	0.0	0.4	0.0	0.0	0.1
Bitterweed	*Hymennoxys odorata*	0.2	0.0	0.0	0.0	0.1
Moth	Lepidoptera	t	t	0.1	t	0.1
Unknown forb		t	t	t	t	t
Hairy goldaster	*Chrysopsis villosa*	0.0	0.2	t	t	t
Spider	Aranaea	t	0.0	t	t	t
Unidentifiable		0.0	0.0	t	t	t
Leafhopper	Homoptera	t	0.0	0.0	t	t
Cocoon	Lepidoptera	0.0	0.0	0.0	t	t
Field sand bur	*Cenchrus pauciflorus*	0.0	0.0	0.0	t	t
Hay		0.0	0.0	0.0	t	t
Shotgun pellet		0.0	0.0	0.0	t	t
Snail		0.0	0.0	0.0	t	t
Unknown insect		0.0	0.0	0.0	t	t
Vine mesquite	*Panicum obtosum*	0.0	0.0	0.0	t	t
Threadleaf groundsel	*Senecio douglasii*	t	t	t	0.0	t
Caterpillar	Lepidoptera	0.0	t	t	0.0	t
Fly	Diptera	0.0	t	t	0.0	t
Plains bristlegrass	*Setaria macrostachya*	0.0	t	t	0.0	t
Kentucky bluegrass	*Poa pratensis*	t	0.0	t	0.0	t
Larvae		t	0.0	t	0.0	t
Thin paspalum	*Paspalum setaceum*	t	0.0	t	0.0	t

Table 2.2. Continued.

Common Name	Order/*Scientific name*	Aggregate Volume (%)				
		Autumn	Spring	Summer	Winter	Annual
Tick	Acarina	t	0.0	t	0.0	t
Blue gramma	*Bouteloua gracilis*	0.0	0.0	t	0.0	t
Fall witch grass	*Digitaria cognata*	0.0	0.0	t	0.0	t
Ground cherry	*Physalis hederaefolia*	0.0	0.0	t	0.0	t
Sand paspalum	*Paspalum stramineum*	0.0	0.0	t	0.0	t
Silver bluestem	*Bothriochloa lugroides*	0.0	0.0	t	0.0	t
Tumblegrass	*Schedonnardus paniculatas*	0.0	0.0	t	0.0	t
Praying mantis	Orthoptera	0.0	0.0	0.2	0.0	t
Dandelion	*Taraxacum officinale*	0.0	t	0.1	0.0	t
Black gramma	*Bouteloua eriopoda*	t	t	0.0	0.0	t
Prairie goldenrod	*Solidago missouriensis*	t	t	0.0	0.0	t
Roly poly	Isopoda	t	t	0.0	0.0	t
Galleta	*Hilaria jamesii*	0.0	t	0.0	0.0	t
Intermediate wheatgrass	*Agropyron intermedium*	0.0	t	0.0	0.0	t
Johnson grass	*Sorghum halepense*	0.0	t	0.0	0.0	t
Prairie coneflower	*Ratibida columnifera*	0.0	t	0.0	0.0	t
Shepard's purse	*Casella bursa*	0.0	t	0.0	0.0	t
Texas bluestem	*Poa arachnifera*	0.0	t	0.0	0.0	t
Unknown lovegrass	*Eragrostis* spp.	0.0	t	0.0	0.0	t
White tridens	*Tridens albescens*	0.0	t	0.0	0.0	t
Rush spp	*Juncus* spp.	0.0	0.3	0.0	0.0	t
Sedge spp	Family Cyperaceae	0.0	0.2	0.0	0.0	t
Spectacle pod	*Dithyria californica*	0.0	0.1	0.0	0.0	t
Bee	Hymenoptera	t	0.0	0.0	0.0	t
Dragonfly	Odonata	t	0.0	0.0	0.0	t
Green sprangle-top	*Leptochloa dubia*	t	0.0	0.0	0.0	t
Knotgrass	*Paspalum distichum*	t	0.0	0.0	0.0	t
Witchgrass	*Leptohoma cognatum*	t	0.0	0.0	0.0	t

Table 2.2. Continued.

Common Name	Order/*Scientific name*	Aggregate Volume (%) Autumn	Spring	Summer	Winter	Annual
Cottonseed	*Gossypim* spp.	0.1	0.0	0.0	0.0	t
Rough tridens	*Tridens elongatus*	0.1	0.0	0.0	0.0	t
Wasp	Hymenoptera	0.0	0.0	0.0	0.0	t

Table 2.3. Annual and seasonal diet composition by frequency of occurrence of Rio Grande wild turkeys at three study sites in Texas, August 2005 to May 2006

		Frequency of Occurrence (%)				
Common Name	Order/*Scientific name*	Autumn	Spring	Summer	Winter	Annual
Other grass		86.7	88.9	36.8	70.0	71.4
Hackberry	*Celtis reticulata*	80.0	50.0	47.4	75.0	64.3
Beetle	Coleoptera	53.3	50.0	73.7	40.0	55.7
Grasshopper	Orthoptera	53.3	22.2	89.5	10.0	44.3
Western wheatgrass	*Agropyron smithii*	33.3	27.8	26.3	70.0	41.4
Rock		6.7	44.4	21.1	40.0	38.6
Western ragweed	*Ambrosia psilostachya*	80.0	33.3	10.5	30.0	37.1
Western soapberry	*Sapindus drummondii*	33.3	16.7	47.4	35.0	34.3
Debris		53.3	5.6	5.3	30.0	22.9
Unknown forb		40.0	27.8	10.5	10.0	21.4
Moth	Lepidoptera	20.0	5.6	31.6	10.0	17.1
Redberry juniper	*Juniperus pinchotii*	6.7	22.2	0.0	30.0	15.7
Prickly pear	*Opuntia lindheimeri*	13.3	16.7	15.8	15.0	15.7
Sand dropseed	*Sporobolus cryptandrus*	40.0	0.0	15.8	10.0	15.7
Corn	*Zea mays*	40.0	5.6	10.5	10.0	15.7
Chickasaw plum	*Prunus angustifolia*	0.0	0.0	47.4	5.0	14.3
Sorghum	*Sorghum bicolor*	26.7	5.6	0.0	15.0	11.4
Woolybucket bumelia	*Bumelia lanuginosa*	40.0	0.0	0.0	10.0	11.4
Skunkbrush sumac	*Rhus aromatica*	0.0	33.3	10.5	0.0	11.4
Spider	Aranaea	13.3	0.0	5.3	20.0	10.0
Peanut	*Arachus hypogea*	6.7	11.1	0.0	20.0	10.0
Bermuda grass	*Cynodon dactylon*	26.7	0.0	5.3	10.0	10.0
Ant	Hymenoptera	6.7	11.1	15.8	5.0	10.0
Sagewort	*Artemisia ludoviciana*	6.7	11.1	15.8	5.0	10.0
Hairy goldaster	*Chrysopsis villosa*	0.0	11.1	15.8	5.0	8.6
Unidentifiable		26.7	0.0	5.3	5.0	8.6
Game feed		20.0	0.0	0.0	10.0	7.1

Table 2.3. Continued.

Common Name	Order/*Scientific name*	Frequency of Occurrence (%)				
		Autumn	Spring	Summer	Winter	Annual
Locust	Homoptera	0.0	0.0	26.3	0.0	7.1
Fly	Diptera	0.0	16.7	10.5	0.0	7.1
Threadleaf groundsel	*Senecio douglasii*	20.0	5.6	5.3	0.0	7.1
Rescue grass	*Bromus cothardicus*	0.0	27.8	0.0	0.0	7.1
Knotgrass	*Paspalum distichum*	26.7	0.0	0.0	0.0	5.7
Winter wheat	*Triticum aestivum*	6.7	0.0	0.0	10.0	4.3
Leafhopper	Homoptera	13.3	0.0	0.0	5.0	4.3
Praying mantis	Orthoptera	0.0	0.0	15.8	0.0	4.3
Knotroot bristlegrass	*Setaria geniculata*	0.0	5.6	10.5	0.0	4.3
Shinnery oak	*Quercus havardii*	0.0	5.6	10.5	0.0	4.3
Larvae		6.7	0.0	10.5	0.0	4.3
Caterpillar	Lepidoptera	0.0	11.1	5.3	0.0	4.3
Rush spp.	*Juncus* spp.	0.0	16.7	0.0	0.0	4.3
Roly Poly	Isopoda	6.7	11.1	0.0	0.0	4.3
Hooded windmillgrass	*Chloris cucullata*	20.0	0.0	0.0	0.0	4.3
Japanese chess	*Bromus japonicus*	0.0	0.0	5.3	5.0	2.9
Dandelion	*Taraxacum officinale*	0.0	5.6	5.3	0.0	2.9
Plains bristlegrass	*Setaria macrostachya*	0.0	5.6	5.3	0.0	2.9
Kentucky bluegrass	*Poa pratensis*	6.7	0.0	5.3	0.0	2.9
Thin paspalum	*Paspalum setaceum*	6.7	0.0	5.3	0.0	2.9
Tick	Acarina	6.7	0.0	5.3	0.0	2.9
White tridens	*Tridens albescens*	0.0	11.1	0.0	0.0	2.9
Black gramma	*Bouteloua eriopoda*	6.7	5.6	0.0	0.0	2.9
Prairie goldenrod	*Solidago missouriensis*	6.7	5.6	0.0	0.0	2.9
Poison ivy fruit	*Toxicodendron radicans*	13.3	0.0	0.0	0.0	2.9
Cocoon	Lepidoptera	0.0	0.0	0.0	5.0	1.4
Field sand bur	*Cenchrus pauciflorus*	0.0	0.0	0.0	5.0	1.4
Hay		0.0	0.0	0.0	5.0	1.4

Table 2.3. Continued.

Common Name	Order/*Scientific name*	Frequency of Occurrence (%)				
		Autumn	Spring	Summer	Winter	Annual
Shotgun pellet		0.0	0.0	0.0	5.0	1.4
Snail		0.0	0.0	0.0	5.0	1.4
Unknown insect		0.0	0.0	0.0	5.0	1.4
Vine mesquite	*Panicum obtosum*	0.0	0.0	0.0	5.0	1.4
Blue gramma	*Bouteloua gracilis*	0.0	0.0	5.3	0.0	1.4
Fall witchgrass	*Digitaria cognata*	0.0	0.0	5.3	0.0	1.4
Ground cherry	*Physalis hederaefolia*	0.0	0.0	5.3	0.0	1.4
Sand paspalum	*Paspalum stramineum*	0.0	0.0	5.3	0.0	1.4
Silver bluestem	*Bothriochloa lugroides*	0.0	0.0	5.3	0.0	1.4
Tumblegrass	*Schedonnardus paniculatas*	0.0	0.0	5.3	0.0	1.4
Virginia wildrye	*Elymus virginicus*	0.0	0.0	5.3	0.0	1.4
Dense-flower bladderpod	*Lesquerella densiflora*	0.0	5.6	0.0	0.0	1.4
Galleta	*Hilaria jamesii*	0.0	5.6	0.0	0.0	1.4
Intermediate wheatgrass	*Agropyron intermedium*	0.0	5.6	0.0	0.0	1.4
Johnson grass	*Sorghum halepense*	0.0	5.6	0.0	0.0	1.4
Prairie coneflower	*Ratibida columnifera*	0.0	5.6	0.0	0.0	1.4
Red mulberry	*Morus rubra*	0.0	5.6	0.0	0.0	1.4
Sedge spp.	Family Cyperaceae	0.0	5.6	0.0	0.0	1.4
Shepard's purse	*Casella bursa*	0.0	5.6	0.0	0.0	1.4
Spectacle pod seed	*Dithyria californica*	0.0	5.6	0.0	0.0	1.4
Texas bluestem	*Poa arachnifera*	0.0	5.6	0.0	0.0	1.4
Unknown lovegrass	*Eragrostis* spp.	0.0	5.6	0.0	0.0	1.4
Bee	Hymenoptera	6.7	0.0	0.0	0.0	1.4
Bitterweed	*Hymennoxys odorata*	6.7	0.0	0.0	0.0	1.4
Cottonseed	*Gossypim* spp.	6.7	0.0	0.0	0.0	1.4
Dragonfly	*Odonata*	6.7	0.0	0.0	0.0	1.4
Green sprangle-top	*Leptochloa dubia*	6.7	0.0	0.0	0.0	1.4
Rough tridens	*Tridens elongatus*	6.7	0.0	0.0	0.0	1.4

Table 2.3. Continued.

Common Name	Order/*Scientific name*	Frequency of Occurrence (%)				
		Autumn	Spring	Summer	Winter	Annual
Wasp	Hymenoptera	6.7	0.0	0.0	0.0	1.4
witchgrass	*Leptohoma cognatum*	6.7	0.0	0.0	0.0	1.4

APPENDIX A

SUMMARY OF PREVIOUS WILD TURKEY DIET STUDIES 1942-2007

Table A.1. Summary of top 3 food items from wild turkey diet studies in the United States, 1942-2007

Location	Sub-Species	Measure	Spring	Summer	Autumn	Winter	Annual
Texas Panhandle[a]	Rio Grande	% Comp.[*,1]	Peanuts Bladderpod Grass	Plums Grasshopper Soapberry	Bumelia Hackberry Corn	Hackberry Peanuts Wheatgrass	Hackberry Peanuts Bumelia
Permian Basin, Texas[b]	Rio Grande	%Comp[1]	Animal food Rescue grass Lotebush	Animal food Rescue grass Hackberry	Animal food Rescue grass Tasajillo	Rescue grass Milvetch Bladderpod	Animal food Rescue grass Chittum
North-Central Texas[c]	Rio Grande	%Comp[1]	Sorghum Cupgrass seeds Skunkbrush		Ironwood Prickly pear Arthropods		
King ranch, Texas[d]	Rio Grande	Rel. Imp[1]	Insects Paspalum	Hackberry Mesquite	Cottonseed cake Acorns Croton	Cottonseed cake Insects Hackberry	Cottonseed cake
Missouri[e]	Eastern	Util. Rank[2]	Digitaria Grass veg. Paspalum		Grass veg. Digitaria Dogwood		
SE West Virginia[f]	Eastern	%Comp[3]			`	Oats Corn Grasses	
South-East Arkansas[g]	Eastern	FOO[**,1,2]	Sugarberry Sweet pecan Black gum	Blackberries *Carex* spp. Acorns		Acorns Grass veg. Poison ivy	

Table A.1. Continued.

Location	Sub-Species	Measure	Spring	Summer	Autumn	Winter	Annual
Alabama[h]	Eastern	%Comp[3]	Green veg. Panicum Acorns	Green veg. Paspalum Panicum	Green veg. Dogwood Paspalum	Green veg. Pine seeds Acorns	
SW Tennessee[i]	Eastern	%Comp[4]	Hackberry Wheat Beech				
Southern Alabama[j]	Eastern	%Comp[3]	Green veg. Insects Chufa	Green veg. Insects Blackberry	Dogwood Chufa Insects	Green veg. Chufa Acorns	
South-Central South Dakota[k]	Eastern	%Comp[1]		Acorns Corn Oats			
Peloncillo Mtn's, New Mexico[m]	Gould's	% Comp and FOO[2]	Juniper Manzanita				
Laramie Peak, Wyoming[n]	Merriam's	%Comp[2]	Grass seed Potentilla	Grass seed Grass seed Triticum	Pine seed Grass seed Alfalfa	Pine seed	
South Dakota[o]	Merriam's	%Comp[2]	Green veg. Grass seed Forb seed	Herbaceous foliage Grass seed Forb seed	Grass veg. Grass seeds	Pine seeds Kinnikinnick fruit Kentucky bluegrass	

Table A.1. Continued.

Location	Sub-Species	Measure	Spring	Summer	Autumn	Winter	Annual
North-Central Arizona[p]	Merriam's	%Comp[2]	Juniper Forbs Grass		Grass Juniper Forbs		
Arizona[q]	Merriam's	%Comp[2]		Forbs Grass Juniper			

[*]Percent composition
[**]Frequency of Occurrence
[1]Macroscopic analysis using crop contents
[2]Microhistological analysis using fecal matter
[3]Macroscopic analysis using fecal matter
[4]Macroscopic analysis using gizzard contents
[a]This study, 2007
[b]Litton, 1977
[c]Quiton and Montei, 1977
[d]Beck and Beck, 1955
[e]Dalke et al., 1942. Data was collected in between seasons.
[f]Glover and Bailey, 1949
[g]Meanley, 1955
[h]Kennamer et al., 1980
[i]Tabatabai and Kennedy, 1984
[j]Exum et al., 1987
[k]Laudenslager and Flake, 1987
[m]York and Schemnitz, 2003
[n]Hengel, 1990
[o]Rumble and Anderson, 1996
[p]Wakeling and Rogers, 1996
[q]Wakeling and Rogers, 1998

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