

Box 50

texotics

by charles ramsey



BULLETIN NO. 49
TEXAS PARKS AND WILDLIFE DEPARTMENT

PADRE ISLAND NATIONAL SEASHORE

texotics

330

By
Charles Ramsey
Wildlife Biologist
Texas Parks and Wildlife Department

Illustrations by Nancy McGowan, staff artist
Photographs by staff photographers

History and Management Implications of
Introduced Exotic Artiodactyls
in Texas

A Pittman—Robertson Project W-76-R, Texas

Bulletin No. 49



TEXAS PARKS AND WILDLIFE DEPARTMENT

acknowledgements

Grateful acknowledgment is given H. G. Gore for his assistance in final preparation of the manuscript, and to R. L. West for his contribution during early phases.





FORWORD

The introduction of exotic game animals has gained publicity in recent years. Statements in favor of introductions and those against introductions have appeared in newspapers across the State.

Spurred by the promise of more game, the novelty of exotics, or by the illusion of a get-rich-quick enterprise, many people are inquiring about this class of game animals.

In 1963 a survey was conducted by the Parks and Wildlife Department to determine the status of exotics within the State. The survey revealed that introductions were increasing and that indeed they were of sufficient numbers to be considered more than just a passing novelty.

A program was initiated to determine the biology of major species and what probable impact these animals would have on native game animals. The first step was to determine what was already known and published.

A review of published information was conducted. During the course of the review it became obvious that little life history information was published on most of the introduced exotic species and that the literature was generally unavailable to the landowner and sportsman who needed it most. The purpose of this bulletin is to make the information available to the interested people in the State of Texas.

history

The introduction of foreign or "exotic" animals is certainly not a new idea. Many years ago primitive man began to tame the beasts he had once hunted. Bones of domestic sheep have been found in excavations of human settlements dating as far back as 5,000 B.C. (Walker 1964). As nomadic tribes drove their half-domesticated animals with them in their wanderings, the movement of exotics by man began.

The early animal transplants were hindered by poor transportation. But wherever civilizations flourished, man's interest in animals was evident. Giraffes were captured by the Egyptians as early as 1,500 B.C. and by the Romans during the reign of Julius Caesar. Hannibal crossed the Alps into Italy in 218 B.C. with his legendary war elephants, and reindeer were being domesticated in northern Europe and Asia by 499 A.D.

Although the domestication of animals made man less dependent on his skill as a hunter, the pursuit of wildlife occupied too firm a place in his culture to be supplanted entirely. As dependence upon hunting for survival declined, hunting as a sport emerged. Pictographs of hunting scenes depict the Egyptians to have been keen sportsmen, and the Greeks and Romans were keenly interested in organized hunts.

With the emergence of hunting as a sport for the ruling classes, game preserves were established and the introduction of exotic game animals began. Marco Polo describes, in the narrative of his travels across Asia, a hunting preserve of Kublai Khan during the period 1259-1294 (Leopold 1933). During the height of the Roman Empire, the Romans introduced the fallow deer into England (Crandall 1964). Pere David's deer *Elaphurus davidianus* is known only from the descendants of the herd formerly kept in the Imperial Hunting Park, Peking, China, although it is believed to have originally inhabited the alluvial plains of northern China (Walker 1964).

The movement of exotics was not restricted to any period in history nor was it restricted to any region. Between the years 1779 and 1913, the citizens of New Zealand introduced some 51 species of mammals into their country (Daniel 1962). These releases were motivated by a desire for animals for sport, food, fur, and nostalgic reasons. Approximately 30 species have become established which have no natural predators or other apparent natural controls over their populations. The exotics attained pest proportions, causing extensive damage to protective watershed forests and pasturelands. "The animals now listed as noxious—various species of deer, pigs, wallabies, opossums, goats, chamois, and thar—were introduced mostly for sport, sometimes for food" (Poole 1959).

Early in the nineteenth century the European rabbit was introduced by settlers in Australia and New Zealand for sport and nostalgic reasons. The resulting population explosion in Australia has cost hundreds of millions of dollars over a 90-year period for control measures. New Zealand's bill for rabbit-control work, amounts to more than \$4,000,000 per year (Laycock 1966).

Europe was not the origin of all introductions of animals which became pests. It in turn received some pestiferous exotics. In 1905 muskrats were released in Prague, Czechoslovakia and from thence invaded eastern Germany, Rumania, Yugoslavia, Poland, and eastern Russia. In 1927 or 1928 they were introduced into France and from there spread over much of Europe. In Finland and Russia it became a valuable fur animal. However, "certainly the sums expended on

destruction of muskrats and repairing their damages are much higher than the profits obtained from fur and flesh" (De Vos, Manville and Van Gelder 1956).

From 1890 to about 1910 gray squirrels from North America were imported into England and have since spread over much of the island. They are regarded as pests because of the damage they cause to young beech and maple trees which are cultivated in valuable woodland timber stands (Laycock 1966).

Exotic introductions moved to the New World with the first explorations and settlements by white men. The Spanish explorers and early colonists brought horses, hogs, and cattle with them from Europe. Often these animals escaped and survived in the wild.

The great herds of wild horses that once roamed the American West were descendants of Spanish stock. Early travelers of the 1830's and 1840's in South Texas reported observing great herds of wild horses (Inglis 1964).

Introduction of wild game in America may date back to the 17th Century since there is some evidence that the present red fox of the eastern United States is a direct descendant of the European red fox which was introduced between 1650 and 1750 from England for fox hunting (De Vos, et al 1956). Exotic big game animal releases are recorded for North Carolina, Tennessee, Missouri, Virginia, California, Nebraska, Massachusetts, New York, and Texas. Since early records are obscure these are probably only a portion of the states where releases have been made.

Since its early history, California has acquired 12 species of exotic big game totaling over 4,000 animals (Craighead and Dasmann 1966). Only the wild boar has become widely dispersed and established in the wild.

New Mexico's barbary sheep have been the most publicized free-ranging big game release in the United States. These animals, released in 1950, apparently have become well established in the rough, semi-arid canyons of the Canadian River. However, their status is still under careful scrutiny (Ogren 1965). Future plans of New Mexico call for the release of kudu, gemsbok, and ibex as soon as a sufficient number is produced from zoo stock (Lee unpublished).

As readily seen, man has been moving animals around for many thousands of years and probably will continue to do so. Many of the movements have been beneficial to man. However, most of the beneficial animals moved were domestic animals (groups dependent upon and controlled by man). The percentage of movements of wild animals which could be called beneficial is much smaller than with the domestic animals. In an overwhelming majority of the introductions involving wild animals the animals have either failed to become established or have become pests for various reasons.

Because of the high percentage of failures or detrimental introductions, wildlife biologists, ecologists, and those concerned with the wise use of natural resources have reservations about the introduction of exotics.

Within this professional group there exist differences of opinion. On one extreme are those strongly opposed to any introductions. On the other are those actively seeking animals to introduce in assumed habitat vacancies. Between these two poles lie most of the group. One point of common agreement is that at present there is insufficient knowledge to predict with any degree of certainty how an introduced animal will react in a new habitat. Research to gain the vital ecological information is needed. This is compatible to both extremes. Information is needed not only to prevent a repeat of an undesirable introduction, but to increase the chance of successful introductions. Examples of both are the European carp, an introduced scale fish which has become a pest in fresh waters, and the Chinese ringnecked pheasant, which has achieved the rank of a prized game bird of northern states.

The history of past introductions bespeaks the use of extreme caution in the introduction of animals into a new region.

ecological implications

There is more to the exotics picture in Texas than being able to identify the animals. And, there is more to survival of a wild animal than simply releasing it outside a confinement. Each animal, and in turn each group of animals, reacts to the environment surrounding it. The reaction may be obvious, such as the animal seeking shelter in extremely cold temperatures, but more often it is subtle and difficult to recognize.

The survival of an animal or group of animals is controlled by the environment, which consists of every phenomenon which acts on the animal. Thus the survival of an animal or group can be affected by weather, food supply, predators, disease, parasites, etc. Attempting to unravel and understand this web of relationships of animals to things which act upon the animal is the science of ecology. From the science of ecology have come broad biological principles which may be applied to the management of wildlife.

All animals have similarities and, generally speaking, the closer the relationship, the greater the similarities. Existence of these similarities makes it possible to anticipate that a newly introduced exotic will conform to the basic biological principles in its new environment as do other related animals. This does not mean that animals are all alike—simply that there are characteristics which they have in common.

Living animals and their environment are inseparably interrelated and interact upon each other. Since no animal can exist by itself or without an environment, let us look at some of the principles concerned with this interrelationship of animals to environment and see how this relates to management of exotics.

To survive and thrive in a given situation, an animal must have the essential

materials which are necessary for growth and reproduction. Stated in a negative way, an animal will not do well in an environment that is unfavorable. The basic requirements for survival vary with the species and the situation. However, the essential materials available in amounts most closely approaching the critical minimum needed will tend to be the limiting one. As an example, axis deer apparently have a large water requirement. Therefore, it is not reasonable to expect them to do well on a dry upland without ready access to water, even though there may be ample food and cover.

Not only may too little of something be limiting to the survival of an animal but too much of a quantity may also prove limiting. Sheep require water for survival. However, they do not do well in areas with high moisture conditions because parasites and disease are more abundant.

The failure of an animal to survive and thrive can be controlled by the qualitative or quantitative deficiency or excess of a factor which approaches the limits of tolerance for that animal. Food is necessary to the survival of an animal. Not only must it be available in ample volume but it must be ample in quality. A man can have all of the cucumbers he can eat and yet not be healthy because his diet would be nutritionally deficient. Corn is good feed for sika deer in moderate quantities. However, sika deer that are exceptionally hungry will eat more than their stomach can handle, and die.

The time element is also important in consideration of factors which might limit successful establishment of an exotic. The period of reproduction is usually a critical period when environmental factors are most likely to be limiting. Axis deer, a tropical animal, is relatively tolerant of cold temperatures. However, fawns born during the winter months have poor chances of survival if born in cold weather.

We have looked at some principles which apply to the individual animal and thus have an influence on the population of animals. However, there are some principles which are basic to the group. A pair of animals under ideal conditions can produce a maximum number of offspring. This is termed biotic potential. Seldom is the biotic potential of the group realized because of the influence of the "limiting factors" on individuals. Thus, the rate of increase of a group is something less than the biotic potential of the individual members of the group. The combined effect of limiting factors working on a group might be thought of as the resistance of the environment to the increase in size of the group. When the environmental resistance reaches the point where the group can no longer increase the size, the upper limits or carrying capacity have been reached. On Texas rangelands one of the dominant limiting factors which determine carrying capacity is food supply.

Vegetation, and thus food supply, is influenced by environment. The food supply is also affected by other animals using the same vegetation as food. Competition in varying degrees will exist between large herbivores, domestic livestock or big game, occupying the same rangelands. Animals are selective in what they eat. That is, they do not eat all plants but select certain ones. In competition for food the animals which use the largest number of plant species have the best chance for survival (McMahan 1964).

Each animal lives within a range of conditions suitable to its existence. Animals that are more tolerant to a wider range of conditions have the best chance for survival. Two animals with the same requirements cannot occupy the same environment without competition. There possibly are vacancies where food and cover are not being utilized, but these vacancies are difficult to recognize. It may even be possible to fill some of these vacancies with exotics, but consideration should be given the limiting principles involved. An animal cannot be expected to survive and reproduce under conditions unfavorable to that species or in severe competition with other animals that are better competitors.

legal restrictions

FEDERAL CONTROLS

"The first effort of the United States Government to control release of foreign wildlife came with passage of the Lacey Act in 1900. Section 2 of that act states that 'it shall be unlawful for any person or persons to import into the United States any foreign wild animal or bird except under special permit from the United States Department of Agriculture.' Later changes gave authority for administration of the law to the Secretary of the Interior. Amendments over the years introduced exceptions which have had the effect of weakening the act." (Laycock 1966).

"Federal regulations prevent the direct introduction and release in the United States of big game animals from foreign countries. Such animals can be imported by zoological gardens, or similar institutions, but may not be released from these places. The offspring of these zoo animals can be sold to private game farms or used to stock private or public land, subject to State regulation and agreement of private landowners or public land administrators." (Craighead and Dasmann 1966).

TEXAS CONTROLS

The Texas Legislature in Article 871a, Texas Penal Code of 1925, declared all wild animals, wild birds, and wild fowl within the borders of this State to be the property of the people of this State.

A state officer was created to enforce laws concerning wildlife. Article 906, Texas Penal Code states: "It is hereby made a special duty of the Game, Fish, and Oyster Commissioner (Parks and Wildlife Commission) to enforce the statutes of this State for the protection and preservation of wild game and wild birds."

The Legislature also defined what animals were game animals in Article 892. From 1925 until the last decade all game laws were passed as separate bills introduced into the State Legislature. As a result, a highly complicated group of local laws evolved with adjacent counties or even precincts within a county having different game laws.

This has brought more uniformity within the counties affected by the regulatory responsibility of the Parks and Wildlife Commission, yet there are still several counties which must have separate legislative action for any changes in game laws.

The enabling act, Article 978, states in part: ". The Parks and Wildlife Commission is therefore granted the authority, power, and duty to provide, by proclamation, rule or regulations, from time to time, periods of time when it shall be lawful to take a portion of the **wildlife resources** of said counties, when its investigation and findings of fact disclose there is an ample supply of such wildlife resources, that a portion thereof may be taken which will not threaten depletion or waste of such supply."

Section 15 of the above Article describes the **wildlife resources**. It states: "For the purpose of this Act, the wildlife resources of the counties enumerated in Section 1 hereof are defined to be all game birds and **game animals**, fur-bearing animals of all kinds, fish and other aquatic life, and marine animals of all kinds."

A note was added to Article 978 in 1963 for the Edwards Plateau Counties. It stated: "No authority is hereby granted to the Texas Game and Fish Commission to regulate in any manner the following: barbados sheep, aoudad sheep, and mouflon sheep. . ."

In 1965 Article 892, which defined **game animals**, was rewritten to clarify the status of exotic game introductions. It stated: "wild deer, wild elk, wild antelope, wild desert bighorn sheep, wild black bear, wild gray or cat squirrels, wild fox squirrels or red squirrels, collared peccary or javelina, and the American bison or buffalo are hereby declared to be game animals within the meaning of this Act. However, no species of any of these animals or any other animals is classified as a game animal if it is not indigenous to the State or any part of the State."

This exempted all exotic big game from jurisdiction of game laws or regulatory responsibility of the Parks and Wildlife Department except by special legislative action, such as the section related to aoudad sheep and the notes added for Kendall and Fannin Counties. Article 978j, Section 6 for Fannin County states: "There is no closed season or bag limit for aoudad sheep." Article 978j, Section 1 for Kendall County states: "It shall be unlawful for any person to hunt, take or kill or attempt to kill by any means in Kendall County any axis deer outside of property enclosed by a deer-proof fence."

Aoudad sheep are game animals in Armstrong, Briscoe, Donley, Floyd, Hall, Motley, Randall, and Swisher Counties.

Thus any State regulation of exotic big game introductions is vested in the State Legislature. As of 1967, only the above mentioned articles were State laws concerning exotics. Otherwise, exotic big game animals are in the same legal category as domestic livestock. The only restrictions on intra-state sale and transportation are related to animal disease quarantines.

exotics in texas

Counties having 50 or more exotics

Aransas	Burnet	Kimble	Motley	Stephens
Armstrong	Calhoun	Kinney	Nolan	Sutton
Banders	Dimmit	Kleberg	Palo Pinto	Titus
Bell	Edwards	La Salle	Presidio	Uvalde
Bexar	Floyd	Llano	Randall	Webb
Blanco	Johnson	Live Oak	Real	Willacy
Bosque	Kendall	Mason	Robertson	Williamson
Brewster	Kenedy	Medina	San Saba	Wise
Briscoe	Kerr	Menard	Somervell	Zapata
Brooks				

The exotic game situation in Texas is unique in that more species of animals in greater numbers have been released here than any other place in North America. A Statewide census conducted in 1963 by Parks and Wildlife Department personnel, indicated that Texas had 13 species of exotics totaling some 13,000 animals (Jackson 1964). A revised estimate in 1966, based on personal observations and inquiries, placed the total population near 30,000 with future introductions and steadily increasing numbers quite probable (Ramsey 1968).

The history of introductions in Texas is incomplete due to the lack of records on many of the introductions. Changes in land ownership and the death of persons associated with the early introductions have obscured much of the information. Jackson (1964) in reporting on the recorded dates of introductions stated: "The first known transplants of exotics involved nilgai antelope stocked in 1930. Then came axis, sambar, and sika deer, and blackbuck antelope (1932); fallow deer and aoudad sheep (1950); mouflon sheep (1951); red deer (1958); oryx (1960), and eland (1961). No record was obtained for the first barasingha deer or wild boar releases."

The interest in stocking exotic game has grown rapidly in recent years. Of a sample of 178 transplants reported by Jackson (op. cit.), 36 ranches received exotics for the first time during the period 1930 through 1953. During the period 1954-58, 54 ranches obtained exotics, and during the period 1959-63, 88 ranches were stocked.

The vast majority of these animals are located in the "Hill Country" of the Edwards Plateau. Virtually all of the species are now existing on private lands under high, deer-proof fences. The exceptions to this are the aoudad sheep in the Palo Duro Canyon near Amarillo, a free-ranging herd of axis deer in Bexar, Comal, and Kendall Counties, and concentrations of wild boar in various Edwards Plateau and Rio Grande Plains counties. Frequently animals escape or are released from captivity, thus increasing the possibility of uncontrolled spreading.

Species present and their estimated numbers are shown in Table 1.

Table 1. Species and Numbers Present in Texas

Species	Total Population (Approximate)	Number of Ranches With Animals
Species in Order of Importance		
Axis deer <i>Axis axis</i>	6,450	69 ^{1/}
Blackbuck antelope <i>Antelope cervicapra</i>	4,125	56
Aoudad sheep <i>Ammotragus lervia</i>	1,300	40
Sika deer <i>Cervus nippon</i>	875	22
Fallow deer <i>Dama dama</i>	445	43
Mouflon sheep <i>Ovis sp.</i>	10,000	121 ^{2/}

Species	Total Population (Approximate)	Number of Ranches With Animals
European wild boar <i>Sus scrofa</i>	10,000	100 ^{3/}
Nilgai antelope <i>Boselaphus tragocamelus</i>	4,000	7
Red deer <i>Cervus elaphus</i>	95	15
Sambar deer <i>Cervus unicolor</i>	60	3
Barasingha <i>Cervus duvauceli</i>	40	2
Eland antelope <i>Taurotragus oryx</i>	25	5
Pigmy deer <i>Mazama sp.</i>	25	1
Zebra <i>Eguus sp.</i>	10	3
Sitatunga <i>Tragelaphus spekii</i>	5	2
Giraffe <i>Giraffa camelopardalis</i>	4	1
Sable antelope <i>Hippotragus niger</i>	4	2
White-tailed gnu <i>Connochaetes gnu</i>	5	1
Impala <i>Aepyceros melampus</i>	1	1
Greater kudu <i>Tragelaphus angasi</i>	3	1
Blesbok <i>Damaliscus albifrons</i>	1	1
Gazelle <i>Gazelle sp.</i>	3	1
Oryx <i>Oryx sp.</i>	9	2
Guanaco <i>Lama guanacoe</i>	1	1
Llama <i>Lama peruana</i>	8	2
Thar <i>Hemitragus sp.</i>	4	1

1/ These are herds under high fence and do not include free-ranging animals in Kerr, Bexar, and Kendall Counties or animals in zoos.

2/ This includes the mouflon-barbados-domestic complex of sheep; therefore, the numbers are vastly underestimated.

3/ This is only an estimated number since the wild boar is not confined by fences and reportedly ranges over a large area.

axis deer

Common Name: Axis deer, Chital, Spotted deer
Scientific Name: *Axis axis*



Counties with 50 or more animals

Bandera	Calhoun	Kerr	Robertson
Bexar	Kendall	LaSalle	Real
Blanco	Kenedy	Live Oak	

Counties with less than 50 animals

Aransas	Comal	Kleberg	San Saba	Webb
Bell	Fort Bend	McCulloch	Somervell	Zapata
Brooks	Hood	Medina	Sutton	
Burleson	Jim Hogg	Palo Pinto	Tyler	
Burnet	Johnson	Refugio	Washington	

RECOGNITION

The axis deer is rufous brown profusely dappled with white spots that persist throughout the life of the animal. The spots sometimes form lines on the lower flanks. A dark stripe runs down the back from the mane to the tip of the tail. The abdomen, rump, throat, and the insides of the legs, tail, and ears are white. A black band encircles the muzzle. Adult bucks have a dark brown, swollen neck during the rut. Yearling bucks lack the prominently enlarged neck although their color is sometimes a darker shade than that of does. There is no seasonal difference in the color of the coat, except that during the cool season it is somewhat glossier, darker, and thicker than during the hot season.

The external glands consist of the inter-digital glands between the toes of each hoof, metatarsal glands on the outside of the tarsus below the hock, and pronounced infra-orbital glands anterior to the eyes. The infra-orbital glands may be flared open when the animal is excited.

Axis deer are medium-sized, standing 35 to 38 inches high at the shoulders (Schaller 1967). Body length is 39.4 to 68.8 inches; tail length is 5 to 10.5 inches; shoulder height is 23.6 to 39.4 inches; and weight is usually 120 to 200 pounds (Walker 1964). The field-dressed weight of axis deer killed in Hawaii has a range of 74-170 pounds for bucks and 55-97 pounds for does. Bucks reportedly lose an average of 24 per cent of their live weight in field dressing and does lose 31 per cent. Nichols (1960) reported that statistical analysis of the data from Hawaii indicated that a few bucks may weigh 243 pounds while does rarely will exceed 141 pounds live weight.

Adult bucks carry 3-tined antlers, each composed of a beam forked at the summit and a large brow tine. Large bucks sometimes grow 1 or 2 projections in the angle made by the beam and the brow tine (Schaller 1967). Schaller quoting Dollman and Burlace gave the record antler length, measured on the outside curve, as 39 inches. Nichols (1960) reported antler measurements from Hawaii as follows: beam length range 9.6 - 31.6 inches and circumference about the burr range as 3.5 - 6.5 inches. A series of antlers dropped by male axis deer showed steady increase in size up to the seventh year, a leveling off in the eighth and ninth years and gradual retrogression thereafter (Crandall 1964).

HABITAT

The axis deer was widespread in India, Nepal, and Ceylon. However, the present distribution has been greatly affected by the elimination of its habitat for agricultural purposes. In India the animals are generally found in moist deciduous and dry deciduous forests, and have occupied the evergreen and thorn forests only peripherally. They are essentially inhabitants of secondary forests, broken here and there by glades, with a good understory of grasses, forbs, and tender shoots; but they tend to avoid the interior of the extensive tall forests (Schaller 1967). Schaller gave 4 factors which appear to have limited the axis deer to these vegetative types; need for water, need for shade, avoidance of high rugged terrain, and preference for grass as a forage.

On the island of Lanai, Hawaii, the major range of the deer is semi-desert in aspect. The brushland is relatively open, with pili grass (*Heteropogon contortus*, Tanglehead) being the predominant ground cover, and scattered kiawe trees (*Prosopis chilensis*, Mesquite), klu (*Acacia farnesiana*, Huisache), and haole koa bushes (*Leucaena glauca*, white popinac leadtree). Adjacent to the brush land is a dense forest of large kiawe trees which covers the narrow coastal plain. The largest part of the deer herd is concentrated in and near the dense kiawe forests (Nichols 1960).

FOOD HABITS

In India axis deer eat both grass and browse, but grass provides the bulk of their diet at all seasons (Walker 1964; Crandall 1964). Their favored forage is green grass less than 4 inches high, but when young shoots are unavailable the animals readily nip the blade tips and flowering heads off the tall, coarse grasses (Schaller 1967). Dharmakumarsinhji (1959) reported that monkeys feeding in trees drop leaves and fruit which the deer pick up and eat.

Nichols (1960) in reporting on axis deer in Hawaii, stated that in the dry land habitat of Lanai, mesquite, huisache, and white popinac leadtree furnished 72 per cent of the diet as determined by rumen sample. In the same type habitat of Molokai, mesquite and lantana (*Lantana camara*) furnished 51 per cent. In the wet forest type of both islands, grasses furnished the greater percentage.

REPRODUCTION

In the wild, bucks with hardened antlers and in the rutting condition may be found throughout the year. Likewise, gravid females may be found throughout the year. However, peaks in breeding activity have been noted. Peaks have been reported for different times in various sections of India; in the winter (Prater 1934 quoted in Schaller 1967), in April and May (Brander 1923), and between March and June (Schaller 1967). In Hawaii the main mating season of the introduced free-living axis runs from April to August, and the major birth season from November to March, although some mating and fawning occur during all months (Nichols 1960). At Woburn, England most fawns were born between Christmas and Easter (Whitehead 1950). In the New York Zoological Park 225 fawns were born throughout the year, with the lowest number in December and January (Crandall 1964). In captivity, a series of diestrous cycles, each lasting 3 weeks, is experienced throughout the year (Heape 1901 quoted in Asdell 1964).

Confusion exists in the literature as to the length of the gestation period. Hodgson, Prater, and Shull each stated that the gestation period is 6 months; Brown found it to be 7¼ months, Asdell 7 to 7½ months, and Sclater and Stebbing 8 months (quoted in Schaller 1967). Schaller (1967) indicated a period of 8 to 8½ months. Kenneth (1953 quoted in Crandall 1964) gave 210 days to 238 days. Nichols (1960) observed that a captive doe had a gestation period of 229 days.

A doe usually bears a single fawn (Schaller 1967; Nichols 1960). There were no twins in the 25 births at the Calcutta Zoo, nor were there any in 97 births at the Bombay Zoo (J. Bombay Nat. Hist. Soc., 1960 quoted by Schaller 1967). Of 225 fawns born in the New York Zoological Park only 1 set of twins was recorded (Crandall 1964). However, Brander (1923) and Walker (1964) stated that 1 to 3 is usual, with twins being common.

Schaller (1967) reported that many axis are born between January and March and appear to conceive the following year between March and June when 14 to 17 months old.

BEHAVIOR

Axis deer are gregarious and are usually found in small herds, although under favorable conditions herds of up to 200 animals are possible. Axis deer are reportedly less shy than other Indian deer, often approaching close to human habitation in search of food. Dharmakumarsinhji (1959) reported that their sense of smell is fairly good but their powers of hearing and sight are moderate. However, Nichols (1960) reported that all senses were acute. When a herd flees, it is generally an old doe that leads and the "master buck" follows behind, often separated by a few lengths (Dharmakumarsinhji 1959).

Axis deer are normally diurnal feeders, resting during the heat of the day and becoming active in the morning and late evening. However, when molested they become nocturnal (Walker 1964). In general, axis have two major rest periods, one in the hours before dawn and the other from mid-morning to mid-afternoon. Peaks of feeding occur for about 2 hours after dawn and 1 hour before and after dusk (Schaller 1967).

Axis deer have an affinity for water. In India they visit the water hole twice a day during the hot season, at about sunrise and in the late afternoon (Schaller 1967).

Axis bucks are more peaceable than most deer and usually several will live quietly with the herd. During rutting periods a single mature buck is usually associated with a group of females (Schaller 1967). Non-breeding bucks form additional groups, although the axis bucks make no attempt to collect or retain a number of does, nor do they establish and defend a territory (Schaller 1967). Instead, rutting bucks join several herds in search of a receptive doe. The axis deer is vocal, both male and female. The rutting male bellows, and both sexes have alarm barks.

MANAGEMENT NOTES

Axis deer are hardy but in the New York area require a shelter in severe winter weather and fawns born in winter are less resistant, often failing to survive unless they remain well-bedded in the shelter at least a few days (Crandall 1964).

The change in dominance resulting from bucks coming into rut at different periods of time may occasionally have serious consequences, particularly in a small confinement. A large buck that had lost his antlers could be injured by a smaller buck that had hardened antlers. This would only happen if the large buck was cornered and could not get away.

Axis deer are notoriously difficult to restrain and can be successfully crated for shipment only by exercise of the greatest caution (Crandall 1964).

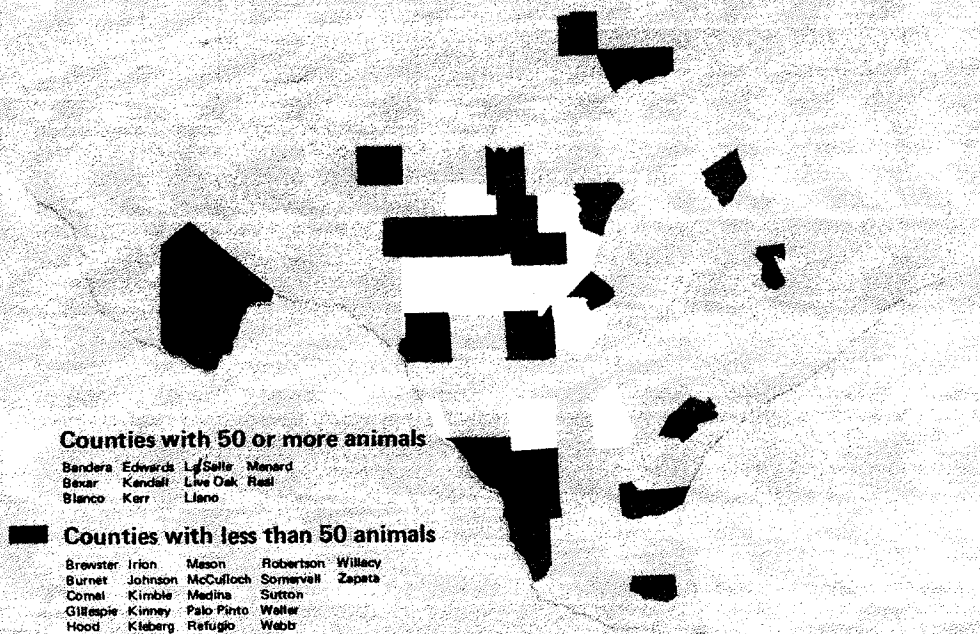
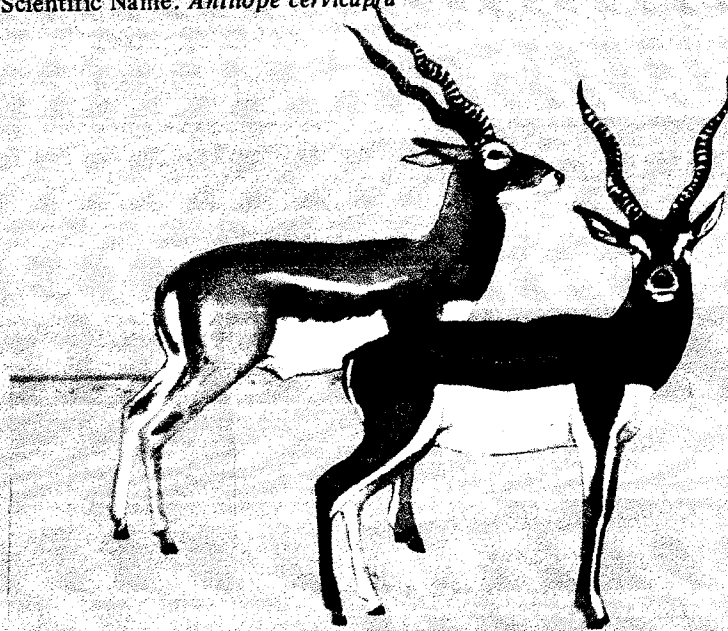
They are somewhat difficult to trap in a box trap because of their habit of feeding as a group. When captured in a wire pen, they may react violently by jumping against the wire, appearing to be bent upon self-destruction.

When badly frightened, they usually break into precipitous flight which frequently takes the form of blind panic, particularly in does and young animals (Nichols 1960). Under such conditions, they may be severely injured when introduced into a new pen by running into the fence.

Axis deer tire rapidly when pursued, and as they become exhausted they seek cover in which to hide.

blackbuck antelope

Common Name: Blackbuck, Indian antelope
Scientific Name: *Antelope cervicapra*



RECOGNITION

The blackbuck is one of the few antelopes in which the coloration of the male differs from that of the female (Walker 1964). The buck is dark brown above, on the sides, and on the outside of the legs. Whereas, the doe is yellowish fawn on the head and back. In both sexes the under parts, insides of the legs, and an area encircling the eyes are white. The brown areas in the males gradually darken with age, finally assuming a shade close to black. Schaller (1967) reported that their pelage had turned quite black by 3 years of age. Crandall (1964) reported much variation in this process, with some animals requiring several years to complete the change while some failed altogether to accomplish it. Schaller (1967) and Lydekker (1913-16) noted a conspicuous change of pelage color during the molt from a black to brown. This was not confirmed by Crandall (1964) in the New York Zoological Park.

The bucks stand 29 to 33 inches high at the shoulder and their total length is 49 to 58 inches (Blanford 1888-91). Twenty-one bucks shot by Meinertzhagen (1939) ranged from 74 to 94 pounds and 2 does weighed 71 and 85 pounds. Crandall (1964) reported a 6-year-old male weighed 92 pounds. Dharmakumarsinhji and Gaikwad (1958) noted that blackbucks became smaller in size from north to south in their range in India. Schaller (1967) also observed this.

Only the males have horns, which are marked with rings and make 3 to 4 complete spirals in adults. Ward (1922) reported the record horn length as 28 and 7/8 inches, but Dharmakumarsinhji and Gaikwad (1958) reported that the record horns are almost 32 inches.

HABITAT

The blackbuck is primarily Indian in distribution, having once occurred from what is now West Pakistan along the foot of the Himalayas from Punjab through Uttar Pradesh and Nepal to West Bengal and East Pakistan, as well as throughout peninsular India, but not in Ceylon (Lydekker 1924).

The blackbuck is an animal of open, flat to slightly undulating terrain, reaching its greatest abundance in areas covered with thorn and dry, deciduous forests. With the destruction of the forest cover, the animals readily adapted to wastelands and cultivation. The species has also penetrated the moist, deciduous forests by following the slash-and-burn cultivators and occupying the ephemeral field and village sites opened up by them (Schaller 1967). Walker (1964) reported that it lives on open plains and avoids hilly and forested areas. Dharmakumarsinhji (1959) reported that it seems to prefer large, salty flatlands or low, undulating, stony hills studded with bushes.

Although the blackbuck probably was once the most abundant wild hoofed animal in India, its preference for open habitats made it highly vulnerable to shooting. As it came into increasing conflict with agriculturalists, it was rapidly exterminated over much of its range. At present no sanctuary harbors a large blackbuck population. A main stronghold of the blackbuck in India appears to be in western Rajasthan, where they are still found sporadically in the isolated semi-desert parts (Schaller 1967). The blackbuck used to range in herds sometimes containing a few thousand, but in modern times a herd of 50 to 100 is considered large (Dharmakumarsinhji 1959).

FOOD HABITS

Walker (1964) reported that short grass, typical of the plains of India, and the various cereal crops are the chief food supply. Blackbuck are almost exclusively

grazers and are generally found in areas of low-growing grasses. They avoid tall grasses, but this is a reflection of their preference for an open habitat rather than their choice of certain grasses as forages (Schaller 1967).

Schaller (1967), Lydekker (1924), and Blanford (1888-91) noted that the blackbuck rarely drank. Dharmakumarsinhji (1959) stated that in hot weather herds come to drink from 9 A.M. to 2 P.M.

A herd forages either widely scattered or as a compact unit, each animal moving along slowly or sometimes remaining for several hours in an area small as 100 feet in diameter (Schaller 1967). In arid areas the herd may move 8 to 12 miles in a feeding foray (Dharmakumarsinhji 1959). During cool weather blackbuck graze intermittently throughout the day, but during hot weather the animals graze during early morning, late afternoon, and at night (Schaller 1967; Dharmakumarsinhji 1959).

REPRODUCTION

According to Lydekker (1924), Prater (1948), and Asdell (1964), mating occurs primarily in February and March. Baldwin (1877) noted that the rut begins in January and February; and Sterndale (1884) found that though most mating is in the spring, some young are born throughout the year, with peaks in March-April and August-October. The second peak had a higher proportion of the females conceive. The 125 blackbuck born in the London Zoo (Jarvis and Morris 1962) and the 97 in the New York Zoological Park (Crandall 1964) showed no seasonal pattern. In England they breed twice a year (Asdell 1964).

Brander (1923) and Lydekker (1924) stated that 1 to 2 fawns are born at a time. Schaller (1967) and Crandall (1964) reported only single fawns. Schaller (1967) reported that 1 fawn per year with females bearing their first young at 2½ to 3 years was observed. He also quoted Taibel in reporting that captive does reach sexual maturity at 6 months of age. However, sexual maturity is often reached earlier in captive animals than wild ones (Hediger 1964).

BEHAVIOR

Blackbuck are gregarious and gather in herds. The composition and social structure of the herds undergo 2 major changes during the year, preceding and succeeding the breeding season (Schaller 1967). During the non-breeding season, herds are loose aggregations of bucks and does. With the approach of breeding season, each mature buck attempts to collect a harem of does. He defends his harem of 3 to 8 does and an associated territory against other males. As a result, 2 types of herds are present during the breeding season: a mature buck and his harem of does and their young, and a herd or herds of bachelor bucks of all age groups.

The buck establishes a "territory" from which any intruding buck is vigorously chased. Fecal deposits at specific locations and secretions from the preorbital glands deposited on grass and bushes serve to mark the territory (Schaller 1967; Dharmakumarsinhji 1959).

Where unmolested the blackbuck are very regular in their habits and behavior, settling down in the same places day after day; but when molested, they become wild, constantly changing their ground (Dharmakumarsinhji 1959). A "territory" is apparently associated with leisure activities. The buck and his harem leave his "territory" on feeding forays and to drink. Blackbuck may graze at any time of the day or night. However in hot weather there is less movement during the hottest hours of the day.

MANAGEMENT NOTES

The blackbuck is hardy and can endure temperatures well below 0 degrees Fahrenheit when provided with an open, unheated shelter (Crandall 1964). However, there is indication that the animal must have access to ample food during the cold period. In the Edwards Plateau many blackbuck died during a subfreezing period when snow remained on the ground for 3 days. Apparently the freezing temperature coupled with the lack of available food caused the deaths. If the animals are fed during such a period, the losses can be significantly reduced. Probably the blackbuck's metabolism is high or its energy reserve is low. However, the animals must be familiar with feed and readily taking it before it is required. Otherwise, they will die before they accept the feed.

Blackbuck can normally be contained by a 4-foot net fence. They are capable of jumping that height, but jumping over an object apparently must be learned and is not natural for them.

Kept in small quarters the blackbuck does well enough, but males so confined are likely to become savage, and breeding is greatly restricted (Crandall 1964).

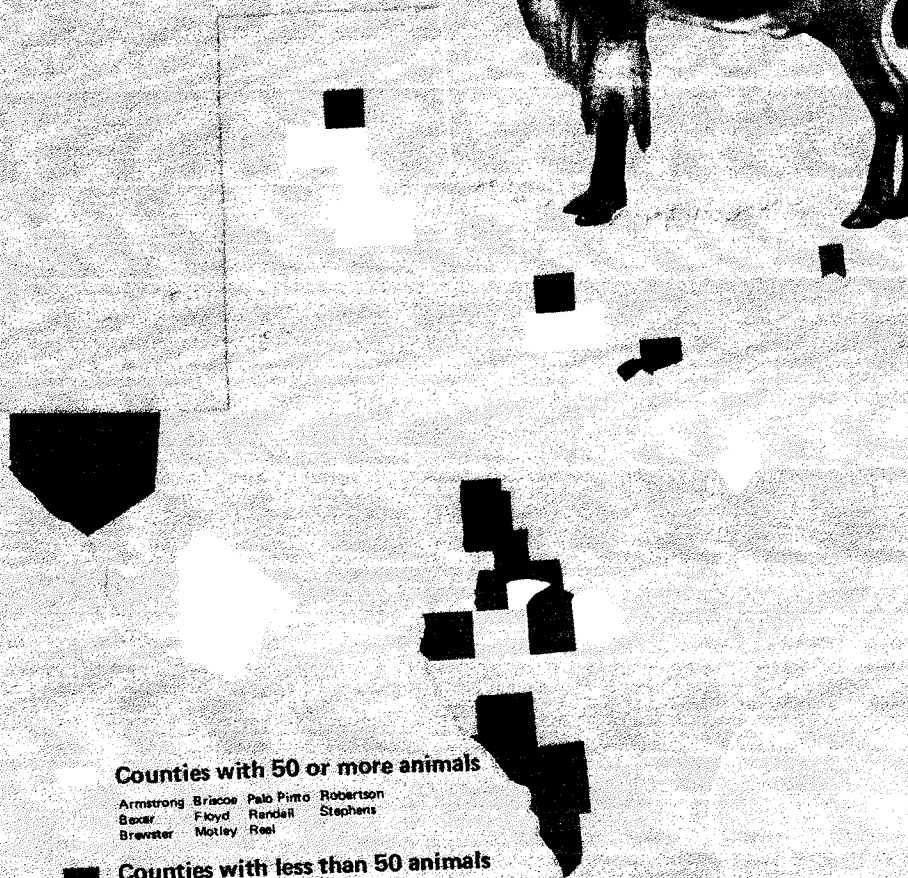
Blackbuck on the range are very difficult to trap. They are wary of anything new within their range, such as traps or fences, and they do not readily accept bait. This proves somewhat of a problem in eliminating excess females without shooting them.

Since blackbuck take several years to turn black, they must be carried a longer time and hence are a greater risk, before they become desirable trophies (Schreiner 1968).

Young bucks are driven from the breeding herd by the mature buck. While young buck usually retreat when approached by the herd male, one that has gained sufficient size and weight will eventually challenge him, usually with fatal results (Crandall 1964).

aoudad sheep

Common Name: Aoudad sheep, Barbary sheep
Scientific Name: *Ammotragus lervia*



Counties with 50 or more animals

Armstrong Bexar Pecos Real
Brewster El Paso Franklin
Garza Kinney Loving Terrell

Counties with less than 50 animals

Bandera Hudspeth Kinney Titus
Cameron Johnson Medina Webb
Culberson Kerr Menard Young
Dimmit Kinble Somervell Zapata

RECOGNITION

The color of the aoudad pelage is rufous or tawny brown with dark brown areas about the head and forequarters. The inside of the ears, the chin, a line on the under parts, and the inside of the legs are whitish in color. There is no recognizable color variation between the sexes or between seasons. Aoudads have a fringe of long hair, called the mane, which begins under the throat and extends down the front of the neck to the brisket. In yearling and mature animals this fringe of hair extends down the forelegs to the knees and is called the leggings or chaps. The mane and chaps are not as well developed on females as they are on males of the same age. The mane on older males may nearly touch the ground even when the head is held upright. A distinctive characteristic is the long, tufted tail which normally reaches the vicinity of the hocks. The suborbital face glands and the foot glands of the true sheep are lacking (Clark 1964). Surrounding the large horizontal pupil of the eye is a brilliant yellow iris.

Measurements taken from aoudads in New Mexico are larger than the type specimens from Africa. The large males from New Mexico measured 44 inches high at the shoulder, 77 inches in body length, and 54 inches around the girth. The females measured about 37 inches at shoulder height, 65 inches in body length, and 55 inches around the girth (Ogren 1965). The specimens from Africa measured from 37 to 39 inches high at the shoulders (Clark 1964). The males, and to a lesser extent the females, are taller in the forequarters than hindquarters. Large males will weigh 320 pounds total weight, whereas the females are somewhat smaller, weighing 140 pounds total weight. The dressed weight of the average mature ram taken in New Mexico was about 175 pounds; an average mature ewe was about 80 pounds (Ogren 1962).

Both sexes have true horns, the males' horns being larger than those of the females. In both sexes the horn tips remain sharp throughout life. The horns sweep outward, backward, and then inward and are rather heavy and wrinkled. Ward (1928 quoted in Clark 1964) gives the best head (from Algeria) as 33½ inches in length around the curve and 13¼ inches base circumference. Horns may reach a tip-to-tip spread of over 30 inches but they never reach a full curl as in native North American bighorn sheep. The horns of the female reach a length of 20 inches (Ogren 1965).

HABITAT

Aoudads are native to northern Africa from the Atlantic Coast to the Red Sea and southward to the Sudan and the north bend of the Niger River. Rough, rocky, barren waterless tracts are their preferred habitats (Walker 1964). The native range of the aoudad has been much reduced due to hunting pressure (Ogren 1965).

In New Mexico aoudads are found in the arid Canadian River gorge where the average rainfall is 16 inches.

FOOD HABITS

In New Mexico on a year round basis, browse averaged 48 per cent, grass 41 per cent, and forbs 9 per cent of the volume of foods consumed by aoudads. In the fall browse averaged 54 per cent of the diet; in the winter grass averaged 86 per cent; in the spring browse averaged 60 per cent, and in the summer browse made up more than 64 per cent (Ogren 1965).

REPRODUCTION

Females become sexually mature at 16 months of age with some earlier exceptions. A male 11 months old was found to be sexually mature although another male 15 months old was not mature (Ogren 1965). They breed throughout the year but the peak in lambing occurs from late March through early May (Ogren 1965). In captivity females are monestrous (Walker 1964). The gestation period is 154-161 days (Asdell 1964). Births in zoos have been recorded throughout the year with a peak in April. Single lambs were common although twins were born about 1 out of 6 births (Asdell 1964; Crandall 1964).

BEHAVIOR

The aoudad is gregarious and generally associates in small family groups consisting of an adult male and female with their offspring of various ages (Walker 1964). They escape detection by remaining motionless rather than leaving whenever danger threatens.

Males frequently stand facing one another 10 to 15 yards apart, then move toward one another until they break into a run shortly before colliding. A male will not attack if the other is off balance or unprepared (Walker 1964). While adult males spar frequently, such encounters are seldom serious, so that several may safely be kept within a confined herd (Crandall 1965).

During breeding periods normal feeding activities of the male are altered by the presence of an ewe in heat. The male or males persist in attempting to gain attention of the female. The ewe determines the time of acceptance and resists the mounting attempts of the male by a jab with the horns (Ogren 1965).

MANAGEMENT NOTES

Aoudad thrive and reproduce in captivity and take prominent position on the list of surplus animals from most zoological gardens (Crandall 1965).

The aoudad is reportedly highly resistant to internal parasites (Crandall 1965). However, if the animals were confined in small enclosures with domestic sheep and goats, parasitism could become a problem.

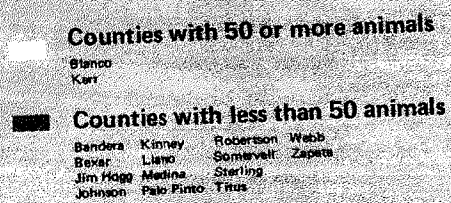
In confinement the "creeps," phosphorous deficiency, seems to be of special importance with the young of this species (Crandall 1965). Adequate phosphorous would need to be provided in the ration or as a supplement.

Aoudads are adept at climbing and jumping. They readily jump a standard 4-foot livestock fence and when pressed can jump a 7-foot fence, although it will normally contain them. When first released in an area, they seek out the roughest topography. If it is to their liking, they will establish themselves there; if not, they may cross numerous fences in search of suitable territory.

Schreiner (1968) reported that 4 to 7 years are required to raise a male to trophy size.

sika deer

Common Name: Sika deer, Japanese deer
Scientific Name: *Cervus nippon*



FOOD HABITS

Sika deer feed on various arborous, bushy, and grassy plants. In summer they prefer grass-like plants, as well as leaves and small shoots of trees and bush plants, but in winter change to branches and twigs. In the Far East of Russia the various basic food plants include diverse species of linden, Mongolian oak, marigold, ash, *Smilax*, and leguminous plants. Toward the end of the summer and fall the sikas mostly eat acorns. In acclimatization areas they take willow, aspen, spindle tree, meadowsweet, clover, vetch, cypress, and others. They seldom eat the plant fully, but tear off individual parts (Flerov 1960).

In New Zealand during the summer when food is abundant, the sika will utilize the browse-tolerant species, especially grasses and herbs. During the winter browse-tolerant species and seedlings are utilized. This exploitation has the effect of conserving area for winter and summer range. Leaf fall contributes substantially to the diet (Kiddie 1962). In the spring the doe's food consists mainly of grass although some forbs are taken (Kiddie 1962).

REPRODUCTION

The rutting season occurs in September and October in New York and Russia (Crandall 1964; Flerov 1960) and in the autumn in Britain (Asdell 1964). In New Zealand the rut also occurs in the autumn, which is April and May because of its location in the southern hemisphere (Kiddie 1962). Estrus lasts several days (Flerov 1960). In the London Zoo births have been observed from April to October, with a peak in June (Asdell 1964). In Russia fawning occurs in May or June (Flerov 1960). In the New York Zoo births have been observed from May to October with the peak in May and June (Crandall 1964).

The average gestation period is given by Kenneth (1953 quoted by Crandall 1964) as 222 to 246 days. Asdell (1964) gives 8 months as the gestation period. Kiddie (1962) gives 30 weeks.

Single sika fawns are common (Flerov 1960). No twins were recorded in 187 births in the New York Zoo (Crandall 1964) and only 5 sets in 108 births were recorded in the London Zoo (Asdell 1964). Kiddie (1962) found no twins in 400 to 500 does which he examined.

Puberty is reached at 16-18 months (Flerov 1960). Hybridization with the red deer has been reported by Kiddie (1962) and Flerov (1960). However, Flerov stated that they are comparatively frequent in the wild, but Kiddie stated that they are rare. Flerov stated that the male red deer drive away the sika males and breed the sika females. Kiddie described the opposite condition; Whitehead (1950) mentioned several cases where sika have crossed with sambar deer and red deer at Woburn Park.

BEHAVIOR

Sika deer are gregarious and during certain periods herds consist of many dozens of animals (Flerov 1960). They are regarded as forest deer, preferring dense undergrowth (Crandall 1964; Flerov 1960). However, they also utilize brush edges and grassy flats at certain times of the year (Kiddie 1962).

Kiddie (1962) reported that in New Zealand during the winter sika are dispersed throughout the forests usually in small family groups. In the spring, as grass begins to grow along the forest edges, sika begin feeding on the grass flats during the hours of darkness, but return to cover before light. Males tend to herd together at this time while does remain in small groups. Prior to giving birth does usually take cover in dense scrubs and will seldom leave until the fawns are capable of running. During the summer sika deer feed in openings outside the

forest, but primarily during the twilight hours. During the autumn before the rut the animals are again dispersed as in the spring. As the rut begins the males take up breeding territories, begin "roaring" and collecting a harem.

A buck's territory is marked by several "territory holes." These holes are dug with the antlers and forelegs to about the same size as those dug by domestic bulls. The buck urinates frequently in these holes and wallows in them thus giving the buck a strong, penetrating odor.

Both males and females are vocal. However, during the rut the males are quite noisy from whence comes the New Zealand expression for the breeding season, the "roar".

MANAGEMENT NOTES

Sika deer are hardy and do well in captivity (Crandall 1964). In the USSR and China they were bred in captivity for their antlers which have a supposed medicinal value. By 1928 there were approximately 5,500 of these "domesticated" deer (Flerov 1960).

Sika deer swim well, sometimes covering a distance of 10-12 kilometers in the sea (Flerov 1960).

Bucks are inclined to be bold or even savage and usually will not tolerate rivals (Crandall 1964).

In confinement both sexes are inclined to accumulate fat, particularly the females, so that diets must be controlled (Crandall 1964).

The venison of the sika deer is reported excellent and fat is distributed throughout the flesh. Bucks remain in fair condition throughout the rut and continue to eat during this period although much less than at other times (Kiddie 1962). The buck reportedly drinks copiously during the rut.

Fallow deer

Common Name: Fallow deer
Scientific Name: *Dama dama*



Counties with 50 or more animals

Blanco Real
Kerr Robertson
Menard San Saba

Counties with less than 50 animals

Bandera	Dallas	Medina	Waller
Bee	Dimmit	McMullen	Washington
Bexar	Johnson	Palo Pinto	Webb
Brooks	Kendall	Somervell	Willbarger
Burleson	Kinney	Starling	Zapata
Burnet	Live Oak	Sutton	Zavala
Carson	Llano	Titus	

RECOGNITION

The coloration of the winter fur is gray or reddish gray, dark on the upper part of the body, and growing lighter towards the lower part. The abdomen is white. On the back the coloration is the darkest of the body, becoming dark posteriorly and gradually changing to black. The tail is white with a rather large, longitudinal, black stripe on the dorsal surface. Dappledness is indistinct in the winter fur. The summer fur is grayish red or red with the distribution of color similar to winter forms. Males and females are exteriorly similar. Fallow deer are very prone to develop different color patterns. Very often albinos are encountered; more rarely melanos. The young are dappled. Bundles of long hair characteristically develop in the sexual region of males and females.

The external glands are rather strongly developed, the preorbitals small, and those between the toes are deep. The metatarsal glands are covered with dense, whitish hair that forms a cushion differing in color from surrounding areas.

Fallow deer are medium-sized, standing from 35.4 to 39.4 inches high at the shoulder (Flerov 1960). Head and body length are from 51.2 to 63 inches; tail length is from 6.3 to 7.2 inches; shoulder height is about 39 inches; and adults weigh from 83 to 176 pounds (Walker 1964). The trunk is elongated, the forelegs somewhat higher than the withers.

The antlers are flattened and palmate with numerous points. Males develop a single unbranched antler the second year, and each succeeding year the antlers are larger and have more points until the fifth or sixth year. The antlers are generally shed in April and new ones are full-grown and free of velvet in August. The front outer curve of the antlers ranges from 25 to 37 inches and the tip-to-tip measurements from 12 to 30 inches (Walker 1964).

HABITAT

The range was originally the Mediterranean region of southern Europe and Asia Minor. Fallow deer have been widely introduced and now are found in the wild state through most parts of western Europe, the western Ukraine, the Baltic countries, Great Britain, and in a few areas in the United States (Walker 1964). It lives in many places in its range in a semi-wild state and is bred in parks in the majority of countries in Europe.

Flerov (1960) reported that plains, non-mountainous, or lightly hilly country with dense, grassy coves and sparse woods, or brushy areas are most characteristic for fallow deer. In mountainous zones they inhabit only places where terrain is flat, but are not found in rocky, high mountain regions. In New Zealand they favor fern, scrub and grassland country, or light forest bordering these, but they normally are not brush inhabiting animals (Davidson 1965).

FOOD HABITS

Flerov (1960) reported that in Russia during the summer fallow deer feed chiefly on grass, in the fall on chestnuts and other nuts, and in the winter on young shoots, dried leaves, bark of trees and bushes, dry grass, mosses, and lichens.

In England grass, young shoots, leaves and bark of trees, chestnuts, acorns, crops, roots, green vegetables, and flowers are all taken (Vasey-Fitzgerald 1946 quoted in Wodzichi 1950).

REPRODUCTION

The rutting season is in September and October in Britain, Russia, and New York (Asdell 1964; Flerov 1960; Crandall 1964), and antlers are shed in April,

May, or June. Fawns are born in June or July. Flerov reported that older does bred first and therefore had their fawns in June while the younger does had fawns in July. Of 200 fawns born in the New York Zoological Park, 158 were recorded in June, 34 in July, 5 in August, and 1 each in September, November, and December (Crandall 1964).

Asdell (1964) and Flerov (1960) reported a gestation period of 8 months while Kenneth (1953 quoted in Crandall 1964) reported a range from 230 to 246 days. They are monestrous (Asdell 1964).

Usually a single fawn is born, rarely twins (Flerov 1960; Asdell 1964). Crandall (1964) reported only 1 set of twins in 158 births. Flerov (1960) reported that the fawn nurses from the doe almost a complete year, but at the age of 1 month the fawns also begin to eat grass.

BEHAVIOR

Domesticated fallow deer are gregarious, but in the wild collect in small herds of females with their young. Most of the time the males make up separate groups (Flerov 1960; Walker 1964). During the rutting season in the fall adult males join the females with their young. The older animals rut before the young ones (Flerov 1960). The bucks gather harems and fight off rivals. The male is vocal and throughout the mating season does a dance-like ritual and bellows in a deep voice (Walker 1964).

Flerov (1960) reported that males become vicious during the rut and fight more frequently than red deer. Crandall (1964) reported that bucks are fairly tolerant of rivals, and if space is adequate several will usually live with the herd with a minimum of fighting.

Fallow deer feed mainly during the morning and evening; although during the winter they feed most of the day (Walker 1964; Flerov 1960).

MANAGEMENT NOTES

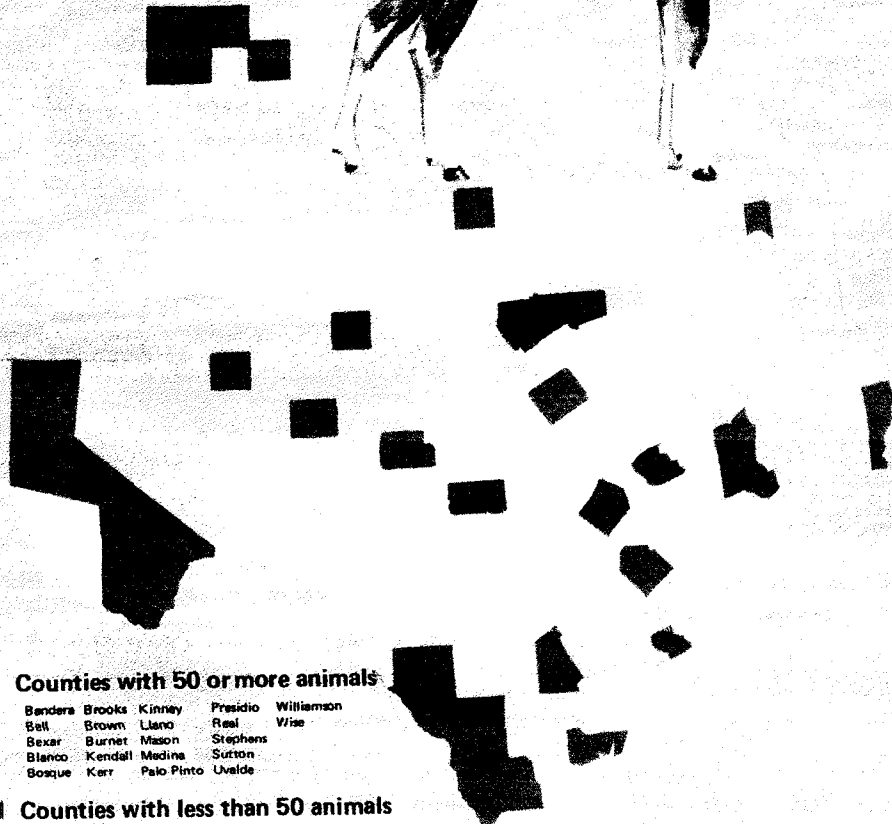
Fallow deer are the deer most commonly kept in captivity. They are hardy, having been kept in captivity for hundreds of years.

Wodzichi (1950) quoting Vasey-Fitzgerald states that fallow deer can wreak immense damage among crops.

Schreiner (1968) reported that 4 to 5 years are required to raise a male to trophy size.

mouflon-barbados sheep

Common Name: Mouflon sheep
Scientific Name: *Ovis* sp.



Counties with 50 or more animals

Bandera	Brooks	Kinney	Presidio	Williamson
Bell	Brown	Llano	Real	Wise
Bexar	Burnet	Mason	Stephens	
Blanco	Kendall	Medina	Sutton	
Bosque	Kerr	Palo Pinto	Uvalde	

Counties with less than 50 animals

Archer	Coryell	Hood	Lavaca	Newton	Webb
Bastrop	Culberson	Irion	Live Oak	Nolan	Zapata
Brewster	Dimmit	Jeff Davis	Menard	Oldham	
Burleson	Erath	Jim Hogg	Midland	Somervell	
Calhoun	Gillespie	Johnson	Montgomery	Titus	
Carson	Hartley	Kleberg	Moore	Walker	

RECOGNITION

The mouflon sheep pelage is an overall color of rich chestnut brown with a black stripe on the flanks limiting the white of the underparts. The lower part of the legs and belly may be a tawny-yellow. The hind neck, throat, chest, and shoulders are blackish and the muzzle is gray or white. In full winter coat, the males carry a heavy throat-ruff of white, tan, and black, and a whitish saddle marking. The rump and short tail are whitish.

The mouflon sheep is among the smallest of the wild sheep. A mature mouflon will stand about 27 inches at the shoulders with total body length of 45 inches. A mature mouflon ram will weigh about 150 pounds and ewes will weigh less.

The males have horns which are rather long, rounded, and slender. The average mature ram will have horns measuring 20-29 inches in length. The longest horn listed by Ward (1922) is 38 $\frac{1}{4}$ inches. An exceptionally good head had 32 inches horn length and 8 $\frac{3}{4}$ inches base circumference. Some horns with a base circumference of nearly 10 inches have been measured. The record on maximum spread of the horn beams was 18 $\frac{1}{4}$ inches from a 9 $\frac{1}{2}$ -year-old ram (Clark 1964). The horns form a rather close curve around the head, the points usually turning outward. In some individuals the points may turn inward and actually reach the sides of the head (Crandall 1964).

HABITAT

The mouflon was once found on Cyprus, through the Grecian Islands to the islands of Corsica and Sardinia. Of its original range, only Corsica and Sardinia have wild mouflons. Those found in Europe today were introductions from these islands. They range in the high, broken mountain tops at an elevation of about 6,000 feet. A thick cover of a type of heather is present, interspersed with grassy glades (Clark 1964).

FOOD HABITS

Grasses, flowers, young plants, and leaves make up the chief part of the diet (Walker 1964). A food habits study of domestic sheep in the Edwards Plateau indicated that the diet consisted primarily of grass. Weeds were heavily used when available and browse was used heaviest when availability of other food decreased (McMahan 1964).

REPRODUCTION

The mouflon is seasonally polyestrous, but in the London Zoo births were spread throughout the year with a marked peak in April. The males are fertile all year (Asdell 1964).

The gestation period is 150-180 days. Twins were produced once in about 10 births with singles being common.

The mouflon sheep will breed with domestic sheep and a fertile offspring is produced. The first generation has a ragged appearance with patches of wool and hair. After a few generations the wool is lost. The barbados sheep, a domestic sheep with reddish-brown hair and black markings, is also present in Texas. It will also breed with domestic wool-producing sheep and, similar to the mouflon-domestic cross, in subsequent generations the woolliness is lost. Also, the mouflon and the barbados will cross, producing an offspring with characteristics of both parents. Because of this ready crossbreeding, Texas has a composite of the 3 sheep with crosses being the most prevalent.

BEHAVIOR

The sheep as a group have excellent eyesight, and are wary and wild. The sheep in Texas vary from tame to wild depending upon how they have been treated. Under a little harassment they become wild, but with feed and gentle handling they become docile.

MANAGEMENT NOTES

The fact that most Texas sheep are crossbred animals does not necessarily detract from their sporting value. They grow desirable horns and the meat is good quality. Huntability ranges from easy to very difficult dependent upon their habitat and treatment.

A management program in which 2 herds are maintained offers some possibilities. A breeding herd of gentle animals can be retained for ease of handling and a herd of wild males can be kept separately for hunting.

The mouflon is capable of jumping a 4-foot fence, although they can usually be contained by a net-wire livestock fence. The mouflon-barbados-domestic crosses are less likely to jump a fence than are mouflons.

europaean wild boar

Common Name: Eurasian wild boar, European wild boar, Russian boar
Scientific Name: *Sus scrofa*



Counties with 50 or more animals

Aransas Kendall
Bandera Kerr
Bexar Medina
Calhoun Real

RECOGNITION

The European wild boar is dark brown, varying to blackish or reddish in coloration. Older animals may appear somewhat grayish. There is no color variation between the sexes and no coat color change between the seasons. The body is covered with stiff, bristlelike hair and usually some finer fur. The body covering is often quite scant and the tail is only lightly covered with short hair. Many individuals have long side whiskers and a mane on the nape. The young are born striped. The wild boar is a medium-sized hog measuring almost 60 inches in body length. A mature animal will stand about 36 inches high at the shoulders. The tail reaches a length of almost 12 inches. Male hogs are larger than females of the same age. The males will weigh from 165 to 440 pounds (Walker 1964).

These hogs have 4 continually growing tusks, 2 in each jaw. The bottom 2 tusks grow upward and outward and come in contact with the upper 2 tusks when the mouth is closed. This causes the lower tusks to remain sharp at the tips.

In Texas the wild boar has crossed with feral domestic breeds. Since domestic breeds were developed from the wild boar, breeding of feral hogs and wild boar is common. Reversion to the appearance of the wild boar occurs in a few generations. However, individuals showing some markings of a domestic breed are frequently encountered.

HABITAT

The wild boar is an Old World species which has been introduced into several regions such as New Guinea, New Zealand, the British Isles, and North America. They generally live under dense cover in forests and woodlands (Walker 1964). They will shelter in tall grass or reeds and in burrows which are self-excavated or are abandoned by other animals. They are fond of mud baths. Individuals construct crude shade-shelters by cutting grass and spreading it over a given area. They crawl under the grass and then raise themselves to lift the grass mat which remains supported by the uncut grass (Walker 1964).

FOOD HABITS

They are omnivorous and eat fungi, leaves, fruits, roots, bulbs, and tubers but also take snails, earthworms, reptiles, young birds, rats, eggs of vertebrates, and carrion (Walker 1964). They are notorious for damaging many cultivated crops. Since the domestic hog was derived from the wild boar it is to be expected that their food habits would be identical to those of free-ranging domestic hogs.

REPRODUCTION

In Russia puberty occurs during the second year. Breeding lasts from November to January and 3 to 5 is the usual litter size, although it may be as high as 10. Gestation lasts 4 months (Asdell 1964). Domestic hogs released by Captain Cook in New Zealand have flourished in a wild state and breed year round, with an average of 6 to 10 to the litter. The males breed at 1 year of age and females at 10 months (Wodzicki 1950). The sow is in heat every 21 days and the duration of heat is 2 to 3 days. Sexual maturity is reached at about 1½ years (Walker 1964) and they are fully grown at 5 or 6 years.

MANAGEMENT NOTES

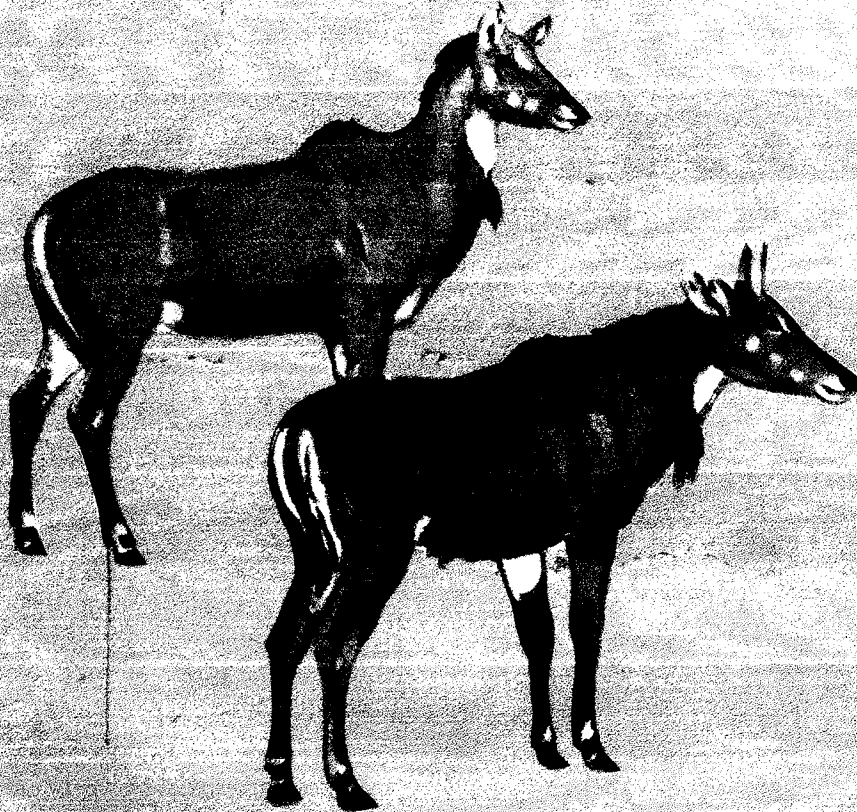
The old boar is an impressive trophy with grizzled appearance and long, sharp tusks, and the young males and sows have excellent meat quality. However, relatively few animals are killed each year by hunters. They are wary and difficult to stalk, and since they are active primarily during darkness they are rarely seen by hunters. Hog hunting is a specialized sport requiring good dogs and active hunters. It is not a leisurely sport. Therefore, it is a game supply which remains relatively untapped.

There is a conflict between wild boars and ranching, particularly in the Edwards Plateau. Hogs can be particularly destructive during lambing or kidding times, killing and eating the young. The hogs are difficult to fence in or out and frequently break through net fences leaving escape openings for livestock. They can be extremely destructive of farm crops.

Feral domestic swine, the descendants of purposely or accidentally liberated animals, have proven to be destructive to both wildlife and crops (De Vos, et al 1956).

nilgai antelope

Common Name: Nilgai antelope or Blue Bull antelope
Scientific Name: *Boselaphus tragocamelus*



Counties with 50 or more animals
Kennedy
Willacy

Counties with less than 50 animals
Blanco
Kleberg
Zapata

RECOGNITION

These animals stand 4½ feet at shoulder, and are somewhat horse like in form. Horns have curved spikes 8-9 inches long and a triangular base. The bull is iron or blue gray in color, with a tufted throat; the cow is hornless and fawn-colored. Both sexes have a mane of stiff hair. The meat is reportedly inferior to most other Indian wild game.

BEHAVIOR

They can be tamed but the males are savage in captivity. Old bulls are often solitary, but parties of 15 to 20 animals are not unusual. They thrive and breed in captivity and are active day or night.

HABITAT

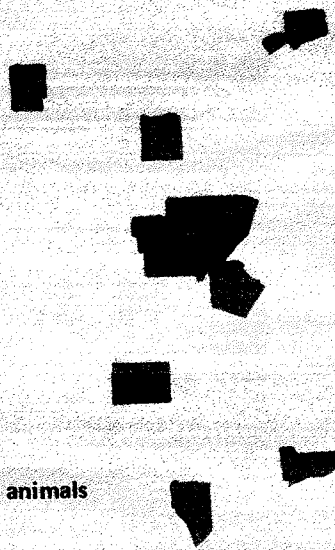
They are native to India and prefer level to undulating ground, usually where thin brush and scattered trees alternate with open grassy plains. Nilgai are rarely encountered in thick forests. In Texas, they are found in the Rio Grande Plains.

FOOD HABITS

Nilgai browse on shrubs and low trees in addition to grazing on low herbage.

red deer

Common Name: Red deer
Scientific Name: *Cervus elaphus*



Counties with less than 50 animals

Borden	Gillespie	Kimbrell	Zapata
Bexar	Johnson	McCulloch	
Blanco	Kendall	Somervell	
Dimmit	Kerr	Starling	

RECOGNITION

Large deer; stag stands about 4 feet at shoulder and weighs from 300 to 560 pounds. They have large antlers, usually with 6 tines per side; antlers with many more tines are not rare; antler length may reach 50 inches. Summer coat is reddish brown; winter coat takes on a grayish tinge. Large pale-buff patch marks the rump and extends along the sides of the tail.

HABITAT

The red deer are found in temperate Asia and Europe, the British Isles, Continental Europe, Asia proper, and the Mediterranean region of North Africa. In Texas they are found in the Edwards Plateau and Rio Grande Plains.

FOOD HABITS

They prefer foliage from deciduous trees; also graze extensively.

REPRODUCTION

The hind gives birth to a single, spotted fawn in spring after a gestation period of 9 months. Apparent crosses with sika deer have been recorded in New Zealand.

BEHAVIOR

These deer are gregarious, run in herds with a hind as leader, and have a warning bark. The stag has a harem during the rut. Their gentle nature makes them the favorite of parks and forest preserves of the Old World.



exotic outlook

From the foregoing chapters of this bulletin, it is evident that not only do we have a large number of exotic animals in Texas, but some are here to stay. Their influence on native game animals in the wild is of utmost importance.

This bulletin is not intended to promote the distribution of exotics in Texas—only to acquaint the reader with the various exotics being propagated and introduced into the State as game animals.

references

- Adam, W. G. 1932. Herd habits of the spotted deer. *Field* 160 (4172):888.
- Anderson, R. M. 1933. Effect of the introduction of exotic animal forms. *Proc. 5th Pac. Sci. Cong.* 1: 769-778.
- Andrews, J. D. 1953. The danger of wildlife introductions. *Garden Gossip*. March.
- Anon. 1950. The distribution of wild deer in Scotland. *Anim. Ecol.* 18(2):187-192.
- Anon. 1951. Deer in Britain. *Nature* 167(4248):509.
- Anon. 1963. Barbary sheep—not in Wyoming we hope. *Wyoming Wildlife*, June, 28-31.
- Asdell, S. A. 1964. Patterns of mammalian reproduction. Second ed. Cornell Univ. Press, Ithaca, New York.
- Baldwin, J. 1877. The large and small game of Bengal and the Northwestern Provinces of India. London.
- Batchelor, C. L. and P. C. Logan, 1963. Assessment of an animal control campaign in the Harper-Avoca catchment. *New Zealand Forest. Res. Notes*. 27 pp.
- Bentley, A. 1957. A brief account of the deer in Australia. *Jour. Wildlife Manage.* 21(2):221-225.
- Blanford, W. 1888-91. The fauna of British India: Mammalia. London.
- Blouch, R. I. 1954. Introductions all around. *Mich. Cons.* 23(3):6-9. May-June.
- Brauder, A. 1923. Wild animals in central India. London.
- Brown, C. 1936. Rearing wild animals in captivity, and gestation periods. *Jour. Mammal.* 17(1):10-13.
- Cahalane, V. H. 1939. Deer of the world. *Natl. Geog. Mag.* 76(4):463-510.
- Cahalane, V. H. 1949. Some effects of exotics on nature. *U. S. D. I. Nat. Park Ser.* pp. 1-14 (Mimeographed).
- Cahalane, V. H. 1949. Some effects of exotics on nature. *Int. Tech. Conf. of the Protection of Nature. U. N. E. S. C. O., Paris, France.* pp. 396-405.
- Caughley, G. 1963. Dispersal rates of several ungulates introduced into New Zealand. *Nature* 200(4903):280-281.
- Christie, A. H. C. and J. R. H. Andrews, 1965. Introduced ungulates in New Zealand (b) Virginia deer. *Tuatara* 13(1):1-8.
- Clark, J. L. 1964. The great arc of the wild sheep. Univ. of Okla. Norman. 247 pp.
- Cottam, C. 1949. The effects of uncontrolled introductions of plants and animals. *Proc. Inter. Tech. Conf. Protec. Nature. U. N. E. S. C. O. Paris, France.* pp. 408-413.
- Craighead, F. C., Jr. and Raymond F. Dasmann, 1966. Exotic big game on public lands. *Bur. Land Manage. memo.* 19 pp.
- Crandall, L. S. 1964. The management of wild mammals in captivity. Univ. Chicago Press, Chicago. 629-711 pp.
- Davidson, M. M. 1965. Changes in wild mammal populations in Canterbury. *New Zealand Forest Serv.* 51 pp.
- Day, A. M. 1948. Introduction of exotic species. *Conv. Inter. Assn., G&F Cons. Comms.* 38:138-144.
- De Vos, A., R. H. Manville, and R. G. Van Gelder, 1956. Introduced mammals and their influence on native biota. *Zoologica* 41(4):163-194.
- Dharmakumarsinhji, K. S. 1959. A field guide to big game census in India. *Indian Board for Wildlife.* 94 pp.
- _____ and Shrimant Fatehsingh Rao Gailwad, 1958. The blackbuck. *Indian Board for Wildlife.* 4 pp.
- Donne, T. E. 1924. The game animals of New Zealand. John Murray, London.
- Elton, Charles. 1959. The ecology of invasions by animals and plants. John Wiley, New York. 191 pp.
- Flerov, K. K. 1960. Fauna of U.S.S.R., Musk deer and deer. *Israel Program for Scientific Translations, Washington, D. C.*
- Flyger, V. 1960. Sika deer on islands in Maryland and Virginia. *Jour. Mammal.* 41(1):140.
- Graf, William. 1963. Exotics and their implication. *Desert Bighorn Council Transactions.*
- Hall, E. R. 1963. Introduction of exotic species of mammals. *Trans. Kans. Acad. of Sci.* 66:516-518.
- Halloran, A. F. and J. A. Howard, 1956. Aransas Refuge wildlife introductions. *Jour. Wildlife Manage.* 20(4):460-461.

- Hediger, H. 1964. Wild animals in captivity. Dover. New York.
- Hibben, Frank C. 1964. The role of exotic animals in game management. Proc. West Ass'n. State Game and Fish Comm.
- Hicks, L. E. 1940. The role of exotics in the Ohio Valley. Trans. 5th N. A. Wildl. Conf. pp. 420-424.
- Hobbs, D. F. 1955. Do newly introduced species present a separate problem? Proc. N. Z. Ecol. Soc. No. 2 pp. 12-14.
- Holloway, J. T. 1950. Deer and the forest of western Southland. New Zealand Jour. of Forest. 6(2):123-137.
- Howard, W. E. 1964. Introduced browsing mammals and habitat stability in New Zealand. Jour. Wildlife Manage. 28(3):421-429.
- . 1965. Control of introduced mammals in New Zealand. New Zealand D. S. I. R. Bull. 45. 96 pp.
- Inglis, J. M. 1964. A history of vegetation on the Rio Grande Plain. Texas Parks and Wildlife Dept. Bull. 45. 122 pp.
- Jackson, A. 1964. Texotics. Texas Game and Fish. April: 7-11.
- Jarvis, C. and Morris, D. (eds.) 1962. The international zoo yearbook. Vol. 111. London.
- Jones, P. 1959. The European wild boar in North Carolina, N.C. Wildlife Resources Comm. 30 pp.
- Kenneth, J. H. 1953. Gestation periods. Commonwealth Agr. Bur. Farnham Royal, Slough, Bucks, England. 39 pp.
- Kiddie, D. G. 1962. The sika deer in New Zealand. New Zealand Forest Service, 35 pp.
- Laycock, G. 1966. The alien animals. Natural History Press, Garden City, New York. 240 pp.
- Lehmann, V. W. 1948. Restocking the King Ranch. Trans. Thirteenth American Wildlife Conf., 236-242.
- Leopold, A. 1933. Game management. Charles Scribner's Sons. New York.
- Letts, G. A. 1964. Feral animals in the Northern Territory. Australian Veterinary Jour. 40:84-88.
- Levi, H. W. 1952. Evaluation of wildlife importations. The Sci. Monthly. 74(6):315-322.
- Linduska, J. P. 1956. Foreign game animals introductions—prospects for the future. 46th Conv. Inter. Assn. Game, Fish and Cons. Comm. pp. 111-116.
- Lydekker, R. 1898. Deer of all lands. London.
- . 1913-16. Catalogue of ungulate mammals in the British Museum. 5 Vol. London.
- . 1924. The game animals of India, Burma, Malaya, and Tibet. London.
- McKnight, Tom. 1964. Feral livestock in Anglo-America. Univ. Calif. Publ. Geog. 61:1-78.
- McMahan, C. A. 1964. Comparative food habits of deer and three classes of livestock. Jour. Wildlife Manage. 28(4):798-808.
- Meinertzhagen, R. 1939. Some weights and Measurements of Large Mammals. Proc. Zool. Soc. London.
- Mochi, Hugo, and T. Donald Carter, 1953. Hoofed Mammals of the World. Clark Schribner's Sons. New York.
- Murie, O. J. 1940. Wildlife Introductions in Alaska. Trans. Fifth American Wildlife Conf. 532-536.
- Nichols, L., Jr. 1960. Ecology of the axis deer. Fed. Aid Project W-S-R Mimeo. reports.
- Ogren, H. A. 1962. Barbary Sheep of New Mexico. New Mexico Dept. of Game and Fish. Bull. 11, 32 pp.
- . 1965. Barbary Sheep. New Mexico Dept. of Game and Fish. Bull. 13, 117 pp.
- Packard, R. L. 1955. Release, dispersal and reproduction of fallow deer in Nebraska. Jour. Mammal, 36:471-473.
- Palmer, T. S. 1908. Decision of the Supreme Court of the United States on the sale of imported game. U.S. Dept. Agric., Bureau Biol. Surv., Circ. 67. 12 pp.
- Pocock, R. I. 1943. The larger deer of British India part IV. The Chital (Axis) and the Hog-deer (Hyelaphus). Jour. Bombay Nat. Hist. Soc. 44(2):169-178.
- Poole, A. L., J. T. Holloway, T. J. McKelvey, R. I. Kean, and I. J. Pohlen. 1959. Browsing animals in protective vegetation. New Zealand Sci. Rev. 17(2):1-21.
- Prater, S. 1948. The book of Indian animals. Bombay Natur. Histor. Soc., Bombay.
- Presnall, C. C. 1958. The present status of exotic mammals in the United States. Jour. Wildl. Mgt. 22(1):45-50.
- Pullar, E. M. 1953. The wild (feral) pigs of Australia; their origin, distribution and economic importance. Mem. Nat. Mus. Melbourne, 18:7-23.

- Ramsey, C. W. 1968. State views of governmental and private programs of introductions of exotic animals. Symposium: Introduction of exotic animals. Texas A&M University, August 27-September 1, 1967. pp. 9-10.
- Ross, John. 1925. The book of the red deer. Simpkin, Marshall, Hamilton, Kent & Co., Ltd. London.
- Roosevelt, T. 1902. The deer family, N. Y.
- Sanders, C. L., Jr. 1963. Habitat preference of the white-tailed deer and several exotic ungulates in south Texas. *Ecol.* 44:803-805.
- Schaller, G. B. 1967. The deer and the tiger. Univ. Chicago Press. Chicago. 370 pp.
- Schreiner, Charles, III. 1968. Uses of exotic animals in a commercial hunting program. Symposium: Introduction of exotic animals. Texas A&M University, August 27-September 1, 1967. pp.13-16.
- Shaw, A. C. 1940. The European wild hog in America. Trans. Fifth N. American Wildlife Conf. 436-441.
- Shirley, E. P. 1867. Some account of English deer parks with notes on the management of deer. London.
- Skiff, J. V. 1948. Is there a place for stocking in game management? Trans. 13th N. S. Wildl. Conf. pp. 215-227.
- Steen, M. O. 1949. Introduction of exotic animals. 39th Conv. Inter. Assn. Game, Fish and Cons. Comms. pp. 42-48.
- Stegeman, L. C. 1938. The European wild boar in the Cherokee National Forest, Tennessee. *Jour. Mammal.* 19:279-290.
- Straub, C. 1966. Where the gnu and the hartebeest play. *Farm Quarterly* 24(4):40-45, 86, 88.
- Taylor, W. L. 1948. The distribution of wild deer in England and Wales. *Jour. Anim. Ecol.* 8(1):6-9, 17(2):151-154.
- Turcek, F. J. 1951. Effects of introduction on low game populations in Czechoslovakia. *Jour. Wildlife Manage.* 15(1):113-114.
- Vinson, C. 1946. Wild "Rooshians" of Tennessee. *Nat. Mag.* 39(8):405-406.
1947. Kentucky's red deer problem. *Nat. Mag.* 40(3):153-154.
- Walker, E. P. 1964. Mammals of the world. John Hopkins Press. Baltimore.
- Ward, R. 1922. Records of big game. London.
- Whitehead, G. K. 1950. Deer and their management in the deer parks of Great Britain and Ireland. London.
- Wodzicki, K. A. 1950. Introduced mammals of New Zealand. New Zealand. D.S.I.R., Bull. 98.