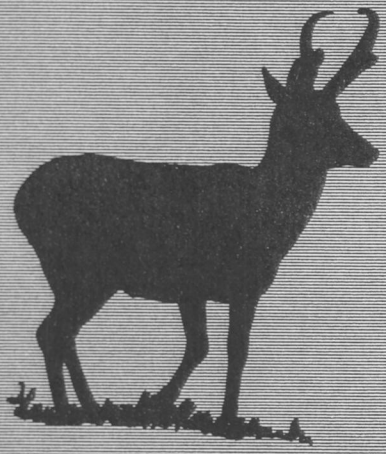
PROCEEDINGS OF THE

FIRST ANNUAL

ANTELOPE STATES WORKSHOP



APRIL 14-15, 1965

SANTA FE, NEW MEXICO

INTRODUCTION

The first meeting of the Antelope States Workshop was held in Santa Fe, New Mexico, April 14 and 15, 1965. Nine western states indicated an interest in supporting a technical session directed at an exchange of ideas and realization of common antelope management problems.

Each participating state contributed a generalized report indicating history, population levels, hunting regulations, harvest, research efforts, management activities, and important problems.

A group discussion was held following each state's presentation. It became evident that certain problems were unique to a particular state, while others were of common interest. Several problems seemed to lend themselves to a unified approach by a group of states directed at management solutions.

It was felt by all representatives that sufficient information was exchanged and interest developed at this first meeting to justify a second Antelope States Workshop to be held in Denver, Colorado in 1966.

The New Mexico Department of Game and Fish would like to thank those organizations who supported the Santa Fe meeting. The Antelope States Workshop invites others interested to participate in the 1966 meeting.

REGISTER

John Russo	Arizona
George Bear	Colorado
Louis Berghofer	New Mexico
Ladd Gordon	New Mexico
William S. Huey	New Mexico
Parry Larsen	New Mexico
Levon Lee	New Mexico
Duncan MacDonald	New Mexico
Tom Moody	New Mexico
Paul Russell	New Mexico
Walter Snyder	New Mexico
Robert Stewart	New Mexico
Richard De Arment	Texas
Tom Haley	Texas
Jack Parsons	Texas
Bill Hepworth	Wyoming
Fred Yeaman	Wyoming
Tommy Moody	New Mexico State University

INVESTIGATION OF PRONGHORN ANTELOPE IN WYOMING

Bill Hepworth

Research on antelope in Wyoming has dealt with many of the aspects of life history, population movements, herd composition, reproduction, mortality factors, food habits; and more recently, the effects of fences, highways, vegetation changes and livestock competition have received attention. Considerable effort has gone into the technique of census, trapping, marking, rearing in captivity, use of drugs to facilitate handling and study of specific deseases.

The height of fawning in Wyoming occurs from the last week of May through the first three weeks of June. The peak in this four-week period varies with the geographical area. Generally the northern herds peak about one week earlier than the southern herds.

Known gestation periods average 252 days with a range of 249 to 255 days. Since these figures were obtained from captive animals maintained in good body condition throughout gestation, it is possible that, under the stress of malnutrition, gestation might be prolonged for as much as 10 days.

Fawn weights at birth vary considerably with the age and condition of the doe, health of the developing fetus and whether it is a multiple or single birth. The smallest newborn fawn weighed at our Sybille Experimental Unit has been 2.3 pounds and the largest 8.5 pounds. The first weight was from an apparent premature birth and this fawn and the twin died. The greatest weight was taken on a female fawn born as a single. Excluding the very low weights, the average seems to be about 7.1 pounds.

The fawns usually begin accompanying the does in numbers by mid-July.

Both male and female antelope have been found to breed when only 16 months of age. No cases of female fawns conceiving have been reported in Wyoming. The height of breeding occurs from September 15 through October 10. Twins are the rule in first pregnancies and have been found to occur in 98 percent of subsequent pregnancies. Single fetuses occur about 1.5 percent of the time and triplets have been found to occur in only 1 of 200 does three years old and older.

The pregnancy rate of wild does 16 months and older has been about 96 percent. The number of corpora lutea of pregnancy found per female was 5.21 and per fetus 2.78.

The number of corpora lutea per pregnant female increased from 3.6 in animals 16 to 24 months of age, to 5.7 in the 27 to 48 month group. The number declined slightly to 5.3 in the animals beyond 4 years of age. This directly reflects the number of fetuses per doe in the various age-groups.

Fawn:doe ratios in July have varied a great deal, but low pregnancy rate has not been found to be a factor. Disease and combinations of inclement weather and disease are believed primarily responsible for low fawn:doe ratios. The average has been found to be about 87:100 with one area showing a low of 15:100. This low was in the Red Desert area between Rawlins and Wamsutter during 1955 to 57 and was attributed, in part, to infection with the bacteria Vibrio fetus.

Longevity in any species is always of interest, particularly as it affects reproduction. In our collections, the oldest jaw ever examined

was from a doe collected in January. Dental wear indicated this animal would have been 10 years old in the spring. The uterus contained one fetus. In most herds, the maximum age of females has not been found to exceed nine years. Because of hunter harvest (hunter selectivity for bucks and preferably, the older larger horned males) few bucks exceeding six years of age have been seen and most are under five years of age.

Food habits studies of antelope in Wyoming have shown this animal to be dependent upon browse, especially during winter. Sagebrush of one species or another and rabbitbrush are the staples in the diet except during periods of spring and summer green-up or when the animals are associated with agricultural areas. In this last case, green alfalfa, grain or lush pasutre grasses may predominate in the diet when they are available. A list of 87 plant species utilized by antelope in Wyoming is here presented. There are, no doubt, others.

Browse

Scientific Name	Common Name
Artemisia tridentata	Big sagebrush
A. cana	Silver Sagebrush
A. frigida	Fringed Sagebrush
A. dracunculus	Green Sagebrush
A. spinescens	Bud Sagebrush
A. tripartita	Three-tip Sagebrush
A. nova X A. tridentata	Blig Sagebrush
Atriplex canescens	Four wing Saltbush
A. confertifolia	Shadscale Saltbush
Purshia tridentata	Bitterbrush

Chrysothamnus nauseosus	Rubber Rabbitbrush
C. vicidiflorus	Douglas Rabbitbrush
Cercocarpus montanus	Mountainmahogany
Sarcobatus vermiculatus	Black Greasewood
Amelanchier alnifolia	Serviceberry
Rosa sp.	Wild Rose
Tetradymis canecens	Grey Horsebrush
Symphoricarpos sp.	Snowberry
Rhus trilobata	Skunkbush Sumac
Opuntia sp.	Pricklypear Cactus
Gutierrezia sp.	Snakeweed
Kochia americana	Summer Cypress
Eurotia lanata	Winterfat

FORBS

Melilotus officinalus	Yellow Sweetclover
Medicago sativa	Alfalfa
Psoralea lanceolata	Lemon Scurfpea
Penstemon sp.	Penstemon
Polygonum aviculare	Prostrate Knotweed
Aplopappus spinulosus	Ironplant Goldenweed
Iva axillaris	Poverty Sumpweed
Astragalus sp.	Milkvetch
A. sp.	Locoweed
Chenopodium sp	Goosefoot
Cordylanthus sp.	Birdbeak
Plantago sp.	Plantain

Rumex sp.	Dock
Euphorbia sp.	Euphobria
Vicia sp.	Vetch
Petalostemon sp.	Prairie Clover
Verbena sp.	Verbena
Stillingia sp.	Stillingia
Ameranthus sp.	Amaranth
Bahia sp.	Bahia
Eriogonum sp.	Eriogonum
Phlox sp.	Phlox
Physalis sp.	Ground cherry
Sidalcea sp.	Checker Mallow
Liatus puntata	Dotted Gayfeather
Lonicera sp.	Honeysuckle
Salsola kali	Russian Thistle
Oenothera sp.	Evening Primrose
Grindelia sp.	Gumweed
Helianthus sp.	Sunflower
Lupinus sp.	Lupine
Ambrosia sp.	Sageweed
Cleome sp.	Spider Flower
Eriophyllum sp.	Eriophyllum
Gaura sp.	Gaura
Lepidium sp.	Pepperweed
Madia sp.	Tarweed
Lomatium sp.	Biscuitroot
Cirsium occidentale	Western Thistle

Potentilla sp.	Cinquefoil
Taraxacum officinale	Dandelion
Amorpha sp.	Amorpha
Aster sp.	Aster
Franseria sp.	Bursage
Lathyrus sp.	Peavine
Castilleja sp.	Indian Paintbrush
Ranunculus sp.	Buttercup
Sedum stenopetalum	Stonecrop

GRASSES, SEDGES, RUSHES

Agropyron spicatus	Bluebunch Wheatgrass
A. smithii	Western Wheatgrass
A. sp.	Wheatgrass
Bouteloua sp.	Grama Grass
Bromus sp.	Brome Grass
Hordeum sp.	Barley
Melica sp.	Onion Grass
Oryzopsis hymenoides	Rice Grass
Poa sp.	Bluegrass
Carex sp.	Sedge
Cyperus sp.	Flatsedge
Eleocharis sp.	Spikesedge
Scirpus sp.	Bulrush
Juncus sp.	Rush

OTHER

Lichen

Body weights of animals have been taken throughout the year on both sexes and several age groups. Whole body weights of mature females reach a maximum just prior to parturition. Whole body weights of males reach a maximum in late August and early September just prior to onset of the rut.

Whole body weights have been found not to be a reliable criterion of condition inasmuch as they can change radically with the fullness of the digestive tract and the condition of the uterus. Hog dressed or clean dressed weights are a good criterion. Normal weights have been established for some age groups and both sexes for part of the year.

ANTELOPE WEIGHTS IN POUNDS

	Male		Female	
Age	Hog Dressed	Clean Dressed	Hog Dressed	Clean Dressed
3 mo.	34	26	33	25
6 mo.	42	34	40	32
1 year	52	42	50	40
13 mo.	72	56	68	53
1½ year	74	58	70	55
2 year	75	59	73	56
27 mo.	78	61	75	57
2½ year	80	64	77	58
39 mo. +	88	70	82	63

Recent studies in the Red Desert area have shown that antelope can endure rather extreme periods of cold even on low levels of nutrition. Weight losses of up to 30 percent were endured by some individual females.

Studies of the diseases and parasites of antelope have been quite extensive. Several diseases are believed important to management of antelope; these include vibriosis (which limits production) and monieziasis (severe tapeworm infestations have resulted in high losses).

Diseases and parasites found in Wyoming antelope include:

Bacteria:	Actinomycosis (Actinomyces bovis)
	Actinobacillosus (Actinobacillus sp.)
	Brucellosis (Brucella abortus)
	Caceous Lymphadenitis (Corynebacterium pyogenes)
	Hepatic necrosis (Corynebacterium pyogenes)
	Pneumonia (Pasteurella multocida)
	Vibriosis (Vibrio fetus)
Viruses:	Vascular Keratitis
Protozoans:	Anaplasmosis (Anaplasma marginale)
	Coccidiosis (Eimeria antelocaprae)
Tapeworms:	(Moniezia expansa)
	(Cysticercus tenuicollis)
Lungworms:	(Protostrongylus macrotis)
Roundworms:	(Cooperia oncophora)
	(Haemonchus contortus)
	(Nematodirella longispiculata)
	(Nematodirus abnormalis)
	(N. filicollis)
	(N. spathiger)
	(Ostertagia (Grosspiculagia) occidentalis)
	(O. (marshallagia) marshalli)
	(O. (Ostertagia) circumcincta)
	(O. (Pseudostertagia) bullosa)
	(Trichostrongylus colubriformis)
	(Trichuris sp.)

Mineral Poisoning: Alkali Disease or Selenium Poisoning

A number of tranquilizing, anesthetizing and narcotizing or immobilizing drugs have been tested on antelope to facilitate handling or capturing of animals. Sucostrin (Succinylcholine chloride) is a successful immobilizer of antelope given at the rate of 14 mg/100 pounds of body weight to adults. Diquel and Vetame, two tranquilizing drugs show promise as means of quieting antelope.

Wyoming was among the first to experiment successfully with mass trapping facilities for transplanting and marking antelope. This state was also a pioneer in developing a method of aerial strip census to count antelope.

At present, the only trapping facilities being used are on a cooperative study with the Bureau of Land Management. Wyoming has supplied antelope to test on various fence types and to determine forage utilization and competition with domestic sheep. Although mass trapping results in some loss, an experienced crew has been known to keep loss and injury under two percent.

Capturing new born fawns for hand raising and to mark and release has been done also to some extent. Colored ear discs and metal ear tags have been used on young fawns. Plastic strap tags have been used in the ears of adults. Returns are very poor and a good marking device for antelope is still being sought.

Use of various dyes has met with some success. Nyanzol "D" Black dye, applied in the fall or winter by aerial spray, was found to show up quite well until spring molt. When antelope molt or shed in the spring the dark patches of shed hair look so much like the dyed hair at a distance that observations must be discontinued. A long-lasting green or fluorescent red dye would certainly be desirable.

A satisfactory means of marking large numbers of animals, preferably on an individual group or individual animal basis is a must to aid in the study of migration and movement.

The effects of various barriers to antelope movement, particularly barriers to the critical movement to winter or summer range and water, are of primary concern at present.

During the early 1950's, some initial work was done to determine the types of fences that antelope could or could not negotiate. Studies are

still in progress today. In southwestern and south central portions of the state, vast areas of public land, under the jurisdiction of the B.L.M. are under consideration for fencing. Many miles of sheep-tight fences have already been installed by this bureau. Two interstate highway systems (Interstate 80 and Interstate 25) are presently being completed. Curtailed movement of some herds appears critical.

Although we realize the safety factor is all important on interstate highways, it may still be possible to have some B.L.M., U.S. Forest Service and private fences built to our specifications.

With this in mind, Wyoming is presently cooperating on a fence study with the B.L.M. So far the study shows that most mature antelope will jump 32-inch fences. Some will jump 36-inch fences and a very few, under stress, will jump 42-inch fences. Cattle guards, both simulated and real, are readily crossed by most adult antelope and some fawns. Dirt ramps built within 10 inches on both sides of a fence and about 14 inches below the top wire are readily jumped by most adult antelope.

The trouble with most of these devices is they fail to permit passage of fawns. In the event fawn movement can not be facilitated in some areas, a great reduction of some herds is foreseen if fences are established. Herds will have to be reduced to a level where a particular range will be adequate for both winter and summer use.

Much work needs to be done both to find fences and/or devices to allow movement, or, in the event none is forthcoming, to determine forage requirements, water requirements and climatic limitations of antelope under specific conditions.

Investigations into the basic ecology of antelope are still lacking and coupled with studies of the effects of fencing, sagebrush spraying, livestock grazing practices and changes in land use, they are facts most needed for future antelope management.

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FRED R. YEAMAN, Wyoming Department of Game and Fish

I have compiled the following paper to attempt to give you people an over-all picture of the antelope situation in Wyoming. This is not a technical paper but will point out some of our antelope problems from the administrative standpoint. Bill Hepworth the Director of our Research Laboratory at the University has been working some on the various phases of antelope research and I am sure you will be interested in hearing his report. Our antelope herds are a very important wildlife resource to our Department and State. We are anticipating more research and intensive management of this species in the future.

HISTORY

The State of Wyoming straddles the Continental watershed and consists of more than 97 and a half square miles of mountain plains, river bottoms and rugged bad lands. Its winters vary a great deal, ranging from very dry to extremely cold each year. The lowest point in Northeastern Wyoming is 3,100 feet above sea level. The highest point is Gannet Peak in the Wind River range which raises to an elevation of 13,785 feet.

As early as 1840 and 1850 Wyoming was noted for its great game populations. Elk, deer, antelope, mountain sheep, moose, buffalo and grizzly bear were common during those years. In 1882 the first game laws passed our territorial Legislature and the contents of those laws restricted any person from killing more animals that he or they could use or dispose of for food. Wyoming attained statehood in 1890. In 1908 antelope in Wyoming were so limited that the Legislature declared a closed season. In 1915 the Legislature re-opened the antelope season in certain counties for the killing of male antelope only. Wyoming's antelope were first censused in 1918, and in that year the population was estimated at 8,387. Our first reported state-wide antelope harvest was in 1929. An estimated 2,558 antelope were killed that year. In 1923 the state's estimated antelope population was 13,895. During 1947 and 1948 antelope management units and areas were established throughout the State. In 1960 Wyoming's antelope population was estimated at 175,000 and we obtained a hunter harvest that year of 31,674. In 1962 we harvested 37,444 antelope. In 1963 the harvest was 35,590, while in 1964 we issued 7,041 less permits and the total harvest dropped to 28,945. A definite decrease in Wyoming's total antelope population has been evident since 1961.

ANTELOPE DISTRIBUTION

After the unit and area system was established in 1947 and 1948 antelope distribution throughout the State showed considerable improvement. In some units and areas it was necessary to liberalize hunting to the taking of two

antelope per hunter, (1951 was the last year we have had a two antelope area) while on the other hand it was necessary to restrict permits in other areas. Our system today is basically the same. We issue a limited number of hunting permits for each unit or area. The number of permits available to residents and non-residents varies by area to better enable the Department to sell all permits allotted for each area. The severe winter storm of 1949 practically eliminated antelope in Southwestern Wyoming and also caused migration and movements of antelope in other areas of the State. We have never recovered the antelope numbers and population which we once maintained in the Red Desert area since the 1949 storm. I believe we lost the biggest percentage of the native antelope to that area and because of present habitat and water conditions have never brought them back to their former numbers.

REPRODUCTION AND POPULATION TRENDS

Herd Classification

Antelope herd classification by unit and area are made in late summer, preferably August, when the fawns are large enough to follow the does and are still small enough to be distinguished. Classifications can be made by both air and ground. One must be careful in selecting good sample areas.

Classification by Hunter Kill

Actual field checks of known antelope kills throughout the season should be made to obtain sex and age information. Analysis of age composition will reflect the extent the herd is being hunted. The value of this technique cannot be over looked as we discover one age group completely missing from the harvest in one particular area unknown to our personnel before the hunting season.

Mortality

This is antelope loss due to causes other than hunter harvest, such as cripple loss, winter loss, diseases, road kills, illegal kills and fences. The effects of these factors vary each year within all management areas and

have to be considered in our over-all program. Mortality losses have been known to vary from five to 30% depending on conditions.

MIGRATIONS AND MOVEMENTS

Wyoming's antelope have different migration and movement patterns. Some of the major problems encountered that must be considered are hunting pressure, winter, fences and water which all effect the normal migrations. In order to define and trace antelope movements, Wyoming has marked antelope by spraying a hair dye by airplane and has ear tagged fawns with some success.

I think you will find it interesting that Wyoming antelope are moving to the higher mountain ranges during the summer months. We are now summering antelope in the Jackson Hole Area and on the south portion of the Big Horn Mountains, where eventually if this migration trend continues, antelope will be in direct competition with other big game animals for summer and winter range. The installation of standard size cattle guards in all fences has helped in the free movements of antelope. Recent studies definitely indicate antelope movements over cattle guards. We have installed cattle guards in sheep tight fences along a number of migration routes to help the free movement of antelope.

The Department has suggested the following type fences to private and public land administrators which we feel less detrimental to antelope movements.

1. A four (4) strand barb wire fence with the bottom wire not less than 16" above the ground and the top not more than 40".
2. A 32" net only fence.
3. A 26" net, 2" off the ground with one (1) barb wire 4" above.
4. The installation of standard size cattle guards in the greatest numbers possible.
5. The construction of dirt ramps or jumping devises in corners of fences have proven beneficial.

From all reports higher fences are not needed to hold livestock and still

allow some movement of antelope.

CENSUS TRENDS

We have the state broken up into five (5) census areas and make a complete count of one (1) area every year. This count is made by airplanes following the strip method and is conducted just prior to each hunting season. It is felt that by continuing pre-season counts we will obtain the most accurate information on hunting season distribution. Other spot counts are made throughout the State when various problems arise. As an example, when a landowner claims he has an over population of antelope on his lands, usually a census will be conducted by one of our personnel and the landowners involved to help resolve the problem.

PREDATION

In my opinion predation has always been a subject for considerable comments among game managers. I personnally feel this has been a factor in antelope management in Wyoming and must be considered. Predators such as eagles, bobcats and coyotes do take a certain percent of antelope in Wyoming each year. Weather and available food supply seems to be the main determining factor. I have actually seen the above predators kill antelope.

HUNTING REGULATIONS

The kill quotas are recommended for each area by our field men including biologists, wardens, and district supervisors. Quotas are presented to the Commission at its May meeting and usually very few if any changes are made by the Commission. Our news media and hunting orders are then released to the public. Applications for non-resident antelope permits are accepted any time after January 1 on a first come first serve basis. Our resident antelope permits go on sale in August and are issued on a first come first serve basis. Resident permit sales are conducted by our field men throughout the State. Of interest is the fact that Wyoming sells more non-resident antelope permits

than resident. The quota allotted is based on past years sales and since our resident antelope hunters have declined, we have had to take up the slack with additional non-residents in order to sell available permits. A resident antelope permits costs $5.00 while the non-resident costs $25.00. The non-resident will be increased to $35.00 in 1966. This includes a landowners coupon of $3.00 for resident and $5.00 for non-resident which is collected by the landowners in the field and forwarded to our Cheyenne office for payment as a reinbursement to the landowners for running antelope on deeded lands. This coupon program costs our Department well over $100,000.00 each year.

We are looking forward to Legislative action to discontinue the landowners coupon redemption. This program has been unsatisfactory to most landowners as some definitely collect more coupons than they are entitled compared to the number of antelope on their deeded lands.

Residents 65 years of age who resided within Wyoming for 30 years are given a free hunting and fishing license which includes an antelope. This free license is causing our management personnel more trouble each year since the demand for free permits is increasing. This group of hunters killed an estimated 2,882 antelope during the 1964 hunting season. The free pioneer antelope license law reads that pioneers may hunt in any antelope area within the State. In some of our small permit areas this has created an over kill of antelope because of the uncontrolled influx of pioneer hunters. We hope to correct this pioneer license management problem through needed Legislative action.

FOOD, COVER AND WATER

As with all wildlife species the subject of food, cover and water plays a key role. Many project studies have been completed along these lines to improve and attempt to hold our own ground. Some of the activity Wyoming has been participating in is evaluating the effects of sagebrush spraying by Federal agencies and private landowners on wildlife. We, not being the agency directly

responsible for administration of the lands, can only make strong recommendations to the land agency involved. This sometimes goes to the extreme where public pressures are solicited to better stress our views. Sagebrush is a very important food for antelope especially during the winter months. The competition between sheep and antelope on summer and winter ranges is an important problem in Wyoming and we feel we have made considerable progress by working closely with all agencies involved. Memorandums of understanding and communication between the various agencies has contributed to better understanding of this problem.

Fencing of public and private lands as well as inter-state highways has caused many problems with antelope management and is another important factor that has to be considered. Access to several popular hunting areas has been eliminated by the construction of fences along State and Federal highways. Fencing studies are continuing to determine what type fence will hold livestock and still allows the free movement of antelope.

WATER DEVELOPMENT

As we continue to receive and analyze factors which involve antelope movements, I feel more emphasis must be put on the availability of water. In some Wyoming areas where rain fall has been unusually light and water facilities limited, actual field reports indicate these factors have an adverse effect on our fawn crop. We started into a guzzler program last year in cooperation with the BLM and from all reports this program has been beneficial to antelope and sage grouse as well as other forms of wildlife. We plan to continue and expand this program.

HUNTING SEASONS

Most of Wyoming's antelope hunting seasons open about the middle of September and continue from 10 to 40 days. We prefer to stagger some opening hunting dates because of lack of cold storage facilities to accomodate a large

influx of successful hunters. A couple of other factors that effect hunting seasons are: safety factor in hunter distribution throughout the area and setting seasons to enable us to have an adequate number of enforcement personnel available to control the hunt.

TRAPPING AND TRANSPLANTING

Some trapping and transplanting of antelope has been done in Wyoming but only to a limited extent and to obtain desired antelope for study and research. We have exchanged antelope with other States for other wildlife. If such a program is anticipated, I would suggest your plans be worked out to enable you to work with new born fawns rather than older animals.

HARVEST

Each year a questionnaire hunter harvest survey is conducted to determine our annual antelope harvest. This survey is conducted by means of a card sent to a random sample of resident and non-residents and pioneer license holders. The procedure for allocating the sample is as follows:

A 40% sample in areas with less than 200 permits.
A 20% sample in areas with 300 to 1,200 permits.
A 10% sample in areas with over 1,200 permits.
A 20% sample of pioneer license holders.

Antelope hunters names and address are obtained from duplicate permit books at our Cheyenne office and forwarded to the University of Wyoming, Statistical Department to complete the survey. All non-resident antelope permits are sold from the Cheyenne office. Information obtained from this survey is as follows:

1. Resident and non-resident ratio for antelope kill by area.
2. The combined resident and non-resident success ratio for antelope kill by area.
3. The ratio of kill by age for state-wide antelope hunting. ADULTS TO FAWNS
4. A ratio of kill by sex for state-wide antelope hunting.
5. The total data compared on the past five (5) years.
6. The ratio kill for adults for all areas.
7. The ratio of male kill to total by areas.
8. The breakdown by counties on pioneer license holders who hunted.

The average success ratio for antelope hunters in Wyoming is about 85%

for resident and about 92% for non-residents, about 44% for pioneers and an overall success of about 88% exclusive of pioneers.

The estimated ratio male kill to total antelope harvest will average in the high 70's. This indicates we are killing mostly male animals and all areas are open to "either sex" hunting. What is happening to the large carry over of female antelope each year? I have a sample of the 1964 questionnaire card and harvest report available for your review.

Some of the unknown factors I feel that are affecting antelope management in Wyoming are:

1. Census error because of various terrain and weather conditions.
2. Crippling loss consists of mainly does and fawns and is greater than generally anticipated.
3. An increase in free pioneer and military licenses sales.
4. The effects of all fencing.
5. The effects of sagebrush spraying.
6. A variation of fawn survival.

We have directed our program toward accumulating more facts on the above subjects. Studies are now being conducted to better evaluate their effects on antelope.

ANTELOPE MANAGEMENT IN SOUTH DAKOTA

Prepared by: Game Division*

South Dakota Department of Game, Fish and Parks

Historical

It is estimated that prior to 1800, over 700,000 Pronghorns ranged the prairies of South Dakota. In 1841 Maximillean recorded antelope as wintering west of the Missouri River along the Cheyenne River and during the spring they would swim the river to summer in the Coteau des Prairie. In 1879 the Yankton Daily Press and Dakotian noted antelope to be abundant on the prairies east of the James River.

By 1909, antelope were considered extinct east of the Missouri River except for an occasional animal that drifted across the river near the mouth of the Cheyenne.

On January 17, 1911, South Dakota House Bill No. 7 was passed making it unlawful to hunt, shoot at, kill, wound, or capture any antelope. This was an emergency law passed to save the antelope from complete extermination. Prior to the passage of this law, it was legal to take five (5) antelope per year.

Since Seton, Grinnell, and other authorities recorded the historical abundance of antelope as exceeding or equaling the buffalo, it is difficult to believe market hunters and settlers could decimate so great a herd of these elusive animals in such a short period of time. It is possible other factors may have influenced this decline in numbers. In 1873, J. H. Allen reported a fatal epizootic had devastated antelope between the Yellowstone and the Missouri Rivers killing an estimated 75 to 90 percent. Other early

(*) Credit for the basic research, technique development, and management programs is due to the efforts of former Game Biologist, Wendell Bever, who is now Director of the Oklahoma Conservation Department.

records reported heavy losses occurred during a severe blizzard in 1893. It has been noted that the mobility of antelope was partially dependent upon the snow trampling of buffalo which provided lanes of travel and food during severe storms. Thus the slaughter of the buffalo could be partly responsible for the rapid decline in antelope numbers.

The first authoritative estimate of the antelope numbers within the state was made in 1924 by Edward W. Nelson, Chief, Bureau of Biological Survey. His estimate placed the antelope population at 680 animals scattered in eleven bands in twelve western counties of the state. (See Figure 1).

In spite of House Bill No. 7 and the creation of an Antelope Preserve in Harding County on January 3, 1921, pronghorns failed to show any appreciable increase in numbers until the late thirties due to poaching, predation, blizzards and diseases. It was not until 1937 that better law enforcement, and perhaps predator control resulted in the first appreciable increase in antelope numbers.

Prior to 1940 antelope numbers in South Dakota were estimated from casual observations of ranchers, sportsmen and other interested parties and by roadside counts of State Game Wardens. At that time these estimates were considered satisfactory since the population was still quite small and management was simply a matter of law enforcement and predator control. However, by 1941 the population was thought to be great enough to afford a limited season. Funds were set aside for a count of antelope in Harding and Butte Counties in 1941. The final tally for that year showed approximately 10,000 antelope in the counties censused and 1000 antelope were estimated to occur in other west river counties giving a total of 11,000 antelope for the state.

In 1924 there were 680 antelope in isolated bands in 12 western counties. Today antelope occur in all 23 west river counties and transplants have been released in seven east river counties. Present statewide Pronghorn population is estimated at 28,000 with 26,000 to 27,000 under intensive management. (See Figure 2). The center of abundance has changed very little since 1924. Harding, Butte, Perkins, and Meade counties contain three-fourths of the total pronghorns in the state. Of the eastern South Dakota releases, all are in marginal range and only the McPherson County plant is believed capable of carrying a huntable population. Lack of sufficient acreage of native rangeland, preponderance of cropland acreage, small pastures with hog-tight and sheep-tight fences, and the generally closely utilized grassland leaves little opportunity for restocking success as has been experienced west of the Missouri River. Deep winter snow accumulation is normal in the Coteau des Prairie of northeastern South Dakota. In 1942 the Department of Game, Fish and Parks issued 500 permits for the first antelope season in 32 years. Table 1 shows the population from areas censused, the number of hunting licenses sold and the projected harvest.

Population and Census

With hunting seasons, accurate census and population data became necessary. Following WW II, a Big Game Research Project was organized (W-12-R). Census methods were tested and evaluated by Wendell Bever. The same system has been used in South Dakota since 1951. Two basic aerial surveys are used, (1) an early summer (May-June) Buck-Doe ratio flight and (2) a late June-early July Doe:Kid ratio check on reproduction.

The first flight is usually begun May 10-15 after the range has begun to green-up. Winter dispersal has occurred and summer distribution finds the pronghorns evenly spread over the prairie. A 33 1/3 percent sampling system is used in the main range. Mid-lines of the transects are 1½ miles apart. Scanning distance is ¼ mile on each side of the aircraft or a total of ½ mile. One-fourth mile is about the maximum distance at which an antelope can be identified as to sex. Altitude of flight is governed by the terrain. Low altitude is desirable but sufficient height is maintained to observe the bottom of drainages. If the population is at least ½ antelope per section, the 33 1/3 percent sample will give no more than 10 percent error.

To remain within the 10 percent error, a number of other influencing factors must be taken into account:

1. Duration of flight periods must not exceed 2 hours.
2. Flights cannot be conducted in rain or fog.
3. Flying speed should be about 65-75 MPH.
4. A 2-3 hour mid-day rest and a good night's sleep are very important.
5. On cloudless days, transects should be flown in a North-South direction.
6. The observer must be proficient at estimating ¼ mile, sexing antelope and have an honest pencil.

The doe:kid ratio flight is conducted as a separate survey in all except one unit. The buck:doe ratio flight is begun prior to the kid drop. Less time is consumed by waiting until the majority of the kids are a month or so old, before a check on reproductive success is made. Productivity is fairly constant and a 10 percent spot check has proven to be adequate. Does are located, and the area surrounding them is circled repeatedly until all

the kids stand up and are readily tallied. This is repeated until an adequate sample is obtained. In the main pronghorn range the doe:kid ratio averages at least 100 doe:100 kids, often reaching 100:115 or 100:130. In the lower density range to the east the ratio grades off to 100:80, 100:60, and down to 100:40. The statewide ratio averages 100 doe:105 kids. Higher productivity occurs in alternate years. Apparently this is a function of the relative number of non-breeding yearlings in the population.

Harvest surveys are basically limited to the post card return which is part of the tag issued with the license. Special studies are periodically conducted, such as crippling loss, parasite incidence, and-so-forth.

Hunter success averages 90 percent, year in and year out. Crippling loss has been reduced through I&E efforts on improved hunting methods and increased popularity of flat-shooting scope sighted rifles.

Harvest Levels

Over the years an arbitrary carrying capacity has been established for each hunting unit. This is based on rancher tolerance of antelope. With scattered farming and alfalfa hay land, the rancher tolerance for antelope is below the range carrying capacity for antelope. About 3 per section over a large area (200-300 square miles) is the maximum density landowners will tolerate. Without farming and fences the range could carry 20 antelope per section. Hunting Unit harvest quotas are set to reduce, increase, or stabilize the population. A harvest of about 25 percent will usually stabilize. The 25 percent figure includes normal crippling and winter losses.

Hunting units in the past have been on well defined boundaries such as major rivers or roads. Occasionally an ill-defined county line has been used. By law, permits are restricted to residents of the State and must be issued out of the Pierre Office. This is done in advance either on a "first come-first serve" basis or a drawing if the number of applicants is expected to exceed the number of licenses available. The former method is the simplest.

A metal locking seal, tag, report card, stamp (to be posted on the basic hunting license) and regulations are mailed to the successful applicants. Unsuccessful applicants get their money back.

Seasons usually open on a Saturday and are at least 9 days in length. This includes two weekends in case of inclement weather the first weekend. Of the successful hunters, 70 percent of the hunters normally fill the first 2 days, 15 percent during the next 5 week days and 15 percent during the last weekend.

An archery season usually preceeds and follows the gun season, 30 days in each. There is no limit on the number of archery permits. An archery license is good in any area open to antelope hunting during the gun season. Archery success is low and the archery antelope hunters are few in number.

Hunting hours are from ½ hour before sunrise to ½ hour after sunset. In other words, whenever it is light enough to see. Shooting can be done from a vehicle, but it is discouraged, as is flock shooting. Greater satisfaction and recreational value is derived from stalking. This is encouraged.

Enforcement

No serious enforcement problems exist with regard to hunting seasons. There are certain standard complaints from landowners, such as:

1. Failure to get permission to hunt.

2. Driving and chasing antelope with vehicles, particularly on winter pasture and on hay meadows when ground is soft and wet.

3. Cripples left in the field and young animals gutted out and left in the field.

4. Occasionally a report of fences being cut.

5. Livestock occasionally found dead which is automatically blamed on hunters. Usually (but not always) dead from some other cause.

Most of the above are really educational problems rather than enforcement problems. With the exception of Number 3, the above are civil law or trespass violation rather than game law violations. In these cases the landowner must sign a complaint. Most landowners are too soft hearted and after they have cooled off, they won't sign a complaint. Basically, the landowners want someone else to patrol and enforce their "No Hunting" signs.

Some enforcement problems do exist from time to time when transient labor or construction crews pull into the sparsely settled areas. Oil drilling crews, missile construction crews, uranium miners, and highway construction crews in the past have made a mark on a local basis. The enforcement is more difficult with the common usage of commercial 2-way radios. Also, these people do not make any special effort to hunt, it is done along with their regular work. Actually, this is more of a problem with deer than with antelope.

Past Research

The census techniques have already been mentioned. Other work is listed below:

1. Food preference from paunch collections throughout the year.

2. Range utilization studies in a 15 section antelope tight fenced enclosure. This was to determine the potential stocking rate of the range.

3. Sheep-Pronghorn parasite relations. This was prompted by lamb and kid losses due to stomach worms. Prior to the completion of this project, the use of phenathiozine salt blocks and abandonment of close herding temporarily cured the problem.

4. Productivity studies from hunting season kills. Basically, this was to determine if yearling does have young (none were found to do so).

5. Several crippling loss studies have been run on a spot check basis. Crippling appears to have decreased to about 10 percent.

6. Work has been done on; crop damage studies, land use trends (with main emphasis on farming), trends in sheep tight fences, intestinal parasite loads, and movement as affected by weather. Most of this is trend information.

7. A kid tagging project to later collect known aged jaws was a failure. No jaws were ever returned.

Interviews of hunters in the field has shown that:

1. Many hunters cannot age or sex an antelope.

2. Hunters with scope sighted rifles kill about 8 percent more bucks than hunters with iron sights.

3. Hunters with scoped rifles average 4 shots to kill an antelope while iron sighted rifle hunters average 13 shots to kill an antelope. This latter group undoubtedly contributes significantly to the crippling loss.

Due to increasing and more varied work load no time is presently available for research work on antelope. Budget restrictions also enter into the picture.

Without new knowledge we feel we are slipping backwards in our management ability. There is no stationary point - either progress or regression.

Management Problems

South Dakota resident hunters are capable of absorbing all the licenses we have to offer. On an average the number of pronghorn licenses are less than one-half of the number of our resident deer hunters. This is not a problem.

Some minor refinements in the hunting season design are needed to secure a better harvest from the cropland areas that are perennial complaint areas.

Hunting seasons probably should be increased in length to obtain a better distribution of hunters with respect to time. Opening day concentrations of hunters often detracts from the recreational value of the hunt and makes it a competative sport.

Concentrations of hunters are often greater than the landowners can handle and maintain order. Most landowners are hunters themselves and appreciate the recreational value of the hunt.

Habitat improvement on wintering areas is needed and will become more important in the near future. Desirable browse plant density and distribution has been decreasing, due principally to the stocking rate of domestic livestock. Coupled with this is the economic pinch on the landowners created by increasing taxes and operating costs and the lower tolerance for pronghorns.

For the past dozen years we have had mild open winters. A long cold winter with deep snow over a large area would severely deplete the Pronghorn population and also drastically lower the landowner tolerance for antelope. These conditions did occur this past winter in a narrow belt along the North Dakota and Montana lines. Pronghorns moved out of the deep snow area and concentrated in historical winter range, which now contains more alfalfa stacks than previously. Cold weather which began on November 13, 1964 did not let up until the end of March, 1965. This stress will undoubtedly show up in a lowered kid crop, as was suspected of happening in 1945 and 1949.

Interstate movement has long been a complicating factor. Summer movement is primarily from west to east as the range drys up. Movement usually occurs but occasionally does not. In the southwest corner of the State (Fall River County) the antelope move east from Wyoming. If very dry

the pronghorn move on into Nebraska. This unit is censused last, just prior to the season setting in July. The buck:doe:kid counts are taken simultaneously.

North of the Black Hills in Butte County near the junction of the Wyoming-Montana-South Dakota borders, a large movement also takes place. This is excellent winter range and usually supports a large influx of antelope from the west from June to October. This shows up on the population figures in Table 1 for the late 1940's.

Some movement occurs on the South Dakota-North Dakota border but the density of antelope is much lower. This is more extensively wheat farming country. Complaints are not uncommon but actual damage is negligible.

Table 1. Trend in Antelope Population, Hunting Licenses Sold and Hunter Harvest

Year	Population in Area Censused	No. Licenses Sold	No. Pronghorns Killed
1941	10,000	500	480
1942	Questionable		
1943	7,973	1,000	976
1944	5,370	500	480
1945	6,721	Closed	
1946	9,442	700	609
1947	14,800	2,000	1,875
1948	13,000	2,549	2,371
1949	7,425	Closed	
1950	10,920	850	759
1951	14,356	3,350	3,151
1952	16,608	8,350	7,880
1953	15,090	5,244	4,750
1954	16,756	5,700	5,196
1955	16,664	4,850	4,281
1956	19,374	6,266	5,616
1957	16,885	4,415	3,885
1958	16,235	3,300	2,900
1959	20,272	5,569	4,950
1960	23,330	6,708	6,037
1961	27,480	8,596	7,990
1962	26,382	6,991	6,152
1963	27,658	8,090	7,280
1964	24,566	7,470	6,050

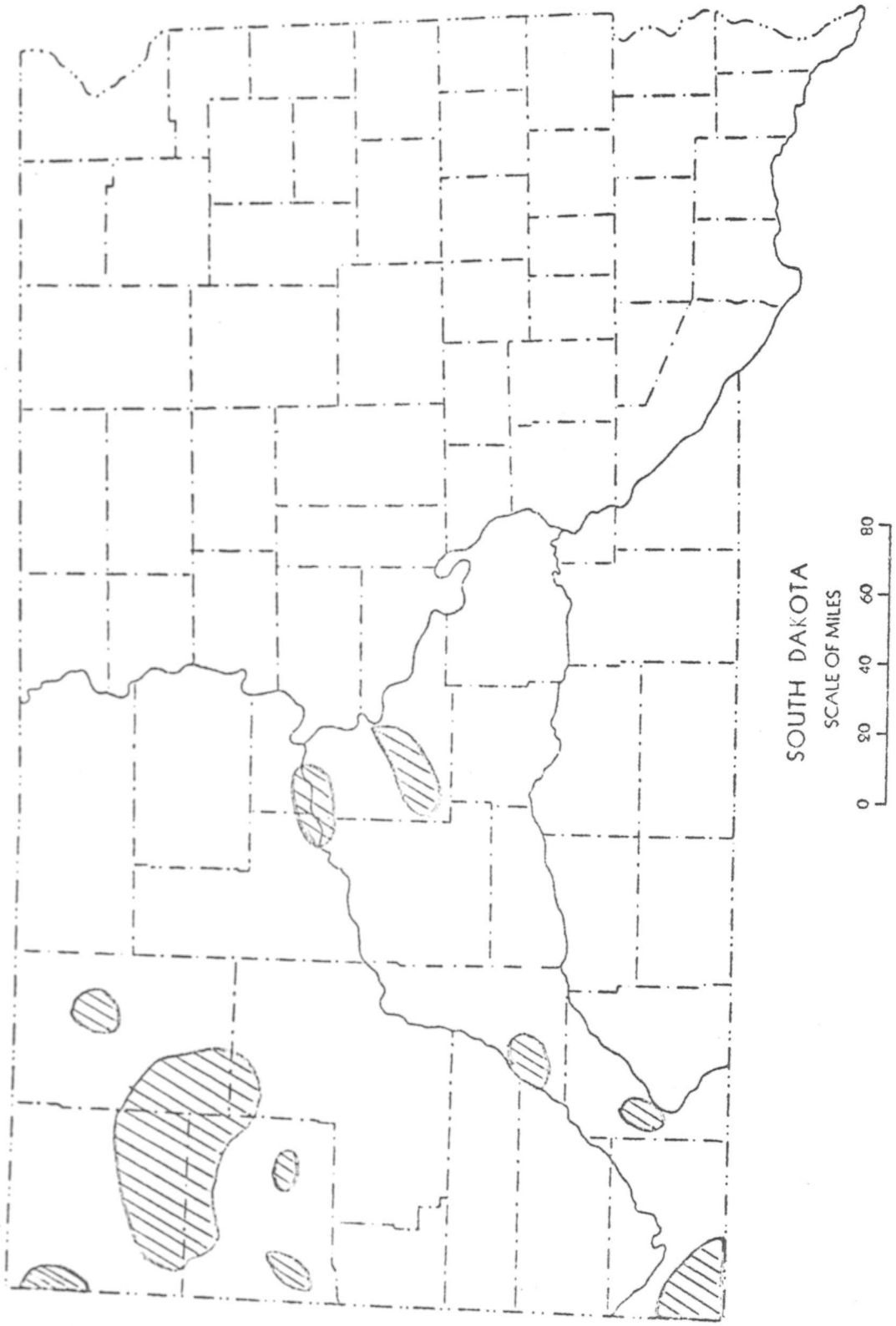


Figure 1. DISTRIBUTION OF PRONGHORNS IN SOUTH DAKOTA, 1924.

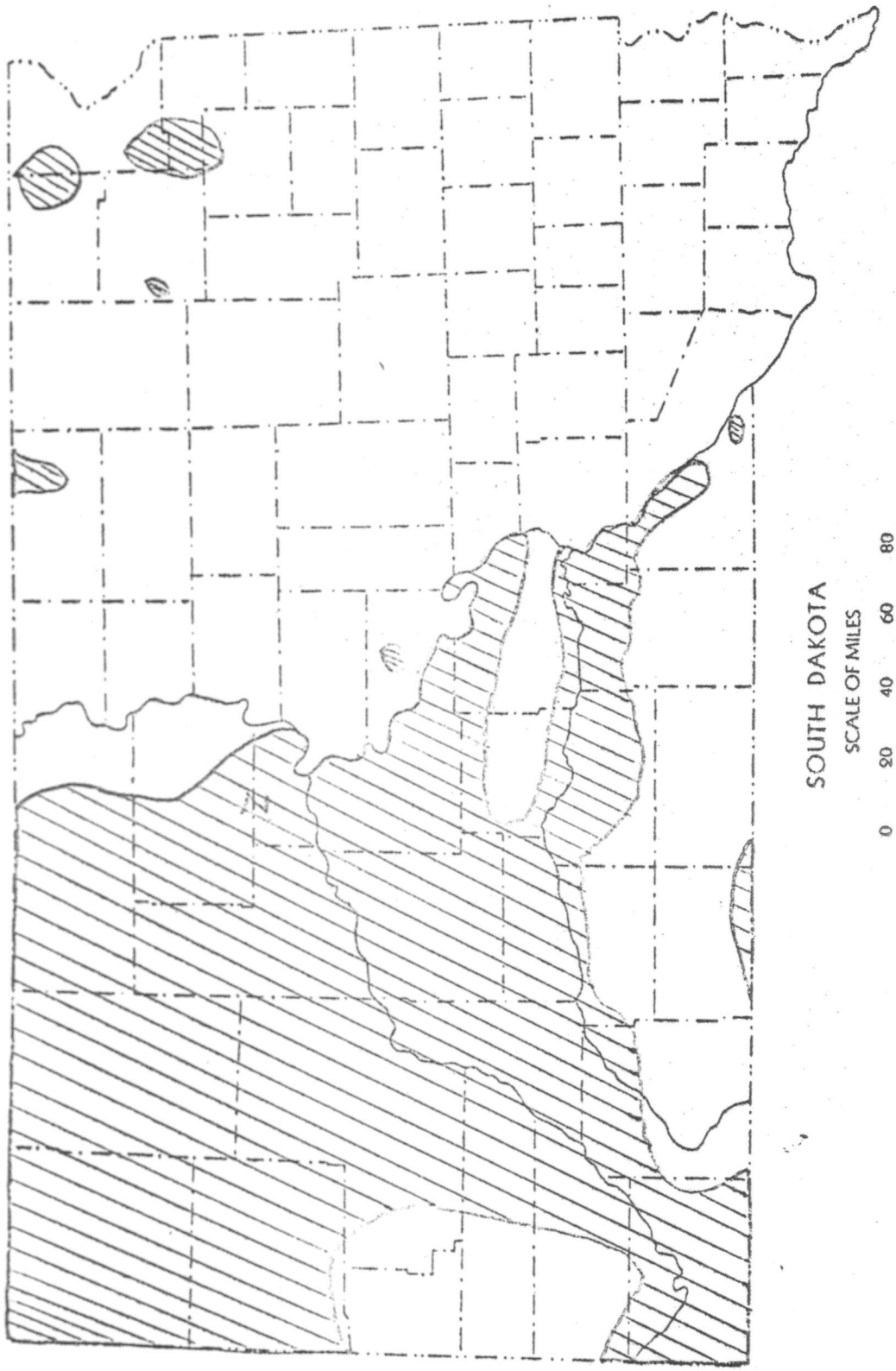


Figure 2. DISTRIBUTION OF PRONGHORNS IN SOUTH DAKOTA, 1965.

DISCUSSION

Discussion following Huey's reading of South Dakota paper.

Gordon commented that it appeared to be less interest in antelope hunting than in New Mexico on the basis that we have always oversubscribed our hunts whereas they have "first come, first served" in other states.

Huey commented that they did have up to 8,000 permits, and if we had that many, we might also be undersubscribed.

Gordon commented on the striking difference in the type of hunting and regulations which control the hunt. This demonstrates that perhaps none of us know just exactly what is right. New Mexico is apparently far more rigid in their regulations than some of the other states. This may or may not be good.

Huey asked for an estimate of the crippling loss in New Mexico.

Snyder: It is probably low; estimated less than 10 percent. We have never had a good crippling loss study.

Huey: This low crippling loss may be due to the more restrictive nature of our seasons.

Hepworth: The very high increase in antelope in South Dakota may be due, at least in part, to the water development program. These are stock tank developments, dugouts.

Hepworth advised that South Dakota is issuing 12,000 permits this year.

Gordon asked what was South Dakota's current estimated total antelope population.

In 1964, 24,000.

Yeaman: It is interesting that they recognize the interstate movement of antelope.

Hepworth: We have also found that we have quite a bit of movement in antelope.

Huey asked if this was mainly due to winter movements or was it shifting around to take advantage of local moisture conditions in the summer.

Winter moisture in the form of snow appears to be the major factor. In Wyoming there are movements practically statewide from winter to summer areas.

Huey commented that in New Mexico one of our major problems with sheep-proof fences is in preventing antelope from moving to areas that have local precipitation and thus local greening up of the food supply.

Hepworth: Most of Wyoming's wintering antelope populations are in cattle rather than sheep ranges.

Huey wondered if this might be due in part to the trampling of snow by the cattle, much the same way that South Dakota speculated on the trampling of snow by buffalo herds before the coming of the white man.

Haley asked what type of range this winter antelope and cattle range was.

Hepworth : Rolling hills, range fairly open.

Haley: How does this differ from the summer range where there is sheep competition?

Hepworth: The summer range is out on the desert.

Haley: Do the antelope move to the winter ranges for feed or protection?

Hepworth: They move to the range with the cattle for feed.

Is this feed cake and hay?

No. It is range that is set aside for winter range for cattle and has good natural feed.

ARIZONA ANTELOPE

Paper prepared for the Antelope Management Workshop
Santa Fe, New Mexico - 1965

John P. Russo

Range

The antelope range in Arizona covers approximately 11,000,000 acres with the largest concentrations found from the Arizona-New Mexico boundary, west about 275 miles into Mohave County (Figure 1). Antelope are found in elevations of 3,000 to 7,500 feet. About 75 percent of their range is above 5,000 feet. The exception is the desert area around Ajo, Arizona, where a small population of Sonoran antelope (Antilocapra americana sonoriensis) is found.

Survey Techniques

Surveys are conducted annually in June and July, in accordance with methods outlined in an antelope manual. The state's antelope areas are divided into 43 flight zones which are flown along grid patterns for complete coverage. The areas covered are preselected and mapped, and described in the procedures manual.

Comparative survey figures are shown in Table I. A further check is made by ground counts.

Approximately 140-150 hours are spent flying antelope surveys.

Hunting

The state is divided into game management units and sub-units. The units are used to designate open areas, number of permits and type of hunt.

Because the demand for antelope hunting is great, all antelope hunting is restricted by permit numbers. In addition, successful applicants cannot again apply for three years. Antelope permit numbers and type hunt are recommended by the district wildlife manager at a Commission meeting held in August, following the aerial surveys. Antelope harvest information is presented in Table 2 and Table 3. Legal antelope are buck only, any-antelope, or buck only the first two days with any-antelope on the third day.

Enforcements and regulations

Regulations pertaining to antelope hunting are presented in the Appendix.

Table 1. Summary of Annual Antelope Airplane Surveys, 1961-1965, Northern Arizona.

Unit	Year	Unit Total*	Percent Change	Total Class.	Bucks	Does	Fawns	Does/ Buck	Fawns/ 100 Does
1 Springer-ville	1961	397	0	397	37	219	141	5.9	64.4
	1962	289	-27.2	289	15	165	109	11.0	66.1
	1963	206	-28.7	206	20	115	71	5.8	61.7
	1964	314	52.4	314	38	152	124	4.0	81.6
	1965	309	- 1.6	309	61	169	79	2.8	46.7
2 St. Johns	1961	143	0	141	22	80	39	3.6	48.8
	1962	215	50.3	214	35	115	64	3.3	55.7
	1963	232	7.9	232	41	112	79	2.7	70.5
	1964	310	33.6	304	87	138	79	1.6	57.2
	1965	342	10.3	342	55	205	82	3.7	40.0
3 Snowflake	1961	77	0	70	14	42	14	3.0	33.3
	1962	66	-14.3	65	5	44	16	8.8	36.4
	1963	84	27.3	84	9	50	25	5.6	50.0
	1964	110	30.9	110	16	68	26	4.3	38.2
	1965	88	-20.0	88	10	49	29	4.9	59.2
4 Winslow	1962	240	0	231	67	89	75	1.3	84.3
	1963	210	-12.5	210	37	116	57	3.1	49.1
	1964	172	-18.1	172	16	109	47	6.8	43.1
	1965	246	-43.0	246	26	135	85	5.2	63.0
5E Sunset Mt.	1962	25	0	25	6	13	6	2.2	46.2
	1963	142	468.0	142	41	82	19	2.0	23.2
	1964	54	-62.0	54	21	25	8	1.2	32.0
	1965	142	62.0	142	27	84	31	3.1	36.9
5W Anderson Mesa	1961	882	0	868	202	520	146	2.6	28.1
	1962	588	-33.3	584	105	393	86	3.7	21.9
	1963	543	- 7.7	539	83	308	148	3.7	48.1
	1964	437	-19.5	437	58	257	122	4.4	47.5
	1965	439	0.5	439	78	293	68	3.8	23.2
6 Apache Maid	1961	260	0	245	43	136	66	3.2	48.5
	1962	79	-69.6	79	17	57	5	3.4	8.8
	1963	134	69.6	121	21	66	34	3.1	51.5
	1964	66	-50.7	65	16	39	10	2.4	25.6
	1965	82	24.2	82	9	45	28	5.0	62.2
7 Kendrick Peak	1961	96	0	93	38	42	13	1.1	31.0
	1962	216	125.0	216	47	126	43	2.7	34.1
	1963	254	17.6	254	55	129	70	2.3	54.3
	1964	253	- .4	253	32	155	66	4.8	42.6
	1965	229	- 9.5	229	47	121	61	2.6	50.4

Table 1. Summary of Annual Antelope Airplane Surveys, 1961-1965, Northern Arizona. (cont'd.)

Unit	Year	Unit Total*	Percent Change	Total Class.	Bucks	Does	Fawns	Does/ Buck	Fawns/ 100 Does
8	1961	58	0	58	6	33	19	5.5	57.6
Garland	1962	96	65.5	96	22	57	17	2.6	29.8
Prairie	1963	79	-17.7	79	9	43	27	4.8	62.8
	1964	67	-15.2	67	12	39	16	3.3	41.0
	1965	53	-20.9	53	5	34	14	6.8	41.2
9	1961	294	0	286	69	130	87	1.9	66.9
Valle	1962	148	-49.7	145	27	95	23	3.5	24.2
	1963	94	-36.5	94	27	59	8	2.2	13.6
	1964	62	-34.0	62	15	40	7	2.7	17.5
	1965	140	125.8	140	17	102	21	6.0	20.6
10	1961	772	0	755	136	369	250	2.7	67.8
Seligman	1962	1014	31.3	1009	168	649	192	3.9	29.6
	1963	986	- 2.8	986	173	526	287	3.0	54.6
	1964	1052	6.7	1052	137	620	295	4.5	47.6
	1965	961	- 8.7	961	219	582	160	2.7	27.5
17	1961	99	0	99	22	49	28	2.2	57.1
Williamson	1962	194	96.0	191	34	107	50	3.1	46.7
Valley	1963	57	-70.6	57	3	40	14	13.3	35.0
	1964	178	212.3	178	22	98	58	4.5	59.2
	1965	149	-16.3	149	49	71	29	1.4	40.8
18A	1961	13	0	13	6	7	0	1.2	0
Truxton	1962	83	538.5	82	16	49	17	3.1	34.7
	1963	204	145.8	203	45	133	25	3.0	18.8
	1964	257	26.0	257	55	141	61	2.6	43.3
	1965	215	-16.3	215	38	151	26	4.0	17.2
18B	1961	93	0	80	21	45	14	2.1	31.1
Mohon	1962	237	154.8	237	34	123	80	3.6	65.0
	1963	411	73.4	411	86	226	99	2.6	43.8
	1964	503	22.4	503	105	253	145	2.4	57.3
	1965	408	-18.9	408	86	226	96	2.6	42.5
19A	1961	246	0	237	53	132	52	2.5	39.4
Lonesome	1962	372	51.2	371	42	188	141	4.5	75.0
Valley	1963	434	16.7	434	67	218	149	3.3	68.3
	1964	485	11.8	485	87	259	139	3.0	53.7
	1965	401	-17.3	401	111	218	72	2.0	33.0
19B	1961	633	0	600	104	310	186	3.0	60.0
Chino	1962	606	- 4.3	599	121	299	179	2.5	59.9
Valley	1963	713	17.7	711	131	363	217	2.8	59.8
	1964	609	-14.6	609	94	378	137	4.0	36.2
	1965	546	-10.3	546	144	320	82	2.2	25.6

Table 1. Summary of Annual Antelope Airplane Surveys, 1961-1965, Northern Arizona. (cont'd.)

Unit	Year	Unit Total*	Percent Change	Total Class.	Bucks	Does	Fawns	Does/ Buck	Fawns/ 100 Does
21	1961	39	0	37	10	19	8	1.9	42.1
Dugas	1962	117	200.0	115	23	67	25	2.9	37.3
	1963	69	-41.0	69	9	41	19	4.6	46.3
	1964	99	43.5	99	13	59	27	4.5	45.8
	1965	77	22.2	77	11	49	17	4.5	34.7
Total	1961	4102	0	3979	783	2133	1063	2.7	49.8
	1962	4585	11.8	4548	784	2636	1128	3.4	42.8
	1963	4852	5.8	4832	857	2627	1348	3.1	51.3
	1964	5028	3.6	5021	824	2830	1367	3.4	48.3
	1965	4827	- 4.0	4827	993	2854	980	2.9	34.3

*Unit total includes all antelope observed in the flight areas including search flights. Total classified includes all antelope classified in these units.

Summary of Annual Antelope Airplane Surveys, 1961-1965
Southern Arizona

Unit	Year	Unit Total	Percent Change	Total Class.	Bucks	Does	Fawns	Does/ Buck	Fawns/ 100 Does
28	1964	32	0	32	11	11	7	1.0	63.6
31 & 32	1961	67	0	67	33	30	4	.9	13.3
Sulphur	1962	99	47.8	99	21	55	23	2.6	41.8
Springs	1963	93	-16.2	83	22	36	25	1.6	69.4
Valley	1964	86	- 7.5	86	31	37	18	1.2	48.6
	1965	80	- 7.0	80	8	53	19	6.6	35.8
35	1961	36	0	36	19	17	0	.9	0
San Rafael	1962	39	1.1	39	12	20	7	1.7	35.0
Valley	1963**	63	22.2	63	14	36	13	2.6	36.1
	1964**	55	-12.7	53	8	27	18	3.4	66.7
	1965**	113	105.5	113	31	41	41	1.3	100.0
Total	1961	103	0	103	52	47	4	.9	8.5
	1962	138	34.0	138	33	75	30	2.3	40.0
	1963	156	5.8	146	36	72	58	2.0	52.8
	1964	141	- 9.6	139	39	64	36	1.6	56.3
	1965	193	36.9	193	39	94	60	2.4	63.8

**Ground observations only.

Table 2. Antelope Harvest Information by Management Unit, 1962-1964.

Unit	Year	Permits Authorized & Sold	Hunters Afield	Buck	Antlerless	Total Harvest	Percent Hunter Success
1	1962	90	85	33	13	46	54
	1963	60	58	28	6	34	59
	1964	90	85	47	19	66	78
2E	1962	30	28	20	2	22	79
	1963	50	48	31	3	34	71
	1964	60	59	23	8	31	53
2W	1962	50	46	14	5	19	41
	1963	50	50	34	1	35	70
	1964	70	68	40	11	51	75
2N	1964	75	74	51	3	54	73
3	1962	40	39	20	2	22	56
3N	1963	26	25	21		21	84
	1964	35	35	19	1	20	57
3S	1963	30	30	22	4	26	87
	1964	40	40	25	3	28	70
4E	1962	40	40	25	1	26	65
	1963	20	19	13	1	14	74
	1964	30	28	16		16	57
4W	1962	70	63	27	3	30	48
	1963	35	35	19	2	21	60
	1964	35	34	21	4	25	74
5	1962	100	98			41	42
5E	1963	30	30	19		19	63
	1964	40	40	27		27	67
5W	1963	100	99	32		32	32
	1964	65	63	34	3	37	59
6A	1962	25	24			2	8
	1963	15	14	3		3	21
	1964	25	24	7		7	29
6B & 8	1962	30	28			13	46
	1963	30	29	13		13	45
	1964	30	30	16		16	53
7	1962	50	48			24	50
	1963	50	50	29		29	58
	1964	40	40	24	1	25	62

Table 2. Antelope Harvest Information by Management Unit, 1962-1964. (cont'd.)

Unit	Year	Permits Authorized & Sold	Hunters Afield	Buck	Antlerless	Total Harvest	Percent Hunter Success
9	1962	50	48			32	67
	1963	50	48	22		22	46
	1964	35	34	14	6	20	59
10	1962	250	241	116	19	135	56
	1963	275	268	149	10	159	59
	1964	250	244	109	19	128	52
12	1962	5	5			3	60
	1963	5	5	1		1	20
	1964	5	5	5		5	100
17 &	1962	175	170			102	60
19B	1963	125	124	90		90	73
	1964	100	92	57	14	71	77
18	1962	50	50	19	5	24	48
18A	1963	50	49	38	1	39	80
	1964	60	59	39	2	41	69
18B	1963	110	107	57	8	65	61
	1964	152	148	55	15	70	47
19A	1962	60	60			37	62
	1963	80	80	45		45	56
	1964	100	100	68	9	77	77
21	1962	65	65			19	29
	1963	50	50	8	3	11	22
	1964	36	36			11	31
28	1964	5	5	4		4	80
31 &	1962	25	25	10	3	13	52
32	1963	30	29	14		14	48
	1964	35	34	7	7	14	41
35	1962	10	10			2	20
	1963	10	10	2		2	20
Total	1962	1215	1173	559	53	612	52
	1963	1281	1259	690	39	729	58
	1964	1413	1377	716	128	844	61

Table 3. Summary of Arizona Antelope Hunting.

Year	Permits Issued	Hunters Afield	Harvest		Total Harvest	% Hunter Success	Season Dates**
			Buck	Antlerless*			
1941	400	387	286		286	73.9	9/20-10/5
1942	750	721	487		487	67.5	9/19-10/3
1943	1072	991	522		522	52.7	9/30-10/11
1949	600	575	437		437	76.0	9/17-10/4
1950	520	502	382		382	76.1	9/16-9/26
1951	835	794	548		548	69.0	9/22-10/9
1952	1233	1201	739		739	61.5	9/20-10/7
1953	1340	1283	828		828	64.5	9/26-10/6
1954	1600	1561	1146		1146	73.4	9/18-9/27
1955	955	914	578		578	63.2	9/17-9/26
1956	445	430	297		297	69.1	9/22-9/24
1957	305	296	205		205	69.3	9/21-9/23
1958	470	456	301		301	66.0	9/20-9/22
1959	1010	994	605		605	60.9	9/19-9/21
1960	1200	1174	722		722	61.5	9/24-9/26
1961	1411	1373	687	68	755	55.0	9/23-9/25
1962	1215	1173	559	53	612	52.2	9/22-9/24
1963	1281	1259	690	39	729	57.9	9/21-9/23
1964	1413	1377	716	128	844	61.3	9/26-9/28

* 1953, 54, 56, and 57 had any antelope hunts but the kill data was not separated.
** 1941 through 1955 had two and/or three section hunts during the outline season.

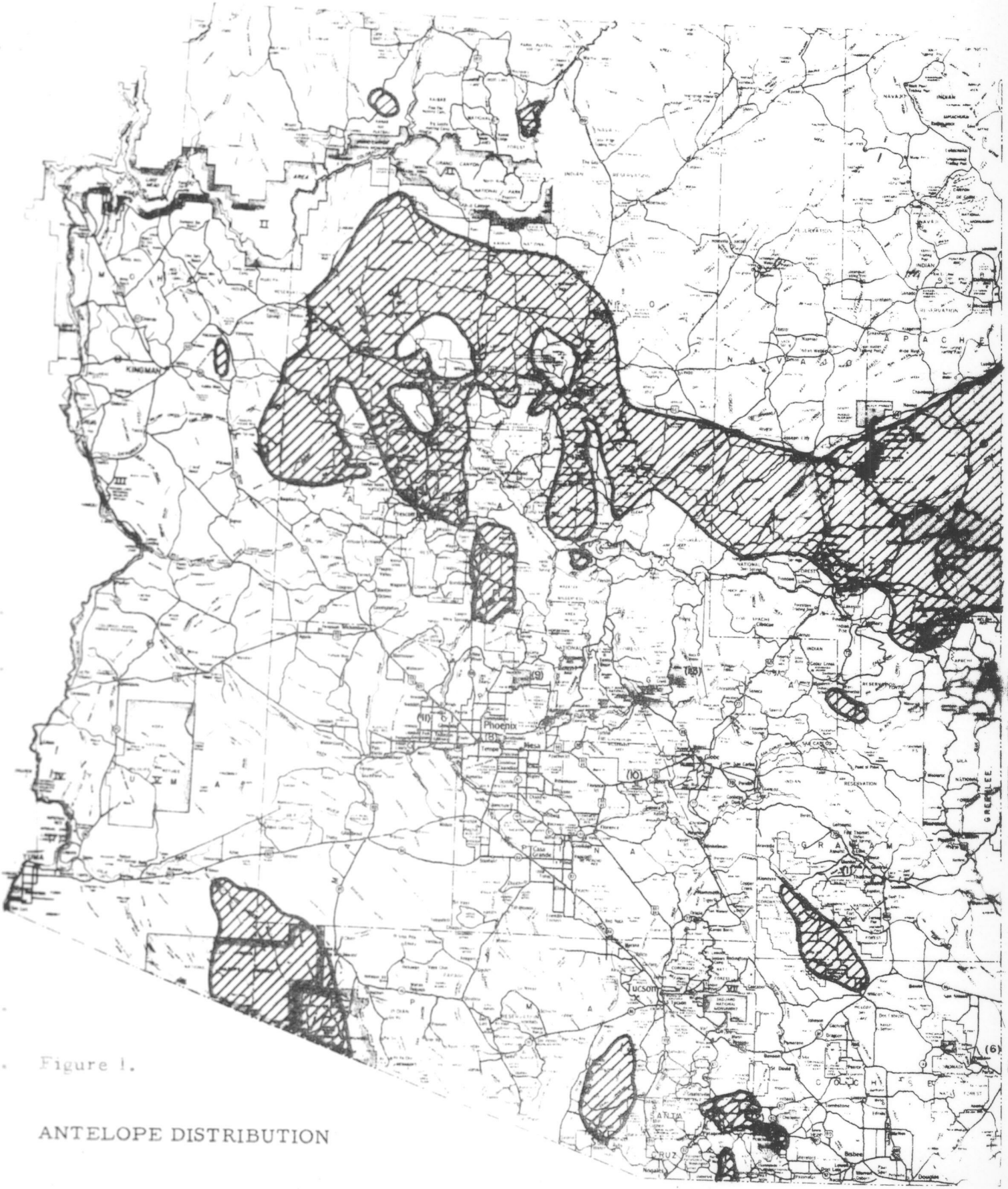


Figure 1.

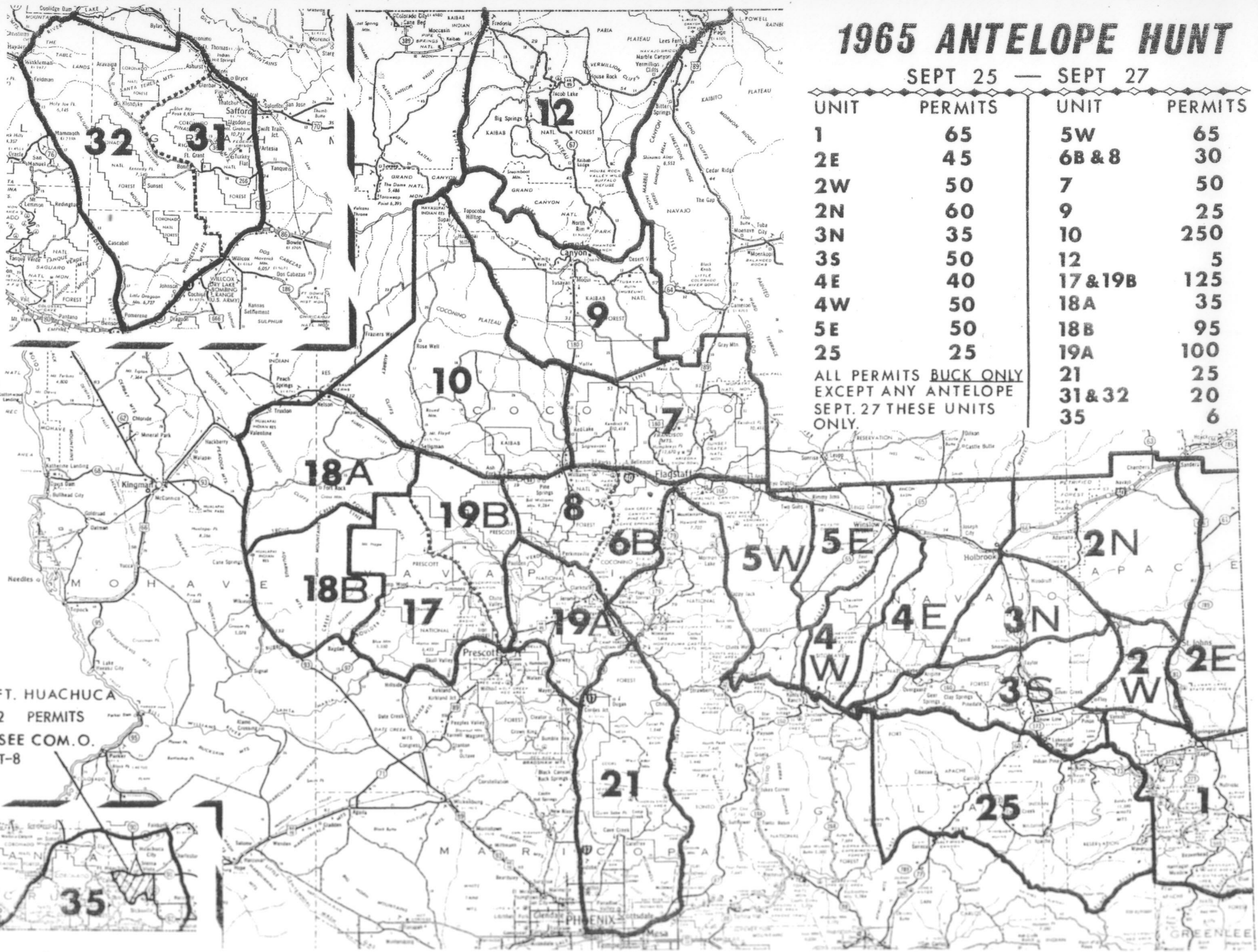
ANTELOPE DISTRIBUTION

1965 ANTELOPE HUNT

SEPT 25 — SEPT 27

UNIT	PERMITS	UNIT	PERMITS
1	65	5W	65
2E	45	6B & 8	30
2W	50	7	50
2N	60	9	25
3N	35	10	250
3S	50	12	5
4E	40	17 & 19B	125
4W	50	18A	35
5E	50	18B	95
25	25	19A	100
		21	25
		31 & 32	20
		35	6

ALL PERMITS BUCK ONLY EXCEPT ANY ANTELOPE SEPT. 27 THESE UNITS ONLY.



Comments on Arizona paper.

Russo stated that he thought predator control could have a significant effect on antelope populations. Any predator control they can get on antelope ranges will help.

Haley asked what type of predator control this consists of.

Russo: 1080 if you are trying to cover a large area. Most of our antelope areas are large. Where there is a local problem of predation around waterholes, steel-trap control works fine.

Haley commented that the predator control problems in Texas probably relate more to the golden eagle.

During antelope trapping operations at kidding time, Paul Webb of Arizona was reported to have said there was a lot of golden eagle activity but Russo did not know of any actual observations of kills.

Haley advised that numerous landowners have reported antelope fawns killed by golden eagles. This past January we found a yearling doe that had definitely been killed by golden eagles. They counted 104 golden eagles on an antelope survey.

De Arment asked if there hadn't been a paper by Arizona on the use of 1080 presented at the San Francisco Wildlife Conference and asked if that had been followed up with other studies.

Russo: It has been followed up but there has been no actual report made of the findings.

Russell asked if Arizona had had trouble in getting landowners or operators to agree to antelope hunts.

Russo: In Arizona we don't normally go to the specific landowner or operator in order to set up hunts. Most of the antelope range is public land. We have meetings throughout the state at which the public is invited and we discuss our seasons. If there are any local problems the landowners or operators are expected to bring them up at that time. We do have small areas where this problem arises that are old Spanish land grants. The major problem in these areas is with deer, not antelope. We normally have excellent cooperation with the public agencies, BLM and Forest Service throughout the state.

Gordon asked if the private landowners who do have hunts, receive any compensation.

No, they do not.

Russell commented that we have a problem in New Mexico that landowners will not allow hunts in some areas where the antelope population could stand some harvest.

Our biggest problem along this line is locked gates, blocking access to hunting areas. The individual wildlife managers have the responsibility for making the recommendations for the number of permits based upon the aerial surveys and ground surveys. This is discussed with the regional manager who may request another check if he feels the manager is overhunting or otherwise recommending improper harvest. The main office does not interfere with this. The local men are put out there for the purpose of managing. If they do make a mistake, then they will have to rectify it by proper management later.

Snyder asked if Arizona pays depredation complaints.

No, they do not. The law states that the Game Department is not liable for damage by game animals.

Snyder asked what is done in the instance of a depredation complaint.

We do attempt to take care of it by reducing herds. As an example, we had a very early elk hunt to reduce a herd that was causing damage on an individual's property. If a man has developed water and the antelope are utilizing it, the Game Department will sometimes come in and develop their own water to compensate.

Gordon asked if Arizona used the department-owned aircraft in aerial surveys or if they contract for this work.

They use one department-owned plane and contract for the second one. They feel that the Cessna 180 is a little too hot for antelope survey work.

Gordon commented that we use a Cessna 210 aircraft. Russo commented that there is power available in case of a dangerous situation and it was a suitable aircraft, more suitable than the 180. The other Arizona plane has a supercharger and large flaps so it is very suitable for antelope surveys. With the contract plane they try hard to get the same pilot each year because of his improved performance with experience.

Yeaman asked concerning the depredation law if they had ever had any landowners take it upon themselves to take care of the complaint.

It hasn't happened with antelope but it has happened with elk. The individual was cited for wasting the meat since he did not notify the department and did not utilize the meat. It was easy to prosecute under that law. If he had notified the department that "if they didn't take care of it, he was going to", he probably would have gotten away with it.

TRANS-PECOS ANTELOPE

STATE OF TEXAS

Tom Haley

First, I would like to explain that the information to be presented was not the result of a detailed study, but information collected during normal operations of Federal Aid Project W-57-R. We do have a study of the Trans-Pecos antelope herd planned and will attempt to initiate it this year.

The antelope population in the Trans-Pecos Region has declined sharply since 1961 when a peak population of 12, 107 animals was recorded during the annual survey. The survey is conducted by strip flying each ranch that hunts antelope. The exact cause of the decline in the herd is not known; however, it is felt that extreme dry weather and poor vegetative conditions during the critical winter and spring months contributed to this decline. Other factors such as predation on young and excessive loss of wounded animals during the hunting season may have contributed to the decline.

The area involved is the Trans-Pecos Region which is all the area in Texas west of the Pecos River. Our major loss this year has been south east of Marfa in Presidio County.

From 1957 to 1961 antelope herds increased from 7,302 animals to a peak population of 12,017 head. Aerial surveys conducted (Table 1) in June and July of each year recorded 7,302 in 1957, 8,963 in 1958, 9,186 in 1959, 8,740 in 1960, 12,017 in 1961, 9,037 in 1962, 8,074 in 1963, and 4,963 in 1964. Fawn production for this period was recorded as 60 per cent in 1957, 98 per cent in 1958, 70 per cent in 1959, 57 per cent in 1960, 73 per cent in 1961, 35 per cent in 1962, 56 per cent in 1963,

and 35 per cent in 1964. Fawn production was determined during the annual survey by observed fawns to observed adult females.

The amount of rainfall received during the late winter and spring months (January-May) was felt to have some effect on the fawn production during the following fawning period. The weather station at Alpine, which is located near the center of the antelope range was used to check the amount of moisture received during these months for the year 1957 through 1964. The Alpine station recorded 4.66 inches in 1957, 5.34 inches in 1958, 3.41 inches in 1959, 2.94 inches in 1960, 3.38 inches in 1961, 2.44 inches in 1962, 4.03 inches in 1963 and 2.40 inches in 1964. There is a relationship between the amount of moisture received during the critical period and fawn production the following summer. Table 1 shows a trend relation between the amount of rainfall and the fawn production for the fawning season.

In 1961 at the peak of the antelope population an outbreak of leptospirosis was found in cattle using the same ranges as the antelope. Blood samples from antelope were collected during the October hunting season. One hundred and twenty-five samples were collected and tested for leptospirosis. Of this amount only two suspected cases were found and no positive cases were located.

The aerial survey in June 1964 recorded not only a low fawn crop of only 35 per cent, but a low per cent of yearlings in the herd. The 1963 fawn production was 56 per cent which is sufficient to maintain a herd; however, it was evident that because of the dry hard winter in 1964 not only was the fawn production affected but also the survival of the 1963 fawn crop. From the information collected to date, indications are that

although a good breeding season may be present during the early fall, it is the amount of moisture received during the critical winter and spring months that affect the fawn production and previous years fawn survival.

In January 1965, field observations by project personnel and reports by landowners indicated that a die-off of antelope was occurring in the herds south east of Marfa. An antelope collection permit was secured and from January 23 through January 28 eleven antelope were collected. Six animals (5 doe and 1 buck) were collected with the use of a rifle and five animals were checked that had died the previous night. A necropsy was run on each animal. Collection was done by Dr. R. M. Robinson, D.V.M., Department of Veterinary Pathology, Texas A. & M. University, Jack W. Thomas, Texas Parks and Wildlife Department and myself.

Report of the gross necropsy finding are as follows. Externally all the animals were in poor condition, but were not severely emaciated. Nearly all animals had varying amount of pulmonary hemorrhage, although some did not show this change. There were no cardiac anomalies, but in several of the animals preivascular effusions of blood were present around the vessels of the rumen, and mesenteric vessels. All animals had a considerable infection of Haemonchus Nematodirus antilocaprea, and Thysanosoma. The bone marrow of all animals indicated hematopoietic activity.

The vascular system where hemorrhage was found had hemorrhage into the media of the vessels, indicating some vascular necrosis of the intestinal epithelium in the upper part of the small intestine. This change was not accompanied by a great amount of inflammatory reaction.

Four of the five does necropsied contained resorbed fetuses, which when sectioned were not accompanied by any inflammatory reaction.

The one doe that contained viable fetuses had twins, and all the other but one contained the remains of twins. One contained a single necrotic fetus.

During this same period an aerial survey was conducted on several of the ranches in this area. Table 2 has the June 1964 survey, October 1964 hunt kill data and January 1965 survey figures.

Table 2

Ranch	June 1964 Survey Buck	Doe	Fawn	October 1964 Harvest Buck	January 1965 Survey Buck	Doe	Per Cent Increase or Decrease
Nopal-Lomavista	85	96	68	36	33	121	-27.70
Antelope Springs	23	23	11	6	3	7	-80.39
McCabe	21	41	12	5	12	44	-18.84
101 Ranch	74	114	59	16	80	228	+25.00

While the collections were being made a record was kept of the number of dead antelope found that appeared to be less than 60 days old. Forty-seven (12 buck, 24 doe, 11 fawn) animals were found, some only a few days old.

It was noted that during the time the collections were being made and survey conducted that a large portion of the antelope located, both alive and dead, were found in a location with a heavy concentration of tarbush (Flourensis cernua). As a result of the collection and condition of the animals checked it is felt that heavy browsing on this plant, was the cause of mortality among the antelope. The animals were forced to eat this plant because of the lack of available feed.

TABLE I

TRANS-PECOS REGION

Year	1957	1958	1959	1960	1961	1962	1963	1964
Antelope Population	7,302	8,963	9,186	8,740	12,017	9,037	8,074	4,963
Alpine Rainfall Jan-May	4.66	5.34	3.41	2.94	3.38	2.44	4.03	2.40
Per Cent Fawn Production	60%	98%	70%	57%	73%	35%	56%	35%
Number Antelope Harvested	774	813	1,307	1,349	1,807	1,699	1,003	231

ANTELOPE IN THE TEXAS PANHANDLE

Richard DeArment *

TEXAS PARKS AND WILDLIFE DEPARTMENT

LOCATION

The Texas Panhandle comprises approximately 26 counties in the northermost part of Texas. It is surrounded on three sides by New Mexico and Oklahoma. There are two major land types - high plains and rolling red plains. Antelope are generally located in the western part of the Panhandle (Figure 1). However there is a herd established in the Northeastern part as a result of restocking efforts.

MANAGEMENT

Population and Harvest

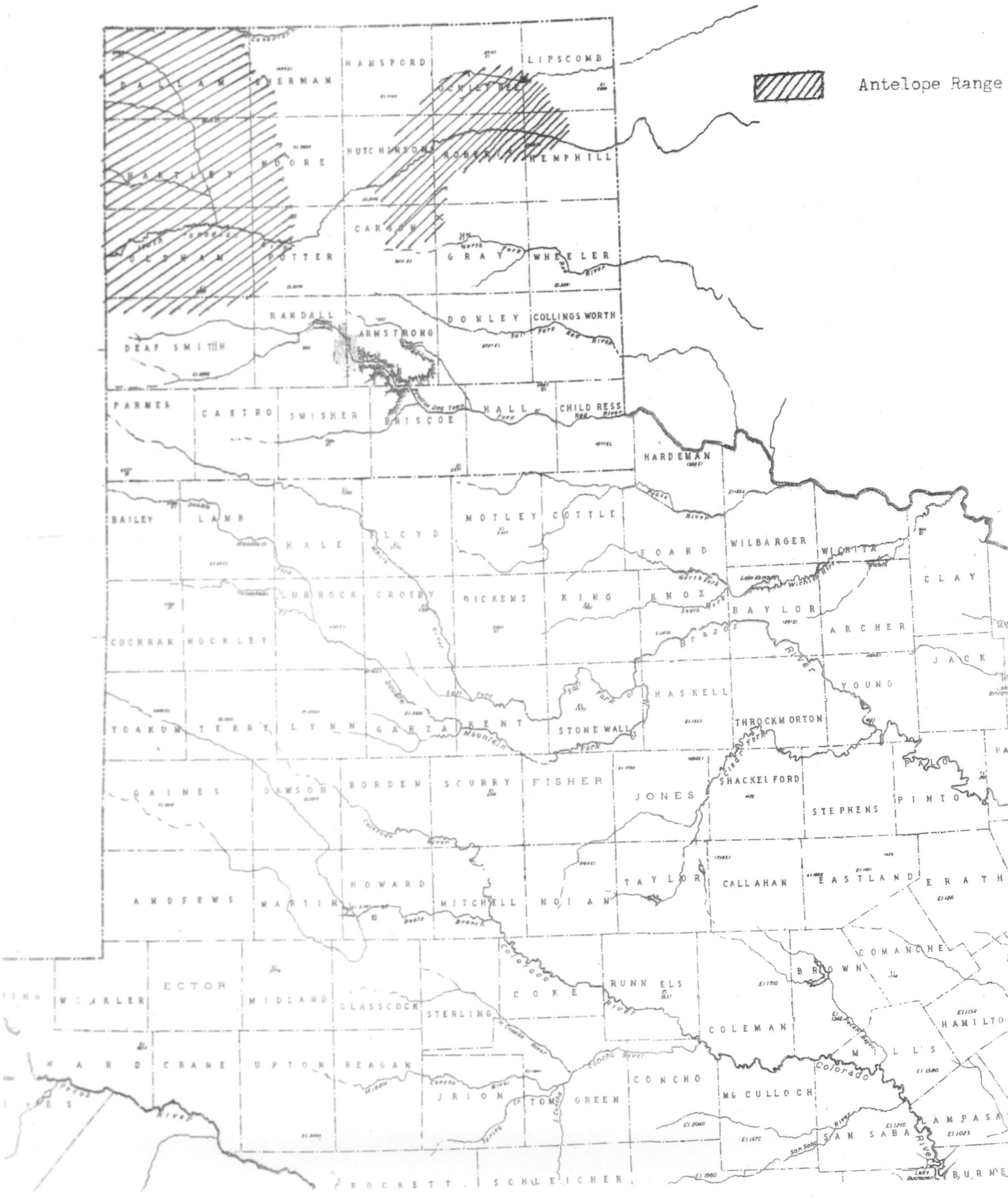
The antelope population in the past was much higher than that at present simply because there was more grassland. Approximately 75 percent of the former high plains antelope range is presently under cultivation. No figure is available as to the past numbers however high population estimates are usually dampened by accounts of early explorers in this region who consistently had trouble finding fresh meat.

One could assume from these accounts that a heavy population was absent. Water was the limiting factor. Cattlemen failed to settle in the high plains area until windmills were established. This region couldn't support cattle except along the watercourses or during wet years when the playa lakes filled. Antelope were probably much more migratory and were forced to follow the moisture.

Population decreased until 1946 when the Department, ranchers, and landowners became interested in its welfare and began an intensified protection

* Data collected under Federal Aid Program P.R. W-45-R

Fig. 1 Antelope Range in the Texas Panhandle



and restocking program.

Approximately 500 antelope were released in the western part of the range during a two year period. They began increasing as a result of this program and by 1953 a count revealed 2,142 antelope (Table 1). The population has fluctuated until the present time. The lowest number was 722 in 1959 and the highest was 3,252 in 1963.

A total of 323 antelope were killed during the first hunt held in Oct of 1953. A hunt has been held every year except 1959, when the populati was low. A total of 441 were killed in 1963 for an all time high.

Hunting Methods and Law Enforcement

All hunting is done on private land with one exception; consequen it has worked best to give all permits to the rancher. During the first hunts the Department kept 80 percent and the rancher received 20 percent. This required a lottery system for issuing permits and also demanded closer supervision of the hunts than was necessary.

Permits are issued on the basis of aerial census. Buck hunting has been the rule except in 1963 when numbers were sufficiently high for hunting does.

In the beginning ranchers gave permits away; however practically all of the ranchers charge for hunting. Prices for hunting range from $10.00 to $50.00 per buck. Hunters are allowed to stalk, not chase, from a vehicle but must be out of the vehicle for the kill.

In the beginning hunts were very closely supervised by law enforcement personnel but now ranchers are helping with the supervision and one warden per ranch is no longer necessary.

Census and Survey Techniques

A total count is attempted by aerial census during the last part of July. This census lasts about two weeks. One mile grids around 300 feet high are

Table 1

Texas Panhandle Antelope Trends

Year	Bucks	Does	Fawns	Totals	Buck:Doe	Doe:Fawn	Permits	Harvest
1953	894	1122	126	2142	1:1.26	1:0.11	355	323
1954	597	738	349	1684	1:1.24	1:0.47	359	327
1955	810	1129	647	2586	1:1.40	1:0.57	405	350
1956	637	1078	335	2050	1:1.70	1:0.31	305	229
1957	419	838	307	1564	1:2.00	1:0.37	180	160
1958	349	768	451	1568	1:220.	1:0.59	152	126
1959	211	387	124	722	1:1.83	1:0.32	No Harvest	
1960	616	900	463	1979	1:1.46	1:0.51	332	159
1961	746	1337	840	2932	1:1.79	1:0.63	408	239
1962	815	1401	720	2936	1:1.72	1:0.51	384	269
1963	733	1843	676	3252	1:2.51	1:0.37	450(302B-148D)	441(295B-146D)
1964	541	1100	457	2098	1:2.03	1:0.42	290	269

flown over the entire area. Flights start at daybreak and last for about 3 hours then are continued in the afternoon for 3 hours until sunset. Ground census suppliments aerial census on isolated herds. A slow flying plane is desired. During the census bucks, does, and fawns are recorded.

RESEARCH

Past research was limited primarily to restocking and distribution studies.

Sex, Age, Conditions, and Measurements

During the initial hunting seasons sex, age, body conditions, and measurements were recorded at various check stations. However this was discontinued in favor of other studies after several years of data accumulation.

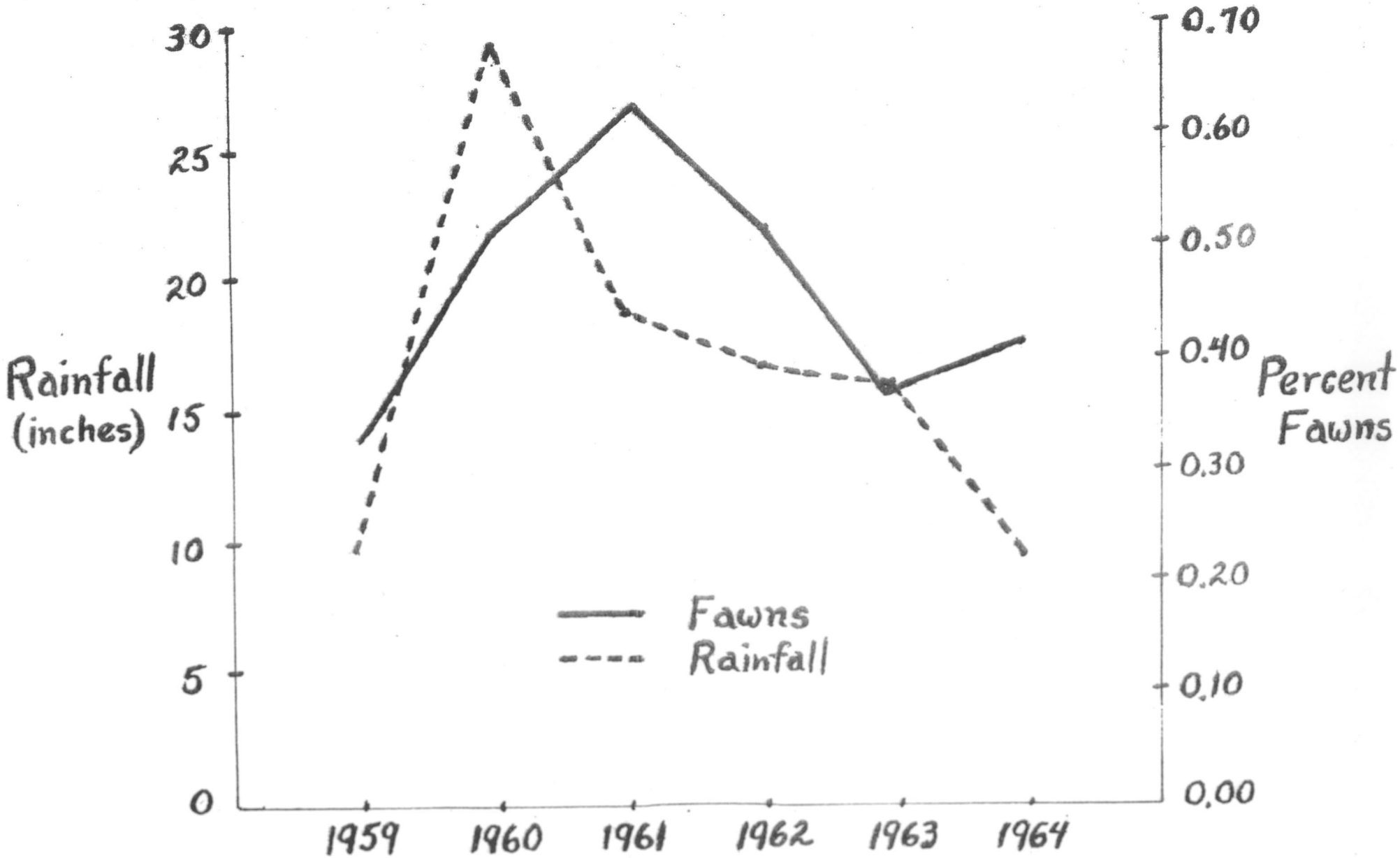
Abortive Disease Study

The objective of this study was to determine if Leptospirosis and Brucelosis were present in the herds and also to determine if these diseases were responsible for the poor fawn crops (Table 1). Serological examination of blood serum, taken during the hunting seasons, by using the simple macroscopic agglutination test, was made by the Northwest Texas Bangs Laboratory over a four year period. This test proved unreliable for Leptospirosis because there were too many cross reactions. Triplicate samples were taken last year, along with a kidney, for the purpose of cross checking the results of the leptospirosis diagnosis. Necropsies were made in conjunction with blood sampling. Although the simple macroscopic agglutination tests showed a 22 percent reaction no leptospirosis was found in the kidneys or by the necropsy examination. No brucellosis was found in over 600 blood samples collected.

Weather Connected Studies

A simple comparison between the annual rainfall (July to June), measured in Dalhart, and the annual doe-fawn ratios was made for a period of six years (Fig. 2).

Fig. 2 Comparison of Rainfall and Antelope Fawn Production in the Texas Panhandle



There seems to be a rough correlation; however this particular comparison is too crude to be used for anything other than stating generalities.

Fawn Studies

Sutdies will be continued to determine the cause of the low doe-fawn ratios. Observations will be made during the fawning season to determine Whether or not they are actually dropping. This data will be compared with the flight census results made during the summer.

MANAGEMENT PROBLEMS

The largest single problem confronting the Department in managing the Panhandle antelope herd is the continued poor fawn crops. All efforts are being directed toward correcting this situation.

Larsen asked if Buechner's figure of 10 antelope per section as an ideal stocking rate was not unrealistically high.

Under ideal conditions it could probably carry 10 per section, but the landowners probably would not stand for it, even though they would get the revenue.

Larsen: This is probably five times the density we have on our best antelope ranges.

It is hard to convince a landowner that an antelope with his head down in the grass is not eating grass and competing directly with livestock.

Comments on De Arment's paper from Texas.

Snyder asked whether they suspected any movement into and out of New Mexico in the Texas Panhandle area.

They have no movement studies so they are not at all sure of what kind of movement they have.

Snyder commented that the men working that area feel that there is definitely a movement between Texas and New Mexico and that this year the movement is toward New Mexico.

Yeaman asked in reference to the years with low fawn crops if you feel that the loss was due to does not being with fawn or occurred after fawns were dropped.

They didn't know just exactly what was dropped so couldn't tell.

De Arment: Last year we put off the census until as late as possible and thought we would get an excellent count, but drought conditions were such that the antelope were badly scattered and we got a very poor count.

Comments on Wyoming paper by Hepworth.

Huey: How do you document that a pioneer has been in Wyoming long enough to qualify for a pioneer license?

He must have a notarized statement to that effect.

Haley: Have you found any evidence of resorption of fetuses?

Only know of one example and that was a female that had had a body weight reduction of about 32 percent. She was certainly in the late stages of starvation.

Larsen: The fetal rate on one of our study areas was running about 197 percent, practically all females with twins, in a normal year. Last summer there were extreme drought conditions. The antelope were in very poor condition prior to breeding season. We expected to have a big reduction in conception rate. The conception rate was virtually the same as the previous year under normal conditions. There appeared to be no disturbance of the normal breeding pattern whatsoever.

Hepworth commented that the ability of antelope to survive extreme conditions is rather amazing. This has been observed both in pen studies and in the wild. In one study, in extreme winter conditions, there was a loss of 86 percent of the sheep in a pasture and only 45 percent of the antelope. The female antelope were carrying fawns while the sheep were not and did not have this additional nutritional requirement.

Haley asked if there were any poison plants in these pastures.

There are no browse species that are toxic. We do have loco weed and this sort of thing in the summertime. The antelope utilize it and don't seem to be affected by it. Soleniferous plants or plants that accumulate solenium in the system do have an effect; otherwise we have not seen a single plant that is normally considered toxic to cattle that has affected antelope.

Haley: Our problem in Texas is with tarbush.

Hepworth advised there is no tarbush at all in Wyoming.

Haley asked what was considered a large head in Wyoming.

Sixteen to 17 inches. Anything over 14 inches is classed as a trophy head.

De Arment asked if the vibriosis was common in sheep in the area where you had the problem in antelope.

It was and this is a sheep winter and summer range. The antelope are only on the range in the winter. We think that the antelope got the disease from sheep. There has been a real history on vibriosis on this area in livestock. We have never had a positive leptospirosis test on antelope nor, incidentally, on any other animal, except moose. We did have three positive lepto tests on moose. There are cross reactions, etc. etc., which may be an indication that lepto may not have actually occurred in those moose. It seems rather strange to have found it in moose and none of the other game animals.

De Arment asked about tricomoniasis.

The only thing it has been found in, in Wyoming, is bear.

De Arment asked if the fawn production was back to normal in the area that had trouble with vibriosis.

The answer was "Yes, the fawn crop is up to 87 per 100 does". The vibrio appears to run in 5-year cycles. Apparently, once the animal has the disease and recovers, it is immune. As the immune animals decrease in the population, a new outbreak can occur with nonaffected animals. There is one area presently in Wyoming in which we suspect vibrio again. We have not yet isolated the disease from any of the animals as yet. Reproduction decreased from about 80 per 100 in '58 to 77 per 100 the following year, then jumped to 110 per 100, then it went to 60, and this last year, down to 30. We are presently collectiong to see if we can attribute this loss to any disease. Range conditions are good and other factors apparently have not changed.

Stewart: How do you determine where you are going to put the ramps and the cattle guards? Do you put them in the corners or at any specific interval?

During the course of the study, they have been put on the middle of the fence, on the corners and all possible locations.

Stewart asked how far apart.

In this pasture study the size is very limited, the pastures are not more than 200 yards on a side. We have no information on what would be appropriate for field use.

Huey advised that in conversation with the BLM, they indicated they would have ¼-mile intervals between structures.

The Wyoming study as presently set up is not giving us the information we need for management use. We will need field tests on various types of terrain and in various types of weather conditions.

Lamb asked how long it would take for the antelope to learn to use these devices.

It would depend upon the circumstances. Some individual animals appear to have a better learning ability than others. This was not correlated with age. Apparently an animal that would jump a fence would also walk over a structure. Other animals that wouldn't try to get over a fence wouldn't try a structure either. Where there have been fences for long periods, the animals apparently negotiate them. In these areas, particularly in the East, the animals can apparently negotiate a 32-inch fence with no difficulty, but here there are no problems of migration. There is food and water available and no winter conditions force movements annually. This situation is not typical of the rest of the state.

Huey asked if the Wyoming guzzler program excluded use by livestock.

Yes. We don't believe that water is critical in the winter where there is snow. The summer distribution of antelope appears to be dependent upon water. In the Red Desert area we have documented evidence that antelope cannot exist in drought conditions without water.

Haley asked what he thought of the conditions where you had no snow but had water developments freeze over completely for two weeks at a time.

Hepworth answered, "This should be critical". Hepworth thought that this situation would be particularly critical where you have animals that have depended upon developed water.

MacDonald asked about studies on mortality factors; in particular predator studies. Several states have mentioned that they feel predation is a problem. This statement alone means little unless you know when it takes effect, how serious the effect is, etc.

We know that wild dogs will kill antelope (this is not coyotes) and that under fenced conditions, bobcats will kill antelope. I have seen eagles kill adult antelope. I have also seen antelope kill eagles. I don't know how extensive this is. I don't think that in any of our antelope herds predation has been documented to the extent that we know how important it is. It is something that needs to be considered definitely. We need to consider a study on a herd or a group of herds under different conditions. Perhaps this is something that this group could consider collectively.

MacDonald: The Effect of predation is certainly influenced by the populations of buffer species.

This is certainly true of golden eagles utilizing rabbit populations and at this point, our other populations appear to be at an all-time low. There is documented evidence that a single coyote can and certainly does kill an antelope.

Larsen commented that the statements about crippling loss may be a low estimate. A study in Utah on deer indicated that crippling loss was very much higher than had been expected and perhaps the study of antelope crippling loss would indicate the same thing.

Yeaman commented about a 2-antelope hunt area in Wyoming where, after the first weekend, you could see dead antelope in every direction from a high hill. He felt sure that the total was at least 30 percent of the harvest.

Hepworth: In one area in Wyoming a local warden estimated that the total crippling loss was 50 percent of the harvest last year. He apparently had a fairly good sample to base this on.

Haley commented that on one ranch in Texas a landowner commented that he had shot, himself, 16 wounded bucks following the hunt. This was about 25 percent of the total harvest.

ANTELOPE MANAGEMENT IN NEW MEXICO

by

Walter A. Snyder

History

Antelope herds in New Mexico have followed the general trend of antelope herds throughout the West. In the late 1800s antelope populations were high and were distributed throughout the state in all suitable habitat. Populations began to decline greatly in the early 1900s. In 1912 a state law was enacted prohibiting the killing of antelope. However, the decline in New Mexico continued to the early 1930s. The statewide population at this time was probably no more than 2,000 animals.

In 1937 the New Mexico Department of Game and Fish began trapping and transplanting antelope in an attempt to re-establish them in their former ranges. This program proved highly successful, and at the present time antelope occupy most of the suitable habitat in the state. Since trapping was initiated in 1937, approximately 4,500 animals have been transplanted throughout the state.

Legal hunting of antelope began in the state in 1932. Harvest data from 1933 through 1964 are presented in Table 1. Harvest level reached a peak in 1961 and has declined in subsequent years.

Aerial surveys conducted in 1961 indicated a statewide population level of approximately 25,000 animals. Reproduction failure in the majority of the antelope herds since that time has necessitated a reduction in harvest.

Census Techniques

The primary censusing technique for antelope is aerial surveys, using a fixed-wing aircraft. In some cases limited censusing is done by ground counts.

Flight survey units have been established in all of the major habitat areas of the state (Figure 1). Surveys are conducted in areas where hunting is allowed on a rotational basis. Each area is surveyed every other year, with approximately

Table 1. Harvest Data: 1932 - 1964

Year	Licenses	Harvest	Year	Licenses	Harvest
1932	300	63	1948	653	425
	(First legal season)				
1933	150	112	1949	1,024	652
1934	150	116	1950	989	768
1935	No season		1951	985	692
1936	325	280	1952	1,735	1,080
1937	275	234	1953	1,382	907
1938	430	387	1954	1,529	910
1939	565	453	1955	993	647
1940	655	516	1956	1,139	1,100
1941	580	455	1957	1,570	1,088
1942	700	547	1958	2,186	1,631
1943	823	657	1959	3,050	2,026
1944	783	601	1960	2,358	1,247
1945	326	286	1961	5,241	3,884
1946	No season		1962	2,755	1,606
1947	490	441	1963	1,394	742
			1964	1,384	859
			Total	36,919	25,412

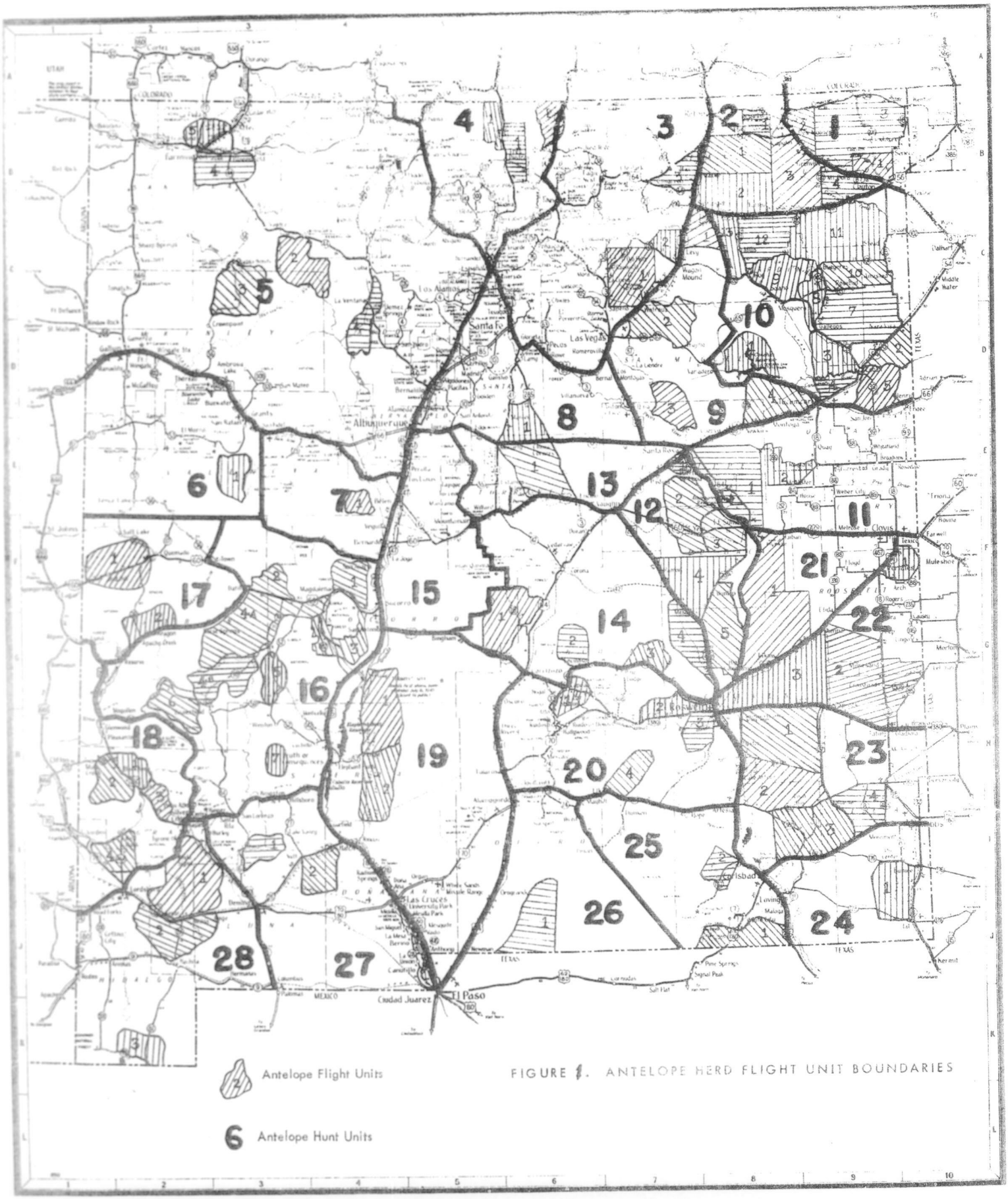


FIGURE 1. ANTELOPE HERD FLIGHT UNIT BOUNDARIES

fifty percent of the total survey area being surveyed each year.

Three types of aerial surveys are conducted. One is a 33-percent sample survey, one is a 100-percent survey, and the other is a fawning survey. The 33-percent survey is conducted between May 15 and June 15 when does are dispersed for fawning. These surveys are conducted on large herd units where terrain is not rugged. One-hundred-percent surveys are conducted after July 15 when the fawns are large enough to be traveling with the does. These surveys are conducted on small herd units or in areas where the terrain is rugged and observation of animals is difficult. Fawning surveys are conducted on a sample basis over most of the antelope range after July 15. These surveys are conducted to determine yearly antelope production throughout the state.

A large portion of the state's antelope herd is not hunted. The unhunted areas are comprised primarily of private land where the landowners do not allow hunting. Periodic surveys are conducted in these areas to check on the antelope population status. These unhunted areas furnish most of the antelope for transplanting.

Hunting Seasons, Methods and Enforcement

Harvest on federal- and state-owned land is controlled by the Department of Game and Fish. Hunting on privately owned land is regulated by state law, but harvest levels are controlled by the individual landowners. Normally the private landowners accept harvest levels recommended by the Department. Hunt agreements are signed with private landowners prior to the hunt. These agreements are set up by state law. The private landowner receives free, 10 percent of the total licenses that apply to his private land. These free licenses can only be used by resident hunters. The landowner also designates the recipient of 20 percent of the licenses that apply to his private land. These licenses must be paid for. The additional 70 percent of the licenses issued for hunting on private land are

distributed to public hunters by the Department. All of the licenses issued for hunting on federal and state land are issued to public hunters.

A drawing is held for public antelope licenses. Normally there are three to four times as many applicants as there are licenses available. When applying for antelope licenses, the hunters designate the area where they prefer to hunt. Where possible, the successful applicants are assigned to hunt in an area of their choice.

Resident licenses are $15.00 and non-resident licenses are $40.00. There is no restriction on the number of non-resident hunters that apply. Normally very few non-residents apply through the public drawing. Most of the non-resident hunters use landowner licenses.

If a hunter draws a public license, he is ineligible to apply for a public license the following year. A hunter may receive landowners' licenses every year.

Check stations are maintained on all antelope hunts, and the hunters are required to check in and out in person. The hunters are assigned to designated areas to hunt. This allows the Department to control hunter pressure and harvest on all antelope herds and to collect accurate harvest information.

Antelope hunts are normally a day and a half in length. They begin at noon on Saturday and continue through sundown on Sunday. In some areas, where the herds are widely scattered, the hunts continue for one additional day.

Statewide hunter success is normally around 60 to 70 percent. Success by individual hunt varies from 30 to 100 percent. Hunter success is primarily dependent upon whether a hunt is buck only or either sex. Poor reproduction the past three years has resulted in a considerable reduction in the either-sex hunting in the state.

Law enforcement on antelope hunts in New Mexico is rigid. As previously mentioned, all hunters are required to check in and out at checking stations. Normally they are required to be at the checking station just prior to the

beginning of the hunt. They are advised of regulations pertaining to the hunt and escorted to the hunting area by a member of the Department. Normally one or two conservation officers are assigned to patrol each hunting area. In addition to this, aerial patrol is provided in areas where enforcement problems are expected to arise.

Research

Research on antelope in New Mexico has been limited. A successful trapping technique was initiated in New Mexico in 1937. Food habits, parasite and disease studies have also been conducted. Currently we are conducting a study to determine factors limiting production in our deep-sand habitat types.

Discussion on New Mexico's paper by Snyder.

Haley asked what was the thinking behind the day-and-a-half season.

Due in great part to the control needed in having hunts on private land by agreement with the landowner. We do have high hunter success on this type of hunt. In one area we had 100 permits and in less than one day had 100 percent success. You usually have no trouble getting high hunter success on either-sex hunts. On our buck-only hunts we usually set up the number of permits to be a little less than the number of buck antelope actually counted on the area. Success usually runs up to 50 or 60 percent on the buck hunts. The main reason for the short hunt is that the ranchers prefer to have us get in and out in a hurry.

Russell comments on noon opening. It was difficult to get hunters scattered out over the ranches when the hunt started early in the morning. We also found that the hunters who had driven all night to get to the hunt area were less efficient and used less caution than those who started around noon. We keep the hunters at the check station until the opening. We take the hunters all out in one bunch at noon and the antelope haven't been disturbed. Normally about 60 percent of our kill comes that first afternoon.

Stewart asked Snyder to describe the application system.

The application form is similar to Arizona's. Hunters can apply up to four in a party on one application. They send in the money for the licenses with the application. We have a public drawing, using the IBM system. This speeds up getting information back to the successful and unsuccessful applicants. Hunters can apply for a first and second choice of area. If the hunter is unsuccessful in his first choice area and if there are permits left in his second choice area after the initial first choice drawings, he will be drawn for on that second choice area. The Southwest area of the state is the only one that normally is not fully subscribed for on first choice applicants, but the last couple of years this has been fully subscribed also.

Snyder gives rundown of harvest. 1961, we had our highest harvest. Normally in

either-sex hunting areas we open up the hunt to 40 percent of those animals we count on the surveys. This usually results in about a 30 percent herd reduction. This was done on most of the areas hunted in 1961. We had 300 permits in 1932. Fluctuated between 150 and 1,000 up to 1961, with the exception of 1958 when we had 2,000. In 1961 we harvested 3,900 antelope. We apparently overharvested quite badly in a few areas. This is primarily due to trying a technique that worked on good producing herds, on herds that were not producing well. Our fawn crop counts run from 100 fawns per 100 does down to 6 fawns per 100 does. Since 1961 we have reduced our antelope hunting considerably. In '64 we harvested 800; in '63, 700; in 1962 we harvested 1,600. The permits have been reduced to roughly 1,400 the last couple of years. Unless we have an increase in fawn production in some of these herds, I doubt that it will increase much.

Larsen commented that due to drought conditions we haven't had all of our good antelope producing areas in good shape at any one time in the last few years. If we have good conditions statewide, we can probably get back up to quite a few more permits. We could probably do that now if we could hunt all of our antelope herds, but some of them are very restricted due to their location on private land.

Yeaman asked that Snyder repeat the administration of landowner permit technique.

It is regulated by state law. We sign a written agreement with the landowner. He agrees to allow so many hunters on his land. In remuneration for allowing the hunters on this land, the landowner gets 10 percent of the total permits allowed for his area. We give him an authorization slip for so many licenses. He gives these to whomever he wants to have the license. The actual license is sold at the check station by the Game Department to the person who is going to use it who has this authorization slip in his possession. The 10 percent the landowner gets is free. With an additional 20 percent of the permits he can determine himself who gets them, although they must be paid for. Normally the free permits are not sold but are given by the rancher to his friends. In a few areas, the ranchers are starting to charge for these permits, but this is the exception rather than the rule.

PRECIPITATION VARIATIONS AND ANTELOPE PRODUCTIVITY

by
Parry A. Larsen
New Mexico Department of Game and Fish

How do fluctuations in seasonal and/or yearly precipitation affect pronghorn net productivity? By "net productivity," I mean the percentage of kids still alive and apparently thrifty when we make our annual surveys in late July and early August. These are the counts we go by when planning our management and hunts.

If we say it was a good or bad year, from a climatic standpoint, does the antelope reproductive performance match our evaluation of the climate?

It's easy to blame poor weather on kid crop failures, but I wonder if we don't sometimes use this as the easy way out to avoid a detailed analysis of the circumstances. Are moisture deficiencies alone capable of causing reproductive failures, or do they operate in conjunction with other factors? If precipitation and productivity are closely related, then the fluctuation of one should be matched by a predictable variation in the other. If moisture is decisive, are we most interested in yearlong, seasonal, or some other combination of precipitation data? I have some charts here with 4 combinations of precipitation data plotted against yearly kid crops. I wonder if you can see meaningful relationships here, or perhaps suggest other seasonal moisture combinations I might try.

A word about the source of this data. The kid:doe ratios were obtained from the Mesa area which has been one of our most stable and productive antelope herds over the years. Even though the herd is comparatively well balanced, you will note that observed productivity has varied from 118 percent down to 9 percent over a 14-year period. The Mesa area is slightly less than 200 sections. The seven ranches involved are all cattle operations, but the area is completely surrounded by tight sheep fence, so movements outside the area are nonexistent. Rigid control measures on the outside keep predator numbers low. The herd has been well hunted almost every year and kept in reasonable balance.

Annual aerial census is flown each July-August, with only 1954 and 1960 being omitted. For our comparisons it is unfortunate that we don't have productivity data for these two years. Nevertheless, we have good survey figures for 14 years, and this is the most systematic and continuous data we have. A U. S. Department of Commerce weather station is located approximately 10 miles west of the Mesa area, and complete weather records are available back about 20 years.

The first comparison of productivity and precipitation I have is the one most commonly made, that is, total rainfall during the calendar year. And yet, I doubt if many of us feel that a tabulation of precipitation on a calendar year basis fits in particularly well with the pronghorn reproductive cycle. A comparison of yearly moisture totals and yearly fluctuations in productivity, as measured by late July-August aerial surveys, suggests only a limited relationship of the two factors. It should be pointed out that in all cases our kid:doe percentages are an expression of an "all doe" count and the inherent error due to yearling does in the "all doe" group is recognized. The amount of error in recorded productivity will vary, depending on survival rate of the yearling female cohort, but some distortion is always present.

The first 8 years (1949-57) offer an interesting sequence. All 8 years are below the long-time average moisture level. This is a serious consecutive dry spell, yet we have 5 years of above-average productivity and 3 low years. The mean productivity for these 8 years is 66 percent, almost exactly the 14-year average.

During this 14-year period we have had three extremely low productivity cycles. In every case these were followed by years of dramatic recovery. The improvement is not gradual, but rather a marked increase to well above the average level. Also, peak periods of productivity do not seem to last more than 2 years; a severe decline follows. What are the management implications?

Spring Seasonal Moisture

A. Figure 1

This graph shows the same yearly recorded productivity, plotted against the moisture which fell during the March-April-May period. The hypothesis is that this is the period during which moisture would result in good or poor range conditions which would influence the mother during the period of greatest fetal growth, the parturition period, and first month of lactation. The theory sounds good to me, but as you can see, the relationship of the two functions is disappointing. It would seem only logical that good spring moisture and resulting green feed would encourage optimum kid survival. Yet two of the lowest productivity years, 1957 and 1961, are years when spring moisture was greater than the long-time average. These two years, however, follow population highs and perhaps a natural reduction was imminent, regardless of range conditions. It appears obvious that spring moisture cannot be isolated from other ecological factors to account for fluctuations in productivity.

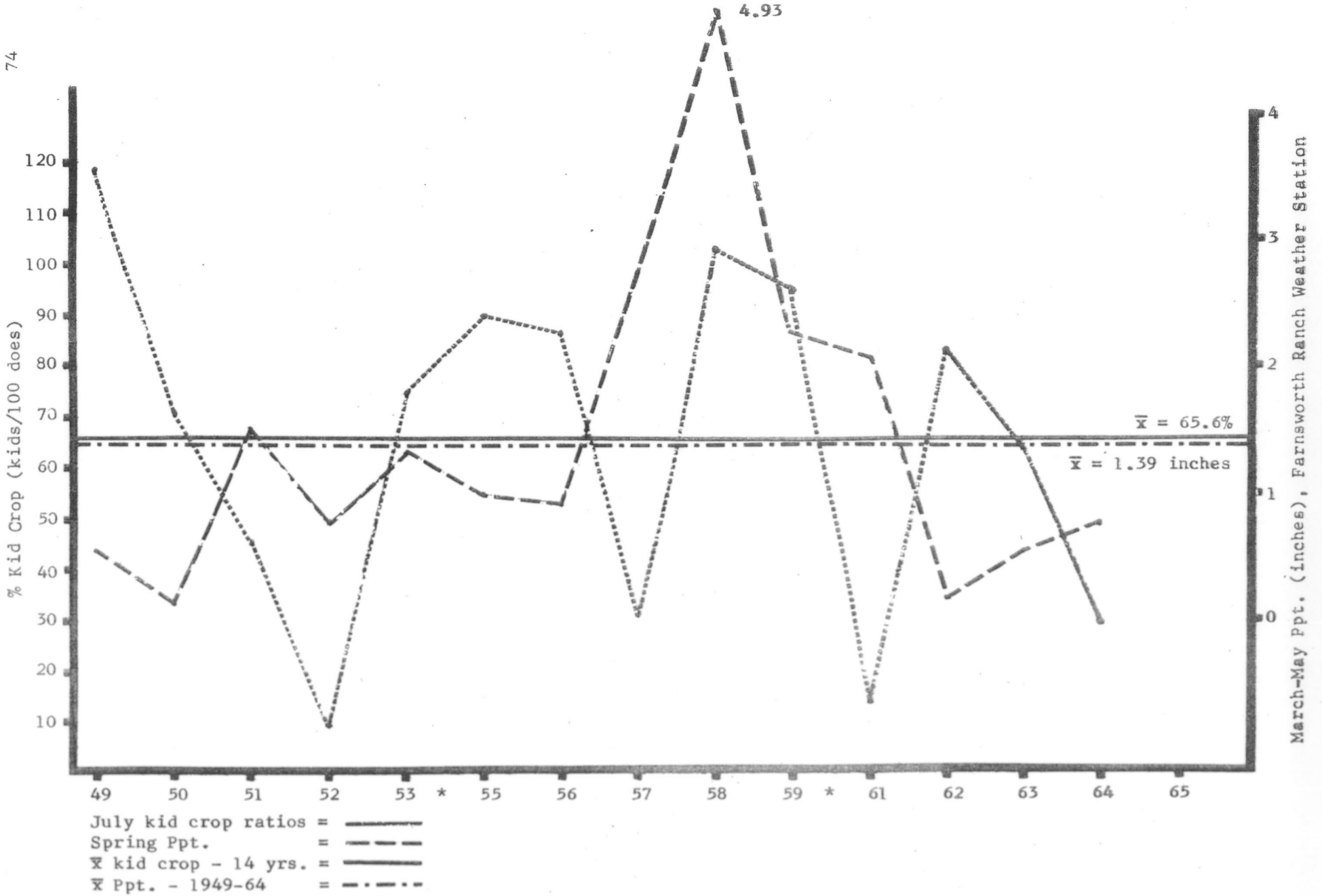
B. January-May, Figure 2

This comparison of productivity and January-May precipitation totals was developed subsequent to this meeting as a result of the papers given by Messrs. Hailey and DeArment (1965). These biologists from Texas felt that this expression of seasonal moisture was the most significant in influencing productivity the following summer.

Comparison of the two expressions of spring moisture (Figures 1 and 2) shows that neither appears to show a consistently better relationship to observed productivity.

Based on an analysis of the antelope reproductive cycle as well as empirical information, it appears probable that late winter-spring range conditions are a major factor in kid survival. Why, then, can't we demonstrate a closer correlation between the two sets of data? Two possible explanations are offered. Perhaps a measurement of rainfall alone is not enough. A given total amount of rain may vary considerably in its effect on developing vegetation, depending on prior range conditions, spacing of rains, etc.

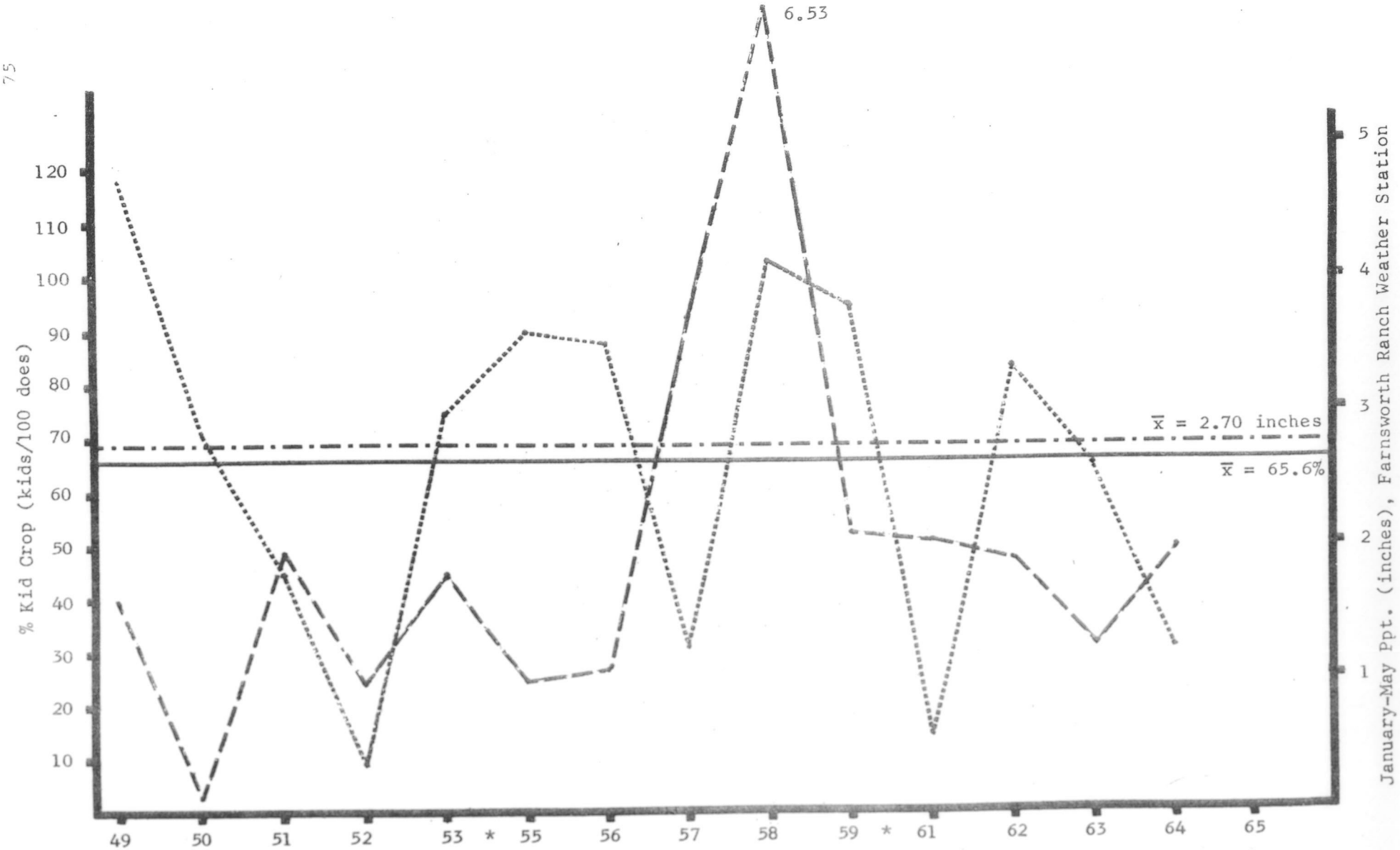
Our productivity data may be misleading because of the failure to distinguish annual proportions of non-bearing yearlings in the female counts. Actual quantitative measurements of seasonal abundance of food items may be the only way to demonstrate the relationship of vegetation and productivity.



Yearly fluctuations in March-May Ppt. and Antelope kid:doe ratios, Mesa, New Mexico, using March-April-May moisture as that which most affects spring and early summer range conditions, and ♀ Antelope body condition and kid survival.

* Years that are missing.

Figure 1



Yearly fluctuations in January-May Ppt. and Antelope kid:doe ratios, Mesa, New Mexico.
January-May = seasonal combination used in Texas (Hailey, DeArment, 1965)

* Years that are missing

Figure 2

Ecological Year, Figure 3

In the 1962 transactions of the Interstate Antelope Conference, Dr. Edson Fichter presents 5 years of estimated reproductive success, plotted against precipitation totals for these 5 "Ecological Years," September through August. An interrelationship of these two factors is suggested. This graph presents our Mesa data in an identical way, even though I suspect our "Ecological Year" may differ from that in Idaho.

These data suggest a positive relationship between the two functions. True, we still have the declines in productivity ending in 1951-52 and 1960-61, following "highs" in productivity; thus these "lows" may not be as serious as depicted. The other sections of the comparison seem to indicate an interrelationship. We recorded 3 successively good productivity seasons between 1952-56, during which time "Ecological Year" moisture remained below the long-time mean. The yearly totals are not seriously low, but together with the preceding year, make up a moisture-deficient period of 4 years. The fact that productivity remained relatively high, suggests the pronghorn's suitability to its niche. Other ecological factors evidently were advantageous, and evidently when combined are more important than moderate deficiencies in moisture. The fact that we do not have net productivity data for 1954 is especially regretable, as this would have been a most instructive period to evaluate in more detail. The agreement of the data since 1956-57 (excepting 1960-61) makes it appear that there may be, at times, a rather close relationship between "Ecological Year" moisture and kidding success.

Climatic Year, Figure 4

Using a premise similar to Dr. Fichter's, I developed a "Climatic Year" which I felt was more consistent with our weather patterns and its probable influence on antelope reproductive success. We have been measuring precipitation and forb frequency of occurrence based on this "Climatic Year" for the two years our project has been in existence.

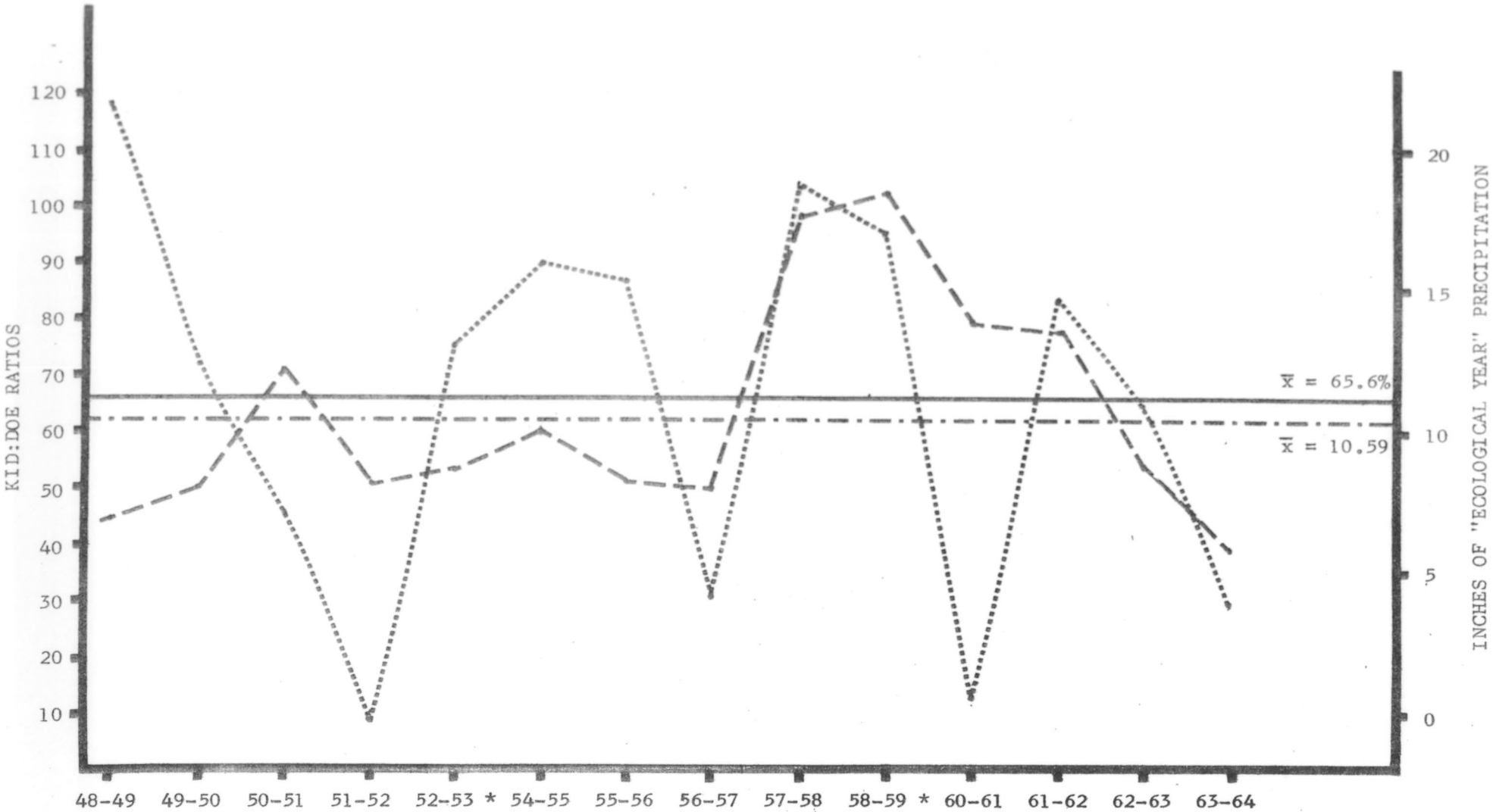
It can be seen that this two-month adjustment from "Ecological Year" to our "Climatic Year" does not result in much change in the indicated relationship of moisture and productivity. In places the agreement of the two functions is improved, but in other places it is reduced.

A statistical comparison of either of these two latter sets of data is needed. A mathematical correlation would give us a numerical confidence in the moisture-productivity relationship. A look at 1948-49 and 1960-61, however, will shake your confidence in the reliability of a prediction of net productivity based on known moisture. One thing is clear, we will be wrong in many cases if we blame poor kid crops solely on moisture deficiencies. A better understanding of the interplay of other major habitat factors and intrapopulation characteristics will have to be developed.

References

Hailey, T., and DeArment, R. 1965. Trans-Pecos Antelope and Antelope in the Texas Panhandle, Antelope States Workshop, Santa Fe, N.M.

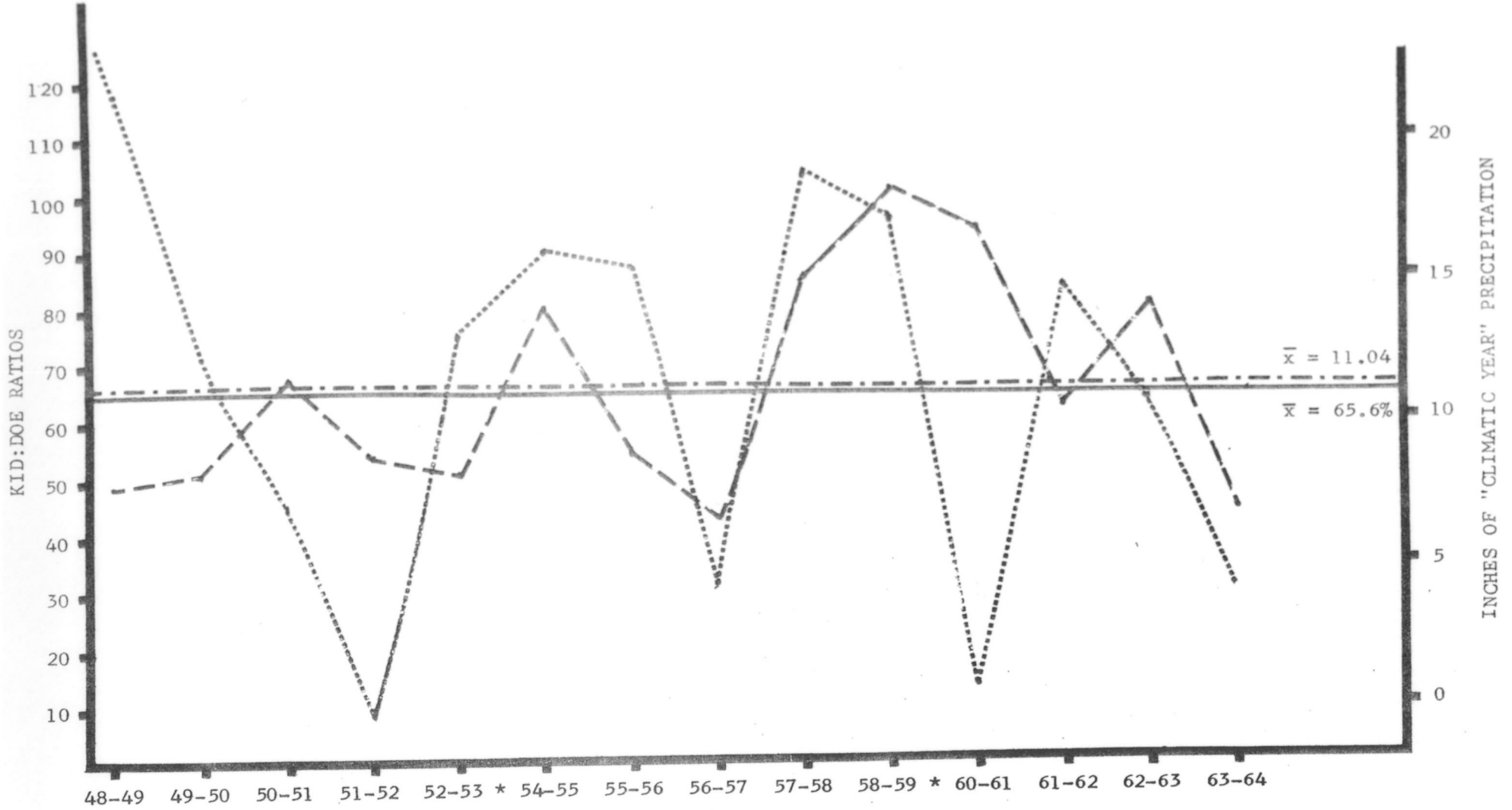
Fichter, E. 1962. Transactions Interstate Antelope Conference



Yearly fluctuations (ECOLOGICAL YEAR - FICHTER - 1962 - Sept.-Aug.) Ppt. x Antelope kid:♀ ratios, 14-year record - Mesa, New Mexico (Farnsworth Ranch Weather Station)

* Years that are missing

Figure 3



July kid crops = ·····

Yearly Ppt. = — — —

$\bar{x}$ kid crop = ————

$\bar{x}$ Ppt. = — · — ··

Yearly fluctuations (CLIMATIC YEAR - LARSEN - W-93-R-6, WP 4, Job 4 - July-June) Ppt. x Antelope kid:? ratios, 14-year record - Mesa, New Mexico (Farnsworth Ranch Weather Station)

* Years that are missing

Figure 4

Discussion of Larsen's presentation.

Snyder asked if there had been any indication of disease in the livestock, such as vibriosis, and Larsen answered, "No, there hasn't been."

Hepworth asked what the soil substrate was, if it were soleniferous. Hepworth suggested that they might consider coccidiosis among the possible disease factors.

Hepworth: You say that your fences are definitely predator-proof?

This was in the Mesa area, not in the LE problem area.

Hepworth asked Larsen to describe a coyote-proof fence.

A trench is dug and net wire is burried 6 or 8 inches in the ground. This is 4- to 6-inch mesh with 3 or 4 strands of barbed wire above the net wire. Whether it is actually predator-proof, I don't know, but they keep after any coyotes that get in.

Hepworth advised that they had actually observed coyotes and dogs climbing over the 5-foot, net-wire fences.

Haley asked about the statement of few eagles in the area during the kidding period and advised that they had seen 20 eagles or more along the New Mexico-Texas border during their fawn surveys.

Apparently the eagles in New Mexico tend to concentrate where the sheep are lambing which occurs in a slightly different area and a little earlier than the antelope kidding. Occasionally an eagle is seen in the area and may possibly take an occasional kid, but it could not be considered a major source of loss, since there are so few eagles at that time in the area.

Snyder asked about the coyote populations on the problem area.

We census coyotes during the denning period when they go around the waterholes. Water is piped to the waterholes and there is no water anywhere except at these areas. We feel that every coyote waters every night during this dry period. We figured last year on the LE problem area we had about $1\frac{1}{4}$ coyotes per section.

Huey asked if Larsen felt that there was any variation in observer efficiency over this period of observations of aerial surveys, and would this make any difference in the doe-fawn ratios. Also, were the doe-fawn ratios correlated directly with the population estimates at other seasons.

The total population has been more stable than the doe-fawn ratio or the kid crop.

Snyder advised that the harvest on this herd had been based on yearly surveys pretty consistently.

Huey suggested that it would be easy to take the doe-fawn ratio, the harvest and the survey and determine if the doe-fawn ratio appears to be accurate on the basis of harvest and population level.

Larsen advised he felt sure the doe-fawn ratio was quite accurate. His confidence was based on observing an inexperienced contract pilot and knowing that he made no errors whatsoever in determining fawns.

Huey commented that we don't want to oversimplify by attempting to find a single factor which is controling our reproductive success.

Larsen answered, "No, however, since we frequently do lay our reproductive lack of success to dry years, this should be investigated."

Lamb suggested that we ought to use a different ecological year than that of Idaho since this is probably not our ecological year in New Mexico.

Huey suggested that the difference would probably be minor.

Parsons asked if we were relying heavily on our forb picture for the spring months. He suggested that in his experience some forbs apparently follow a cyclic pattern regardless of rainfall. We may have a low forb occurrence in a particular species in a year with high rainfall and the following year, with low rainfall, you may have a high occurrence of that forb species.

Larsen: Certainly it is better to actually measure the vegetation than to measure the precipitation and assume its effect on the vegetation. In food habit studies in this general area, it appears that there is no one forb which is of major occurrence. There is a continuous variety of forbs occurring in the samples and no one which is dominant.

MacDonald commented that correlations should always have an ecological basis since it is possible to obtain a good fit statistically which may have no actual basis in fact.

Larsen agreed and said he felt the ecological basis of the correlations was sound.

De Arment mentioned that his chart of precipitation was taken for the year from July through June, rather than the calendar year.

ANTELOPE MANAGEMENT AND RESEARCH IN COLORADO

George D. Bear

Colorado Game, Fish, and Parks Department
Fort Collins, Colorado

ANTELOPE MANAGEMENT WORKSHOP

April 14 - 15, 1965

La Posada Inn
330 East Palace Avenue
Santa Fe, New Mexico

MANAGEMENT

Population and Harvest Levels

Current antelope populations are a prime example of what good management practices can accomplish. The antelope population in Colorado in 1860 was estimated to be 2,000,000 animals. By 1918 there were less than 1,000 antelope remaining in the state. The seasons and bag limits were very liberal until 1897, when the Department of Forestry, Game, and Fish set the daily bag limit of one antelope. Further restrictions were introduced in following years, until the Legislature closed the seasons in 1899. This law remained in effect until 1945, when limited seasons were again permitted. The antelope population increased to an estimated population of 14,000 to 15,000 antelope at the present date.

There are approximately 38,000 square miles of rangeland suitable for antelope in Colorado. These animals occupy approximately 30,000 square miles, or two antelope per square mile at present, thus, leaving room for expansion. It is estimated that antelope populations in the future may increase to as many as 15,000 to 20,000 animals before a leveling-off of numbers occurs.

A limited season was opened in 1945 due to complaints by ranchers in areas of dense antelope populations. There were 834 animals harvested during this season (Table 1).

Table 1. Colorado antelope license sales and hunter harvest during a twenty-year period, 1945-1964.

Year	Number of Licenses Sold	Percent of Harvest			Total Antelope Killed	Hunter Percent Success	Percent of Total Kill By Day		
		Bucks	Does	Fawns			1st	2nd	3rd
1945	1120	70	24	6	834	74	-	-	-
1946	1350	69	27	4	1113	83	-	-	-
1947	no season								
1948	no season								
1949	1277	60	33	7	1129	88	-	-	-
1950	2396	61	33	6	2148	90	-	-	-
1951	1893	62	32	6	1646	87	-	-	-
1952	2125	64	31	5	1922	90	-	-	-
1953	4951	65	32	3	4456	90	-	-	-
1954	4033	57	40	3	3338	83	-	-	-
1955	3900	58	39	3	3167	81	-	-	-
1956	3440	66	30	4	2969	87	-	-	-
1957	4027	62	32	6	3302	82	-	-	-
1958	2715	65	31	4	2262	83	-	-	-
1959	2237	69	28	3	1900	85	-	-	-
1960	1825	67	28	5	1713	94	80	17	3
1961	2153	63	32	5	1905	88	76	17	7
1962	2903	72	24	4	2588	89	75	20	5
1963	4512	68	28	4	4023	89	74	21	5
1964	5785	60	34	6	4885	84	70	25	5

The annual harvest of animals built up to a peak of 4,456 antelope in 1953, then declined to 1,713 in 1960. The number of antelope harvested annually has increased during the last four years. The highest harvest of antelope in the state, since the antelope hunting season was reopened in 1945, occurred last year (1964) when 4,885 animals were taken by hunters. The hunter success ratio has been quite high during the past fifteen years, approximately 80 to 95 percent. Bucks make up the larger portion of the harvest each year, approximately 60 to 70 percent, while does comprise 30 to 40 percent of the harvest, and fawns less than seven percent.

The antelope hunting license costs $10.00 and is limited to Colorado residents only. This license or permit is issued on a public drawing basis. The permit entitles the hunter to an antelope of either sex within a specified land area or management unit; except in a few localities where the hunters must kill a buck or doe as specified on their permit. License holders are required by law to return a hunter report card to the Department within 15 days after the hunting season.

Due to the increase of license sales during the period 1960 through 1963, revenue also has increased from $18,250 in 1960 to $45,120 in 1963 (Table 2). Revenue from antelope hunting license sales comprises approximately one percent of the total revenue received from big game license sales in Colorado, whereas, in comparison, deer hunting license sales comprise approximately 75 percent and elk licenses 20 percent of the total revenue received.

TABLE 2. The relative economic value of the various big game license sales in Colorado, 1960-1963.

Year	Type of License	Number of Licenses Sold	Revenue	Percent of Total Big-game License Revenue
1960	Antelope	1,825	$ 18,250	0.6
	Deer	163,043	2,156,062	75.2
	Elk	39,447	683,950	23.9
	Mt. Sheep & Bear	-	8,720	0.3
	Total		$2,866,982	100.0
1961	Antelope	2,153	$ 21,530	0.6
	Deer	200,811	2,584,397	76.3
	Elk	44,406	771,660	22.8
	Mt. Sheep & Bear	-	9,976	0.3
	Total		$3,387,563	100.0
1962	Antelope	2,903	$ 29,030	0.7
	Deer	214,407	2,954,222	77.4
	Elk	46,798	824,020	21.6
	Mt. Sheep & Bear	-	10,631	0.3
	Total		$3,817,903	100.0
1963	Antelope	4,512	45,120	1.0
	Deer	231,234	3,358,915	77.3
	Elk	51,268	906,000	20.8
	Mt. Sheep & Bear	-	37,835	0.9
	Total		$4,347,870	100.0

Hunting Seasons, Methods, and Law Enforcement

The antelope seasons in Colorado have been held primarily in September. Occasionally a special season has been held later during the winter months to reduce antelope numbers in problem areas. September seasons are normally of three-day duration. A permanent opening date has been set for the third Saturday in September. As shown in Table 1, 70-80 percent of the antelope shot during the past five years have been harvested during the first day of the hunting season, 17-25 percent killed the second day, and less than seven percent the last, or third, day.

Due to the open nature of the habitat occupied by antelope, most hunters pursue antelope from, or through the use of a vehicle. There is a law which states it is unlawful to pursue game animals with a vehicle, but it is not strictly enforced. Hunting laws are enforced by Wildlife Conservation Officers or other management personnel patrolling the hunting areas. A few check stations are established, but they are primarily for research purposes. In the past, violators were generally tried in a "Justice of The Peace Court"; but due to a recent change in the judiciary system in Colorado, violators are now tried in a District Court.

Census and Survey Techniques

All early estimates of populations or counts were made on the ground by wardens or field men. Due to the limited nature of ground counts, it is doubtful that accurate counts were obtained on the total number of antelope occupying the several areas. Aerial censusing was started in Coloardo during 1947. At present both ground and aerial counts are used to determine antelope herd structure and numbers.

Antelope ranges are divided into management units or land areas delimited by definite land features. The units vary in size and shape. Aerial counts are conducted on the shortgrass prairied regions of eastern Colorado during the period extending from February through April while the counts in the western part of the state are conducted in April and May, due to the persistence of heavier snow-cover. These are total counts; sex ratios are also conducted at this time. These early counts are complete or cover the entire antelope ranges. A second count, a fawn-doe count, is conducted in late July and August to determine the reproductive success. This second count is a partial census. Only a portion of each management unit is randomly sampled, the actual area dependent upon coverage needed to count and age a sufficient number of antelope. The state is divided into four regions for administrative purposes, and a pilot and airplane are assigned to each region. A DeHaviland Beaver, Piper Super Cub, Cessna 182, and Cessna 180 are aircraft recently used during aerial census work. The pilot is responsible for the aerial antelope counts in his region following a schedule established by the Regional Game Biologist. Field men serve as observers. Some effort has been directed toward obtaining the same observers to count specific areas each year, thus standardizing the counts to some degree.

Aerial census techniques used are similar to those employed in other states. Flying altitude is maintained at approximately 100 to 300 feet above the ground, depending on the topography of the land and the stability of the air. Flights are conducted in early morning and evening whenever possible. Census strips are generally one mile wide, but may be narrowed in rough terrain or during poor census conditions.

RESEARCH

Past research was directed toward transplanting antelope and several aspects of their life history. This work was conducted primarily in the eastern portion of the state on the plains. "Antelope trapping was initiated in Colorado in 1947 and continued through early 1955. A total of 1,999 pronghorns were trapped from six locations on the eastern plains and transplanted to 21 different sites where antelope were wanting or nearly extinct. By 1959, twelve of these transplant herds had increased to the point where open seasons were permitted" (Hoover, et. al., 1959, p. 82). Much care and work was directed toward surveying new transplant sites. A rule of thumb offered was as follows: there should be at least one square mile of native grass for each animal, and the number of animals should not be less than 100.

Fetal development was also investigated and fawns were captured and tagged. The investigators (Hoover, et. al.) examined 42 pregnant does. Most of these females, 92.9 percent had twins while only 7.1 percent of the does had single fetuses. The sex ratio of the fetuses was nearly equal. The investigators also described the morphological development of antelope fetuses. There was 228 fawns captured in the period from 1947 to 1955. The average return of tagged antelope was 11.9 percent; most of these animals were shot less than 10 miles from where they were initially tagged. Also, most of the tagged animals were shot before they were three years old.

Stomach samples were taken from antelope for food habits studies. There were 320 samples collected during the period from 1947 to 1955, the

majority of these were taken in the eastern part of the state. Samples were obtained mostly during hunting season; some were obtained from antelope shot during crop damage control work, and a few were intentionally collected. Browse and forbs were the major food items eaten. Browse was most important during the winter months and the forbs during the spring and summer months when they were succulent.

Antelope were examined for parasites and diseases. There were 40 antelope examined, and the investigators (Hoover, et. al.) concluded that parasites and diseases at that time didn't constitute a management problem in Colorado.

A two-year study on antelope behavior was completed last fall by a Wildlife Management graduate student at Colorado State University; but the results have not yet been analyzed and published.

Present studies are directed toward population dynamics and census of antelope. Two antelope populations are under study, one in the shortgrass regions in north-central Colorado and the other population is located in a shrubby habitat in the northwestern part of the state. The study is concerned with the age and sex structure of the herds and sources of mortality. The other portion of the study is directed toward evaluating the aerial and ground census techniques.

Studies to be undertaken are a food habits study in the shrub dominated rangelands in western Colorado, a physiology study, and a basic study of bitterbrush mortality on antelope ranges.

Research problems under study and studies to be started in May, 1965, as part of the Colorado Federal Aid Project entitled Antelope Investigations, W-40-R, are as follows:

Sex and Age Composition of Antelope Herds

The objectives of this study are to obtain sex and age counts for at least two major herds in the state, test various aging techniques, and to obtain information on antelope mortality. Study areas were established in Larimer and Moffat counties where major antelope concentrations exist in two different vegetative types, the rolling prairie region and in the areas characterized by a shrub overstory. Check stations are established on both study areas during the hunting season to gather information on the number, sex, and age of the antelope killed by the hunters; also, to obtain data for evaluating various aging techniques. Young to adult ratios are obtained from aerial and ground counts in late July; while sex ratio counts are conducted at other times of the year. Age distribution is to be plotted and potential increase predicted for each herd from this data. An effort is also made to gather information on other sources of mortality through the year.

Antelope Census

Aerial and ground counts are made on the two study areas mentioned above. Helicopter counts are made in late July and early February. Fixed-wing counts are made at monthly intervals to determine seasonal variation in census techniques and between types of aircraft. Counts are made three times each day--early morning, mid-day, and late afternoon. Data on vegetative type, visibility, wind and air conditions, air temperature, distribution of animals in the herds, sex ratios, and age ratios will be gathered. Ground counts will be conducted from a vehicle with the aid

of binoculars and a spotting scope on pre-determined transects. Comparisons will be made with aerial counts.

The Moffat County Bitterbrush Mortality Study

Shrub covered rangelands in northwestern Colorado have been very productive antelope ranges. Some of the area is dominated by bitterbrush, which appears to be an important plant species in the welfare of the antelope occurring in the area. Recently the bitterbrush has started "dying-off" at a rapid rate. The purpose of this study is to evaluate the bitterbrush mortality in the area and to provide estimates of bitterbrush, big sagebrush, and rabbitbrush densities. Permanent plots will be established along line transects. Each bitterbrush plant on each plot will be tallied in one of six classes, depending on the relative percent of the crown cover still living. The total number of plants and the percent coverage for each browse species on each plot will also be recorded. Percent coverage shall be determined by angle gauge readings.

Food Habits of Antelope

Food habits of antelope have been studied on the plains region of eastern Colorado, but such work is lacking on the browse ranges of western Colorado. The objectives of this study are to determine the food preferences and foods eaten by antelope living on a sagebrush and bitterbrush range in Moffat County, Colorado. Three antelope shall be collected for stomach samples each month throughout the year. Observations will also be made on feeding animals: the amount of time antelope spend feeding during each day, the time of day they feed, the vegetative type they are feeding within, the plant species they are feeding on, and the general condition of the vegetation at the time of the observations shall all be recorded.

Physiological Studies of Antelope

The objectives of this study are to measure the physiological and morphological characteristics of antelope collected seasonally to establish "physiological norms" and to provide basic morphological data as related to sex and age class, Moffat County, Colorado. Three antelope are to be collected each month for a food habits study and these animals will also be used for this study.

Blood samples will be taken as soon as possible after the death of the animal and later analyzed for blood chemistry and cell volumes.

Two carcass weights shall be made in the laboratory; a bled weight and an eviscerated carcass weight.

External body measurements to be made are: ear length, head length, head width, neck circumference, hoof length, hind feet lengths, tail length, mammary gland dimensions, scrotum dimensions, horn measurements, and girth.

Pelage colors and pelage color patterns will be recorded.

Length, width, and depth measurements, weights, and volumes shall be made on some of the glands (adrenals, thymus, thyroid, pituitary, testes, epididymides, prostate, and ovaries) and on some organs (liver, kidneys, heart, spleen, lungs, brain, eyeballs, and stomach).

Several measurements are to be made on the lower mandible.

The length and width of the uterine horns, vagina and cervix and the weight of each of these organs will be recorded for all female reproductive tracts.

Fat deposition measurements are to be made on the brisket, rump, mesentary, kidney, and the marrow of the left femur and tibia.

LITERATURE CITED

Hoover, R. L., C. E. Till, and S. Ogilvie. 1959. The antelope of Colorado. A research and management study. State of Colorado, Dept. Game and Fish. Tech. Bull. No. 4. 110 pp.

Discussion on Colorado paper by George Bear.

Snyder asked if Colorado was burdened with much private land in their antelope range.

No, most of the land is open. The hunters talk to the ranchers to obtain permission to hunt and some may charge a fee, but this is not normal.

Huey asked whether the Department or the hunters contact the landowner.

The Department contacts the landowners.

Huey asked how large are the hunt areas.

They vary in size. The units are set up on the basis of easily recognized landmarks.

Larsen asked if hunters could hunt in any area within the hunt unit.

Yes.

Gordon asked if there was a system for landowner permits.

Yes. The landowner has one permit reserved for him and the landowner himself must use the permit. A fee system is very uncommon.

Huey asked whether hunters must leave their vehicles at ranch headquarters.

Yes, and this system works well where landowners are reluctant to open areas.

Larsen stated that Colorado harvests 4,000 in a population estimated at 16,000, which gives a 25 percent reduction. Is this reducing the Colorado herds?

No, the populations are climbing rapidly.

Larsen commented that we kill only approximately 10 percent of the herds in New Mexico.

Bear: Doe-fawn ratios are from 95-125. These are productive herds and they have been increasing in the last few years.

Yeaman stated that in Wyoming the populations are increasing but some areas are poor in reproductive success.

Haley stated that reproductive success varies with moisture in spring and summer in Texas.

De Arment stated that the fawn-doe ratio was very low in the Texas Panhandle.

Gordon asked if there was any restriction against driving off highways or ranch roads.

Bear: There is none in Colorado.

Yeaman noted the estimated 2 million antelope in Colorado in 1860 and less than 1,000 in 1918 and asked if Bear had any explanation as to why this great loss.

Apparently it was due to indiscriminate hunting.

Gordon asked about Colorado's experience with the net wire fence problem.

It has not been a major problem since 1939. We are waiting for the results from Wyoming studies.

Huey asked whether most of the antelope movements that occurred were due to heavy snow conditions.

Yes, there are no great movements in other seasons. Antelope moved 30 to 40 miles this winter. This was unusual. Normal movement is about 5 miles.

Gordon asked if all of the aerial survey work was 100 percent sample or whether they used any strip samples.

They have started a study to figure the appropriate subsample for census work.

Gordon asked if they census all areas 100 percent every year.

Yes, but they are trying a subsample with a 100-percent survey every 4 or 5 years.

Yeaman asked about the percent accuracy of their aerial survey.

Bear replied that they studied the costs and compared the results of helicopter survey with fixed-wing survey. They found there was no difference in the surveys in winter. In July and August there is a considerable difference with the fixed-wing survey counting 76 percent of what the helicopter counted.

Snyder asked if they have their main survey in the winter due to the grouping of antelope.

Yes, but it is better in the spring when groups have begun to break up and antelope are in somewhat smaller groups.

Snyder asked if they surveyed in July and August for fawn crop.

Yes.

Gordon asked the ratio between the applicants and license holders.

In 1963 there were permits left over. Hunters are now permitted to apply each year for antelope permits rather than every other year.

Larsen asked what success hunters had in the areas where they had to hunt afoot.

Success was good. Hunters appeared pleased with the idea and the ranchers prefer it greatly.

Snyder asked if the percent kill ran high to bucks in hunter choice areas.

Yes.

Yeaman asked what the fee for resident antelope licenses were.

$10.00.

Yeaman asked why Colorado hunters bothered to come to Wyoming for antelope.

They're out for trophy bucks. In Colorado, with the intensity of hunting, the age composition runs high to 2-year-old animals. The herds are young. There are few bucks over 3 years old. In Colorado they have a study area set up to determine how close they can crop the herds. There are six to seven hundred antelope in a fenced pasture. The cripple loss in brushy country has run approximately 20 percent of the permits. Part of this cripple loss may be due to the fact that doe or fawn only permits are issued, which makes hunters occasionally leave does with horns in the field.

Gordon asked if such high cropping stimulates reproduction.

No information yet, but perhaps the study will show.

GENERAL DISCUSSION SESSION

Huey asked the group by states what was the most important problem they faced in antelope management.

New Mexico - Snyder: The most serious management problem other than harvest regulations and obtaining proper harvest is in the kid loss in certain years. This could be boiled down to reproduction and/or survival.

Larsen: We have a fluctuation in July kid:doe ratios of from 9 to 118 percent. This figure in one of our stable herds. The problem is apparently statewide.

Russell added the problem of sheep fencing, suggesting that the two were probably related.

Huey expanded on this by stating that fawns might not be able to negotiate fences that adult antelope could in moving to water or areas of rainfall where food production was better and thus this might influence fawn production or survival.

Wyoming - Hepworth: Probably the two most important problems are distribution and changes in land use, sagebrush spraying and changes in livestock use.

Larsen asked if Wyoming was getting less sheep.

Hepworth: No, but the distribution is changing.

Huey asked if the concern with sagebrush spraying was for the effect on the antelope or for the reduced vegetation.

The reduced vegetation. The importance is due to the fact that on the winter ranges, sagebrush is often the one plant that limits antelope distribution.

Huey asked how effective the sagebrush spraying was.

They do not reseed and the sagebrush does come back. They allow the natural vegetation to come in.

Yeaman asked if this problem was taking place in other states the way it is in Wyoming.

Huey thought that the fencing problem was getting more and more serious and we

were going to be concerned with it more and more as time goes on. Building fence is becoming the thing to do to avoid keeping an expensive sheep herder. This is being encouraged by the BLM.

Hepworth thought that Wyoming's problem was more critical than New Mexico's or Colorado's because of the snow conditions.

Huey stated that in New Mexico restricting movement to areas of local moisture was more important than movements because of blizzard conditions.

Stewart pointed up the loss of considerable antelope range due to fencing around the Roswell area and the complete elimination of some antelope herds.

Huey commented that with respect to spraying in New Mexico, we have seen more chaining and reseeding than spraying, both pinyon-juniper and sagebrush.

Huey commented on an area that had been chained about four years ago and the sagebrush had come back very succulent and green. The sagebrush is now associated with good grass where it wasn't before.

Stewart commented that the BLM is not planning to do any seeding in the Farmington area now - they will just chain and let the natural vegetation come in. No spraying will be done.

Huey asked De Arment what he considered the most serious problem facing antelope in the Panhandle area of Texas.

Reproduction and survival, low doe-fawn ratios and the need to find out why. There is no fencing problem since it is all cattle range.

Haley commented on the Trans-Pecos area, the low numbers due to low fawn production. The problem of noxious vegetation, specifically the tarbush, is one that is related to poor conditions when this is the only thing available. It is present in all the antelope ranges. There is a problem with fencing in that area. Although it is cattle range, they are already putting up sheep-proof fences which does limit antelope movement.

Russo, commenting on Arizona's problems: They also have reproduction problems and some of the antelope areas are being converted to summer home areas.

Huey commented, or rather asked, if anyone thought that there was direct competition between antelope and livestock.

Hepworth mentioned that there is some competition directly between sheep and antelope when they are on the same range. On the desert ranges, the winter antelope range is summer sheep range so the competition is not direct.

Haley commented that on the Trans-Pecos area the competition problem is getting less severe since some of the former sheep range is going out of the sheep business.

In South Dakota, habitat improvement on wintering ranges is needed. South Dakota also mentioned interstate movement as a complicating factor.

Colorado also indicated that their major problem was survival of young. Spraying of sagebrush is becoming a problem and there is some damage to winter wheat by antelope.

Huey asked if the group thought that we could benefit from some cooperative investigations on some of these problems.

Haley commented that Wyoming's fencing study would certainly help them. They had been contemplating something similar but hadn't yet done it. The reproductive problem would probably be different in each state.

Huey commented that the problems of reproduction in New Mexico, for example, are probably different from those in any other state.

Huey: Probably one solution to the fencing problem would satisfy the problem in all states. Huey suggested that if Wyoming's fencing study is far enough along, perhaps we could participate in cooperative studies to test the effectiveness of some of the structures.

Hepworth advised that they were planning to discontinue any more pasture-confined fencing structure tests since it is impossible to duplicate the circumstances that are found in the field. There are basically four types of fences or combinations of fences and devices to let the antelope through that we would like to test in the field. We are not yet in a position to outline this study but are considering it. We haven't made a proposal to the BLM yet, but we are considering one for an ecological study on antelope. If this program is consummated, the fencing study will become a part of it.

Huey wondered if it would not be to our mutual benefit to cooperate with the BLM in the other states and go along with fencing under certain circumstances to provide tests for the various structures.

Hepworth thought that this is the approach we are going to have to take.

Huey: Our BLM has approached the New Mexico Department for the sum of money which they want to put into wildlife development on a cooperative basis.

Huey advised that they wanted to spend $70,000 in New Mexico on wildlife and they wanted us to cooperate with them. One of the things we discussed with the BLM was the fencing problem and some of the structures that could be put in fences with the idea of alleviating antelope problems in those areas.

Comments from Hepworth: Once the report on the antelope fencing study is available we will be in a better position to recommend what type of structure should be used. We anticipate this report to be available within 6 months.

Hepworth: We do have a copy of the thesis now.

Hepworth advised that they do have some opinions but they haven't had an opportunity to go through the entire study and evaluate it.

Huey suggested that Hepworth, when he had an opportunity to evaluate the report,

suggest to the rest of the states how they could best approach a test study of these structures, cooperatively. We could prepare a job description or something of that nature and send it to all the participating states and ask them, if they could, to participate in the investigation. This would provide an opportunity for replications under varied circumstances.

Hepworth: The thing that concerns Wyoming is that if they go into a multiple-use program, the 32-inch fence is not high enough to hold cattle, and net wire is a must if they are going to hold sheep. Apparently the problem is going to have to be faced by a structure which allows the antelope to go over or under, or perhaps a let-down type of fence. We are not convinced that a fence will be the answer.

Huey: In talking with Dick Kerr of the BLM, apparently the sheep areas in the northern half of New Mexico that are still under herders, are rapidly becoming uneconomical. And, apparently the sheep will be practically gone in a very short time unless the BLM stimulates fence-building.

Hepworth: This is what they are doing in Wyoming at the present time.

Huey: This sort of thing started in New Mexico 20 years ago on private lands.

Huey commented that although the private lands are already pretty well sheep-fenced, it might be possible to go in and put structures on some of their fences if they were interested in getting their antelope back.

Parsons commented that in Texas, some of the larger sheep operators are taking a long look at the profits from antelope and thinking of setting up a program directly for antelope. This would include all wildlife and recreation, not just antelope.

Comments by Huey: The reproduction and survival problem seems to be pretty much a local one, unless someone has other comments.

Larsen commented on the false impression of reproductive success given, due to the presence of large numbers of yearling does in the population. Larsen asked if the other states make any sort of adjustment in their surveys to compensate for this factor.

Hepworth commented that this is actually an apparent doe-fawn ratio and these apparent ratios need to be adjusted. In Wyoming they take this into consideration.

Hepworth: You can probably assume that your survival of yearling males is roughly the same as your survival of yearling females and you can obtain your estimate of yearlings in the herd from the yearling bucks which are identifiable.

MacDonald commented, reference the individual problems regarding reproductive success, that in anything as complex as this, there are several different approaches that can be taken, even though the problem may not be the same in any of the states; we might reach a consensus here as to who is going to take what approach to determine their problem and compare notes on the different techniques to be used. This might avoid a certain amount of duplication of effort, even though the final results might not be the same in any one of the states. Certainly the techniques in getting at a population dynamics study are comparable even though the ultimate problem might not be the same.

Huey: Perhaps we should ask the states if they have any plans over the next year

to conduct investigations into the causes of reproductive failure and of the causes of poor survival rates.

Bear: We have a study in Colorado that is underway, which will attempt to determine some of the mortality factors.

Haley: In Texas we hope to get started this year on a long-term study, including trapping and marking, collection of reproductive tracts, disease studies, parasite studies, just as comprehensive as we can make it.

De Arment would like to further continue this low doe-fawn ratio study in the Panhandle country, continue the disease work. We are also collecting several fawns to take down to Texas A & M.

Snyder: If we could work out some sort of an agreement between the states here to better disseminate the information about the jobs we're conducting and the information we have collected, it would be of considerable benefit to all the states.

Huey suggested that perhaps twice each year, maybe January 1 and July 1, we could present to the interested states, a compilation of any information on antelope that the states believe would be of interest to the other states. We could send completion reports that were done during the 6-month period to a central location, and I volunteer New Mexico for this year. This central location would put all the reports together and disseminate them to the individuals. Perhaps the individual states could send 25 copies of each report.

MacDonald suggested including Job Descriptions as well as Completion Reports so that you can tell what is going to be done as well as what has been done.

Lamb: This sort of thing was done by the Browse Revegetation Committee and it worked very well for several years.

Huey agreed that this information would be gathered, collated, and distributed to the interested states and individuals.

Huey asked Russo what plans Arizona had for conducting investigations of survival and reproduction. They plan to get research involved in this. A lot depends upon the time that research can give. We would like to get some kind of an answer as to what might be happening there.

Huey: I don't see how we can, at this stage, present a unified approach to this problem of reproduction and survival. We can keep each other informed as to what we are doing. I don't think we know enough about it or have gotten close enough to find anything out about it to be able to develop a unified approach.

Huey asked Wyoming if their general research approach to reproductive failure would be a disease approach.

Hepworth: No, we intend to investigate all the possibilities that there are.

With reference to South Dakota's stated problem of poor range conditions on their winter ranges, Huey asked if anyone had given any thought to range improvement through anything like revegetation projects. Huey asked also about water units.

Hepworth: This is an area we are definitely giving consideration to, but we don't have any plans for anything yet. The BLM was interested in getting into this area.

Larsen commented that he thought that New Mexico did not have an extensive problem of water due to extensive stock waterings, with the possible exception of the Navajo country.

Huey pointed out the Tres Piedras area where the sheep herders were carrying water twice a day to the sheep and probably that the antelope were potentially suffering from lack of water in that area.

Yeaman: We worked a memorandum of understanding with the BLM. The BLM shared the expense of the original cost and installation. The Game Department assumed the cost of studying the effects and the upkeep.

Hepworth: The rainfall in the area where we put the guzzlers was far below normal, and yet they maintained their water supply throughout the summer.

Huey asked if they were preparing to conduct a detailed evaluation of these guzzlers.

Yes. This past year was Wyoming's first year at evaluation. Utah has done a lot more work.

Hepworth: The initial idea of these guzzlers was mainly to benefit sagegrouse, but we found we were getting a lot of antelope use and a lot of cottontail use.

Huey: We have recorded a lot of antelope use on the guzzlers we have put in for the prairie chicken on the east side of New Mexico. We don't know if the antelope would disappear if we took the units away.

MacDonald: In your evaluation of the water units, have you done any control studies or have you depended upon utilization to determine the effectiveness.

Hepworth: We are attempting to keep antelope in an area where the guzzlers have been put and where they did not stay before.

MacDonald: Then, in effect, you have a control from a preguzzler study of the fact that antelope did not use this area.

Lamb: The next question is whether the increase in antelope use for the guzzlers came from the antelope that were in surrounding areas and the total herd did not increase.

Larsen: This sort of evaluation would serve our purpose. We would not need to evaluate our own, necessarily, if we had documented evidence that they worked somewhere else.

Huey asked Wyoming if they had studies underway or if they contemplated studies to investigate the effect of sagebrush spraying.

Hepworth: We are evaluating the spraying on a statewide basis. We are trying to catalog all of the spraying that has been done and all those areas that are anticipated in the future. I appears that this program is going to be stepped up by

all agencies, including private landowners, and if so, we will be out of the sagebrush business.

Huey: You are as concerned about your sagegrouse as you are about your antelope, are you not?

Yes. Our recommendations are being made by both bird men and big game men.

Huey: Are you conducting any studies to evaluate livestock competition?

Not at present. We do have one study on sheep-antelope competition in a sagebrush-grassland type. This is year around competition, not limited to any particular season.

Yeaman: With reference to sagebrush spraying, in working with the BLM and Forest Service, both agencies notify the Game Department prior to any spraying that they plan. Both their men and ours evaluate the situation. These investigations are more of a biological reconnaissance than a detailed study.

Discussion was held concerning a name for the group. Several of the participating states are not members of the Western Association; therefore, it would not be advisable to consider this group a subcommittee of the Western Association of State Game and Fish Commissioners. Decision was reached to call the group The Antelope States Workshop. The question arose as to whether membership in the organization should be limited. It was decided that the individual states would be voting members and other participants, such as federal agencies, would be guests rather than actual members. We would have one man from each state be the representative and information could be funneled through him. It was decided to hold the meeting in Denver next year. Bear will make arrangements. The time was set sometime around the middle of February to be decided by Bear.

Huey suggested that the chairmanship of the group should rotate with the host state. This was agreed.

Huey commented that many directors stated that they were burdened with out-of-state travel restrictions and that there were an awful lot of meetings to be attended now and he suggested that we assure the directors that this is contemplated for a two-time meeting and that at the end of next year's meeting, we would evaluate the results so far before determing whether to continue.

MacDonald suggested that perhaps we could meet every other year, alternating with the elk committee which has decided to meet only once every other year.

Selection was made of some of the representatives for the states present. Newman was named for Wyoming, Parry Larsen for New Mexico, George Bear for Colorado. The other states did not name their representative at this time. Everyone who wishes to come will be invited but there will be but one official representative from each state.

Hepworth suggested discussing the possible agenda for the next meeting.

Huey suggested that sometime late in the year, each state send to George Bear their recommendations for what they have to present on the agenda and perhaps what they think someone else might have, and from that, Bear could prepare the agenda.

Discussion was held concerning the advisability of preparation of a bibliography of antelope literature. The group decided to wait until next year when a committee could be appointed if it was deemed advisable.