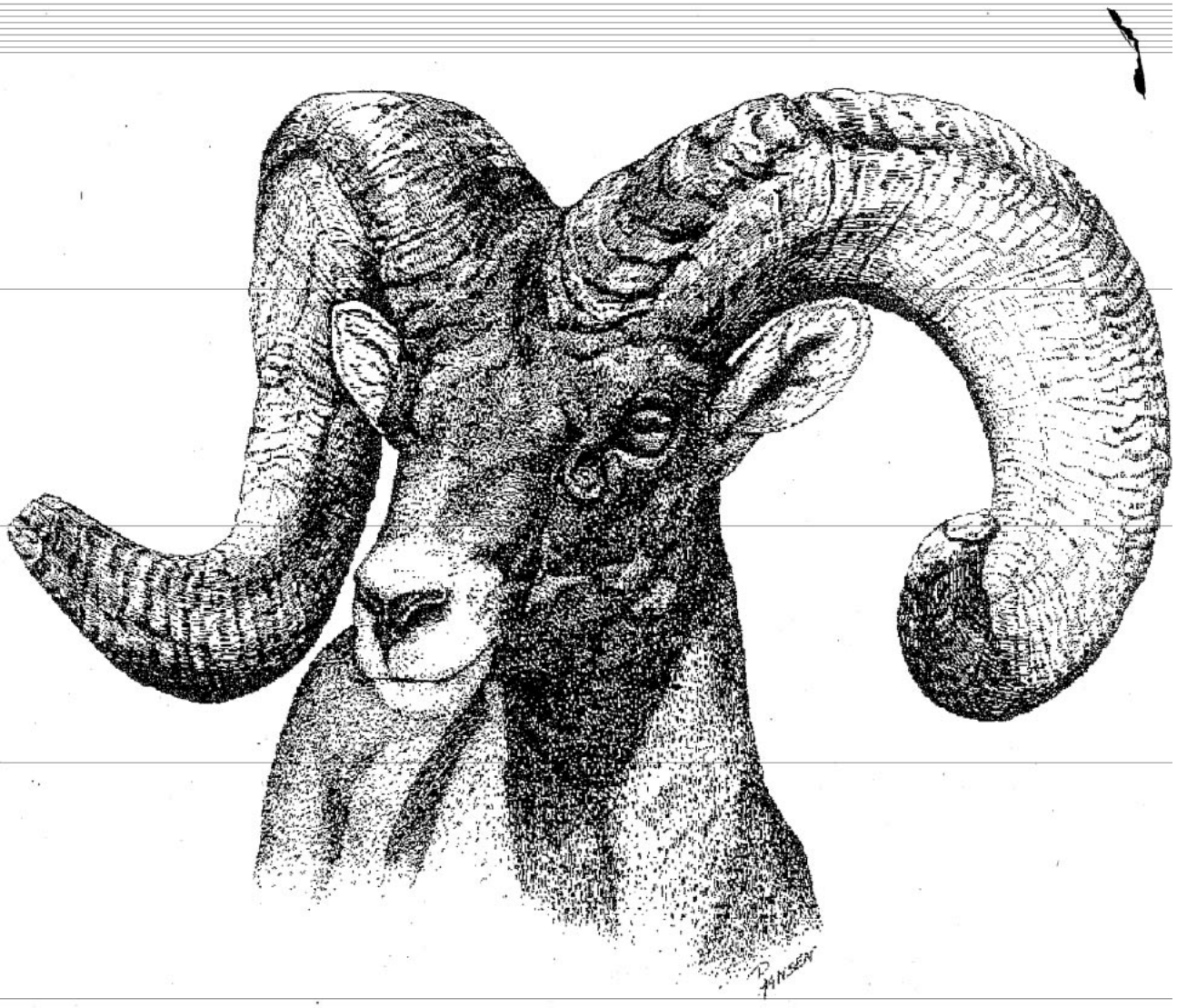
DESERT BIGHORN COUNCIL TRANSACTIONS



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Desert Bighorn Council

THIRD ANNUAL MEETING

DESERT BIGHORN COUNCIL

APRIL 7–8–9–10

FURNACE CREEK

DEATH VALLEY, CALIFORNIA

Welcome Address Given
By

C. Gordon Fredine
United States National Park Service
Washington, D. C.

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EFFECTS OF BURRO ON DESERT WATER SUPPLIES

Richard A. Weaver
Game Manager I

Introduction:

It is the purpose of this paper to describe the effects of the wild or feral burro on desert water supplies, particularly as they relate to wildlife, and as observed in California's southeastern desert area by the water development crew of California's Department of Fish and Game.

The many other aspects of the burro-wildlife relationships, such as over-gram, plant succession, erosion and incompatability, will not be dealt with at length here,

It is generally felt that, on its range, the feral burro competes with the native game species such as bighorn sheep, deer and quail, and with *the* introduced chukar partridge, The burro's effect on desert water supplies can be generalized in three categories--total usurpation, physical destruction, and nuisance habits,

Usurpation:

Burro can and do totally usurp small water supplies. Natural and artificial tanks that depend on rainfall to replenish their water supply have been drained dry by burro, leaving no water for other animals. At small seeps and springs, burro will use the total water supply as fast as it becomes available,

The burro is a large animal and uses proportionately more water *than* the game species use. The burro is more dependent on water than are many of the native game species. I have never found evidence of the burro ranging more than eight miles from a source of water, The burro is the dominant creature on most of his ranges, and the competition for water in areas of limited supply is acute,

Physical destruction:

The burro's hooves are formidable weapons and effective tools, capable of destroying a water supply by breaking pipelines. Ranchers, miners and other desert residents have experienced this although it has not occurred on any Department of Fish and Game water development to date. Such pipeline destruction usually occurs where the pipe *is* exposed rather than buried. At a small leak, where they are unable to water, the burros apparently will paw at the pipe so relentlessly that they eventually break the pipeline at a coupling. They are reported capable of breaking new steel pipe of two inches or more in diameter.

Cement and masonry pools constructed by the department to accumulate developed spring water have been destroyed in the same manner. When the stored water is depleted the thirsty burro, trying to get more, keeps striking with its front hooves until the basin breaks out. This usually occurs at remote sites where materials have had to be back-packed in, where it was impossible to find good aggregate, and the resulting structures have not been strong enough to withstand the burros' pawing. Water developments where salvage metal containers were substituted for cement have also been destroyed by burros.

At some remote water developments detritus accumulates in canyon bottoms from.heavy burro traffic, choking diversions built to protect developments, with the result that storm water, silt and debris has buried the development. This requires repeated maintenance.

In some instances the trampling of burros making heavy use of a spring may reduce or entirely 'stop the flow of water. This so compacts the earth that water is unable to emerge or is partially dammed. Our development crew has found that when this compacted earth is picked through to the rock formation from which the water is coming, an increased flow usually results,

In all fairness to the burro, he frequently uses his hooves to uncover water by pawing out large holes, sometimes several feet deep. This may occur in a sand or gravel-filled natural tank. The result is water available to other forms of live, either until it disappears from use and evaporation or until a storm fills the hole again.

As an example of what burros can do with their hooves (though in this case it neither increased nor destroyed the water supply), we have seen a spot three feet in diameter that was pawed out of hard rock at a seep that was too small to supply their needs. Over a long period of years their relentless pawing had worn a concave semi-circle in the rock.

Nuisance habits:

One of the strongest objections to the burro stems from their habit of fouling the water. Some water becomes extremely befouled with an accumulation of burro excreta. This is serious at tanks and small seeps that do not clean themselves as would a running stream. The pollution and stench become so strong that other animals either leave the area or use the polluted water only as a last resort. Continued trampling and pawing keeps these polluted sources roiled. Where burro are eliminated, these extreme conditions clear up and the water becomes useable again.

One of the ranchers' strongest objections to the burro is their monopolizing of water sites, keeping stock and wildlife away. For hours at a time they loiter around the site, standing in the water if possible. Ranchers claim that calves, trying to water, have been kicked and trampled to death by burros. Even though the bighorn and other animals may not be kicked to death, the deprivation of their vital water supply surely takes its toll.

In general, it is felt that the wild burro is incompatible with both wildlife and domestic stock. Where bighorn sheep are forced to share a watering site with burros, they are seldom there at the same time. The bighorns must wait until the burros leave, and then the water supply may be completely depleted or reduced to an insufficient amount.

Control:

The simplest and most effective measure to eliminate the problems described in this paper is the elimination, or at least the reduction, of the burro populations. Where this is not possible, a careful evaluation of water development sites should be made. Water development can have a very adverse effect on game populations if it results in increased burro use. A decrease in the area's game populations would be the inevitable consequence. Our crew has actually refrained from developing some springs for this very reason.

If water development is done in burro range, care must be taken to make all structures strong enough to withstand burro damage.

The fencing of watering sites to let the bighorn use the water but exclude the burro is worth consideration, but the situation where this is possible is indeed rare. In addition, a burro-proof fence is costly and difficult to construct.

A narrow cut, or tunnel, to the source of water has been used to improve springs and eliminate the chance of pollution since, in such a situation, the burro cannot defecate in the spring.

EFFECTS OF WILD BURROS ON BIGHORN IN DEATH VALLEY NATIONAL MONUMENT

Lowell Sumner
Regional Research Biologist

When a severely limited environment is invaded by a large, non-native animal with a fairly high breeding potential and no natural enemies, new pressures on the environment are inevitable. Sane native plants and animals give ground. Such an invader is the wild burro of Death Valley, a region where the severe limitations of food and water are self-evident,

The theoretical multiplication rate of a pair of wild burros can be calculated: Assuming that under extremely favorable conditions the females would have a colt every year after reaching the age of two, and assuming (for convenience) that their productive life span is 30 years, then one pair of wild burros and their progeny could, at the end of 30 years, total 65,536 wild burros.

Burros were brought to Death Valley 100 years ago, and have run wild for at least 40 years. The original strays *must* have started with much more than one pair. Obviously, the burro populations have been curbed by some factor. The evidence even indicates some decrease during recent decades from a peak wild burro population for *the* southwest as a whole (McKnight, 1958, p. 172).

Control by man would have had to reach astronomical proportions to have been a major factor in this decline, and there is no evidence of this type of control on any'such scale. Evidence of disease as a factor is wholly' lacking. The most obvious control factors have been shortages of food and water. Here the evidence is by no means lacking--it is continually mounting.

Questions that now need mare precise answers are: What has been the price, in terms of impaired watershed protection and desert ecology, of allowing the burro populations to reach a peak and then decline through self-generated shortages? What native wildlife has declined because of these shortages of food and water?

For at least 25 years, biologists have deplored the impoverishment of desert food and water supplies by wild burros to the detriment of other wildlife--particularly the desert bighorn. We can summarize their findings here. But we must also acknowledge that observations on conflicts between burros and bighorn so far have been quite casual and generalized. The conspicuous lack of detailed knowledge on this subject is the basis for a special plea at this time for an organized life history and ecological study of the wild burro-preferably as a cooperative project by various wildlife agencies and institutions represented here.

In Death Valley, observations of wild burro activity versus desert bighorn extend from 1935 to 1959, recorded independently over the years by approximately five park rangers, a park naturalist, six park biologists, and eight biologists from other institutions and cooperating agencies. Their testimony over this 24-year period has been the same: Where the burros have increased markedly, the bighorn have dwindled or disappeared. On the other hand, places where bighorn still come to drink regularly, and in considerable numbers, seem to have one thing in common: they are not visited by wild burros. Other biologists who have made similar observations elsewhere include Russel Grater, John Russo and Gordon Gullion (McKnight, p. 172).

Since about 1941, wild burros have been absent or virtually so, from all the mountains bordering the east side of Death Valley. These rugged ranges comprise the most consistently dry and barren mountain terrain in the Monument. It may be no accident that this very barren, but burro-free, area has yielded higher sheep counts than the much better-watered, and more spacious, mountains on the west side of the Valley.

We used to be quite sure that the west side mountains with their large wild burro populations now contain only a fraction of the total sheep population, despite the fact that those mountains afford a larger and originally more favorable sheep habitat. To a degree, this still appears true, but since 1955 the discovery in the Panamint Range of some important sheep areas that have not yet been invaded by burros, such as Twin Springs and Blackwater Spring, has raised our estimates of sheep numbers for the west side to some extent, and indicates that the burros have not yet brought about such a totally lopsided distribution of sheep as had been feared.

One must be careful not to place all the blame on the wild burro in the many cases where the establishment of mining camps in the vicinity of springs once used by bighorn has been an additional adverse factor for the sheep. However, the general picture of burros through their own activities displacing bighorn in large uninhabited portions of the west side mountains seems fairly well demonstrated by numerous observations made since 1935, of which the following provide a sample:

In the Panamint Range

Butte Valley: Sheep were reported as common prior to 1915 and even into the early 30's; by 1935, there were "large herds of burros, no evidence of sheep," Wild burros continued abundant there from 1935 to 1958, when 200-250 were estimated to be visible from the road during an interagency inspection by the California Department of Fish and Game, California Department of Agriculture, U. S. Fish and Wildlife Service, Bureau of Land Management, and National Park Service. Since the 30's, bighorn appear to have disappeared from the area entirely. Impoverishment of edible vegetation has been extreme.

Eagle Spring was in use by bighorn in 1935; in 1935, it was invaded by burros and there was no evidence of bighorn. In 1955, Richard Weaver

and Fred Jones noted some old sheep pellets in the vicinity.

A spring north of Wingate Wash was in use by both burros and bighorn in 1937, the respective use being separated by a rocky obstruction that protected some water and considerable vegetation for the bighorn. In 1939, a cloudburst was found to have removed the barrier and the vegetation, The burros had hill access, and there was no evidence of bighorn.

In the Cottonwood Mountains

Burro and Rest Springs have had heavy and continuous use by burros commencing long before 1935. In that year, there was still occasional use by bighorn; in 1937, three rams were observed at Burro Spring. By 1939, the forage was severely depleted but occasional tracks of bighorn were still observed. Today this region is one of the classic examples of denudation by burros. Richard Weaver counted over 60 in that drainage in 1958. There have been no bighorn observations about the spring for years.

Pinyon Spring (about 2-1/2 miles from Burro and Best Springs) received some bighorn use in 1937 in spite of heavy concentrations of burros. In 1938 and 1939, there was heavy infestation and pollution by burros and diminished bighorn use. We believe this situation still exists.

Cottonwood Canyon is well-watered, but has been heavily browsed and trampled by burros and trespass cattle for more than 50 years. A few bighorn inhabit the adjacent rough slopes, and appear to feed occasionally on the canyon floor; however, we have no record of sizeable numbers such as one would expect if the edible vegetation had not been browsed by burros into hedge-like forms, where not removed altogether.

The *two* Dodds Springs and Grapevine Wash have experienced a similar history. In 1935, 34 bighorn were counted in this well-watered and formerly well-vegetated area, mostly lambs and yearlings. By 1938, wild burros and some cattle had invaded the area; bighorn sign was scarce though still present. In 1939, burros were plentiful, bighorn sign scarce, and the vegetation extensively denuded. This is the situation today.

What happens when bighorn and wild burros actually meet at a spring has seldom been observed. Mr. Phil Day, who has prospected and lived for about 25 years in Death Valley, related that once when he cautiously approached a spring through tall brush to catch one of his burros, he saw a ram suddenly rush forward and catapult itself against the ribs of the burro, which took off at a high lope and did not stop for a long distance.

But the outcome of such encounteres is biologically irrelevant. Mr. Day himself considered burros to be seriously detrimental to bighorn, Scarce desert forage and water consumed by herds of burros is not recovered by the bighorn population because of the quickness of an occasional ram.

The foregoing emphasis on springs would be misleading if it gave the impression that the burro-bighorn conflict is largely confined to water. Our observations have been made near water in large part because our bighorn census work was focused at the water holes. But when bighorn stop visiting springs used by burros, much more than water usually is involved. As Mr. and Mrs. Ralph Welles have written (1959, pp. 206-209), "The status of the feral burros is regrettably clear and has finally fallen into proper perspective..his effect on forage, vegetation, wildlife in general, erosion control and watersheds is increasingly and alarmingly clear. Some areas on the western slopes (of the Panamint Range) have already been so devastated that they will not recover in our lifetime. In some sections of the Arcane Meadow area, the ground and vegetation has the appearance of having been harrowed, the grasses and annuals which were not eaten having been pulled up by the roots and pawed under."

What specific information do we have on forage competition between burros and bighorn? Hardly any. Mr. and Mrs. Welles (1959, pp. 21-22) have recorded 43 bighorn food species for the Death Valley region, mostly for the east side at the lower elevations. The California Department of Fish and Game has compiled information for the Death Valley area showing 13 species of forage plants used by wild burros. To this, the present writer can add possible Shadscale (Atriplex canescens), although the presence of cattle in a few instances renders this additional evidence uncertain. In any case, the meager information on wild burro food habits comes from areas that very incompletely overlap the habitat where most of the bighorn information for Death Valley has been obtained.

Three of the burro food plants, Spiny hop-sage (Grayia spinosa), White Bursage (Franseria dumosa), White Burrobrush (Hymenoclea salsola), are rated by the Welles as lightly used by bighorn. The same would apply to Shadscale (Atriplex canescens)observed by the writer. How many first-choice bighorn food items are eaten by burros we cannot say. Although circumstantial evidence points to heavy competition, adequate management and protection of both burros and bighorn requires that we replace inference, however strong, with definite knowledge.

This brings us again to the plea made earlier, for an adequate burro research program. We urgently need to know-what wild burros eat and how much, how much they drink and at what seasons, how far they can travel from water and to what extent this limits their further distribution. Before we can evaluate the requirements and magnitude of a management program on lands occupied by both burros and bighorns, we must determine the effective reproduction rate of wild burros, the mortality pattern and the possibility of any limiting pathology, herd territories and seasonal migration habits, the principal ecological effects of wild burros on vegetation, water and other wildlife, and the most appropriate available methods of burro management and control.

All agencies, institutions and organizations having interests and responsibilities in the protection of desert wildlife and vegetation where

wild burros occur--and in the protection of the wild burro from his own eventual self-destruction--have a stake in a program of wild burro research. If the agencies gathered here today that are concerned directly or indirectly with wild burros could pool their efforts, each contributing what it could to a joint program, our effectiveness in managing the neglected, but ecologically very important, wild burro would be tremendously increased, and the future for both burro and bighorn would be brighter.

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EFFECTS OF WILD BURROS ON RANGE CONDITIONS

Nelson Elliot
Bureau of Sports & Fisheries Wildlife,
U.S. Fish & Wildlife Service

Although the presence of wild burros generally have long been recognized in desert and semi-desert areas of the West, their effects on range conditions are difficult to evaluate as no specific studies on the subject have been made.

Generally resource management officials, livestock operators and biologists agree that the presence of wild burros in the scantily vegetated areas they usually occupy, aggravate range and wildlife management problems.

Range management programs of governmental land administering agencies and stockmen include regulation of wild burro populations in efforts to balance animal use with carrying capacities. Likewise wildlife management agencies place emphasis on regulating wild burro populations to minimize competition with wildlife species dependent upon forage on game ranges.

In the absence of control measures wild burros soon increase beyond the carrying capacity of the range and cause excessive competition with both livestock and game. It is essential therefore that reductional measures be taken to at least minimize such competition.

There have been concerted efforts in several sections of the southwest to remove burros from the range with the result that former populations have been reduced as a whole. Unfortunately such a decrease is not evident in much of southeastern California and particularly in and adjacent to Death Valley National Monument. In this region excessive numbers of burros appear to remain almost constant. Prior to enactment of the California burro protection law from 35 to 50 animals were collected annually during November and January from the same vicinity of Panamint Valley, the Argus Mountains and Saline Valley for a period of five years during which there appeared no noticeable decrease in burro numbers.

Wild burro numbers in this region are exceeding the carrying capacity of the range and have for at least the past decade. Over concentrations have seriously depleted ranges in several sections. With no noticeable population fluctuation and restricted control by man other controlling factors are apparently involved otherwise with the reproduction potential a significant increase should have occurred. The most obvious factors appear to be shortage of food and water. In absence of effective control this continually mounting damage to already badly abused range could well become permanent.

There has long been evidence that as over-grazed ranges become depleted burros will move to ranges not previously occupied perhaps to avoid starvation. For example, when Lowell Sumner counted $big-horn sheep in the Dodds Springs-Grapevine Wash area in 1935 there were no burros in this formerly well vegetated area.. By 1938 wild burros had invaded the area. In 1939 burros were plentiful and the vegetation extensively denuded.

There seems little doubt that when burros remain concentrated they will determine the fate of desert ranges. As Mr. and Mrs. Ralph Welles have written, "The status of the feral burro is regretably clear and has finally fallen into proper perspective---his effect on forage vegetation, wildlife in general, erosion control and watersheds i's increasingly and alarmingly clear. Some areas on the western slopes of the Panamint Range have been so devastated that they will not recover in our life time.

Although specific studies have not been made on wild burro range relationships to be sure many similar studies on various range manage-ment problems have been made. We have data on range use and require-ments for domestic livestock and studies have been made relative to competition between livestock and certain big game species. To cite a few, for example, the following studies were conducted under the Cooperative Wildlife Research Unit Program in 1958 alone:

Effects of domestic livestock exclusion on vegetation in the Sonora Desert (Ecology, 38(3).

Carrying capacity of various vegetative subtypes and the influence of livestock on carrying capacity for white-tailed deer in southern Arizona.

Plant succession and utilization by livestock and big game in a sand dunes area in Freemont County, Idaho.

Such studies undoubtedly will contribute helpful information to game management. Although your combined knowledge represents the nation's most reliable information on the management of desert dwelling wildlife it appears essential that specific studies on wild burro range relationship are needed as an aid in managing the welfare of Desert Bighorn Sheep.

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WILD BURRO LEGISLATIVE PROBLEMS IN CALIFORNIA

Walter S. Ball, Chief
Bureau of Rodent and Weed Control and Seed Inspection
California Department of Agriculture

Back in 1952 a press release pointed out the presence of wild burros in some of California's desert ranges and suggested that they were acceptable game animals protected by no closed season. This led to a few hunters taking the field, some dead burros and some very loud protests from humane organizations and interested citizens.

Early in 1953 a bill was introduced into the California State Legislature making it an offense to kill burros in California. This so-called "burro law", passed as a temporary measure, is now a permanent part of the Fish and Game Code. No other state has recognized the burro in its laws, either by declaring it a game animal or providing for its protection.

A measure passed by the California Legislature in 1957 established a major burro sanctuary in the Death Valley - Saline Valley - Panamint Valley areas which is designed to afford protection for a certain number of burros. Without proper management a concentration of burros within the Sanctuary eventually will lead to an over-concentration . which in turn leads to the burros depleting their range. Fortunately the present law provides for the issuing of permits to capture burros for the purpose of domesticating them as pets or beasts of burden, The number of permits and the number of undomesticated burros which may be taken under such permits is determined by the Department of Agriculture which, according to law, bases its determination on the number of undomesticated burros necessary to properly preserve and maintain the species in relation to the available land,

To make this determination it has been necessary to rely on the combined knowledge of the Department of Fish and Game, U. S. Bureau of Land Management, the U. S. Fish and Wildlife Service and the National Park Service. In this way it may be possible to maintain at least some control on the number of burros in the Sanctuary, if people will go to where the greater number of burros are concentrated, Permits to capture burros for use as pets or beasts of burden are usually issued for one or two burros. If the applicant requests a greater number of burros for use as pack animals and he is not known to us as a packer an investigation is made, Applications to capture burros in large numbers for use in burro races, old Miner's days, and similar events have not been approved. Questions to the applicant as to the ultimate disposition of the burros have never been answered. Spot checks are occasionally made to determine the success of the permittees.

We have issued 248 permits to capture a total of 681 burros for use as pets or beasts of burden. Of this number of permits 22 were issued for a total of 337 burros for use in pack trains. Death Valley National Monument lies within the Burro Sanctuary and by agreement with the National Park Service we include upon our burro permits a statement that, "in addition to this permit a special permit must be obtained from the National Park Service to capture burros within Death Valley National Monument". We have been told by the Park Service that at least 150 burros have been captured within the Monument so we know that all of the permittees do not report to us when burros are captured.

Primary responsibility for the enforcement of the sections of the Fish and Game Code pertaining to burros lies with the Department of Fish and Game. Complaints have been received by the Fish and Game people that persons were trying to catch burros for dog food or to sell out of State. Investigations have revealed that in most cases these persons had a valid permit issued by the Department of Agriculture to capture burros as pets, In one case, where an arrest was made because the persons catching burros did not have a permit, the court ruled that the ranchers paid taxes on the burros on their land and that they had a right to catch the offspring. Enforcement of the burro law except where the suspect is apprehended in the act and is on public domain is almost impossible because:

1. It is not possible to distinguish a wild burro from a domesticated burro.

2. Burros, imported into this State are not required to be inspected or branded.

3. Licensed sales or auction yards are not required to maintain a true and complete record of transactions, involving burros such as is required for transactions involving horses and cattle.

Some violations of the burro law probably occur but there is little that can be done other than patrol the burro habitat as time and manpower permits and thus hold violations down to a minimum.

Section 4187 of the Fish and Game Code states that any owner or tenant of land or property that is being damaged or destroyed by burros may apply to the Department of Agriculture for a permit to kill such burros. We have investigated several complaints of burro depredations; and in addition to the common complaints of the burro consuming available forage, fouling water holes, and destroying pipe lines, same ranch owners state that burros consume the cottonseed meal which is fed to the cattle at intervals. In same desert areas supplemental feeding is usually done during June before the summer rains and in the winter months. The burros soon learn the feeding areas. In addition to investigating these problems ourselves, we seek advice from the U.S. Bureau of Land Management and other agencies before issuing permits to

kill burros. So far only one request for a permit to kill 25 burros has been received. The request was granted and it is expected that we will soon receive other requests. We hope that the unlimited granting of permits for the capturing of burros for pets and pack animals will keep the burro population under some kind of control so that it will not be necessary to grant many permits to kill burros. Obviously all of this is not even a good management plan, but it appears to be the best that can be done under the present legislation.

INTERRELATIONSHIPS BETWEEN WILD BURROS AND BIGHORN

Chairman: Malcolm N. Allison
District Agent for California,
Branch of Predatory Animal and
Rodent Control, Bureau of Sports
Fisheries and Wildlife

DISCUSSION: (Note: The tape recording was not referred to. Therefore this is a review of the discussion).

Kelley: What is your idea about fencing - is it practicable?

Weaver: I do not feel that fencing is the answer. It is expensive and does not seem to get the job done. There is a considerable maintenance problem in connection with it also.

Sumner: The use of railroad irons for posts, heavy net wire and large boulders arranged on the inside and outside of the fence allowing the sheep to leap in and out of the enclosure would seem feasible.

Question raised as to whether the lambs would be able to use the water in connection with this type of water fencing.

Aldous: I do not recommend fencing around water..

Russo: You do not have to worry about the lambs as it has been my experience that wherever the adults go the lambs can follow.

Sumner: The burro population in southern California is estimated at 4,000.

Ogren: Suggested money raising plan for study in this respect in the amount of $35.00 from members of the Council.

There was no action taken on this proposal.

Elliott: Announced that bill had been introduced with respect to Federal regulation in connection with the burros,

Ball: Gave responsibility of the State Department of Agriculture with respect to management of burros. Under the present law it was hard to tell what the outcome would be as they had proceeded cautiously in issuing permits. Further there was no way to determine outcome of success or failure of permittees.

There was an informal recommendation that the Council should form up a project in connection with the burros. The chairman recommended such action and by popular demand of the group, Lowell Sumner was chosen as Chairman of a research project including food studies, and to select the members. At a business meeting formal action was tkaen in this respect.

Garland R. Farmer, D.V.M.
Major, U.S.A.
Atomic Ehergy Commission
Las Vegas, Nevada

Ladies and Gentlemen:

I am most happy for the opportunity to appear before you to discuss some of the things we are doing. I should like for you to know that the Atomic Energy officials, for whom I work, extend their greetings to you; also, their regrets for not being able to drop in on you, It is through their sincere interest and concern with these problems that I am able to appear before you, My purpose is to inform you of the work that is being undertaken jointly with the Desert Game Range at Las Vegas on a study of radioactive fallout as it pertains to the desert big horn sheep.

In 1956, 1957 and 1958 we have taken the hock joints from as many desert bighorns as we could get. The largest number usually is taken during the fall hunting session, when we are able to get a joint from each of the animals that is shot. First, let me tell you a little extra work we are doing that we call the off-site animal investigation project. At the Nevada Test Site we have a test herd of 50 cattle on which a complete radio-analysis is being done. In conjunction with our herd, there is a herd operated by the University of Nevada at Caliente, Nevada and Contact, Nevada. The results of this project are not yet ready for publication but should prove to provide an extensive amount of information on the metabolic chain of some other radioactive fission products.

I should like to tell you briefly a little about radiation and how it affects an animal body. Essentially it involves the water molecule. Water molecules subjected to gamma radiation, for example, will became a positively charged water radical and give off an electron. A positively charged water molecule will react with another water molecule and may produce hydrogen and hydroxy radicals. The electron on the other hand will react with a water molecule to produce a negatively charged water molecule. This electron will then react with another water molecule to produce hydrogen radicals and hydroxy radicals. Radicals are extremely reactive chemical entities. It is through the reaction of these radicals that damage is done. Suffice it to say that the hydroxy and hydrogen radicals in the presence of water produce hydrogen peroxide. Hydrogen peroxide then is liberated in the tissues or in the cell. We all know hydrogen peroxide is a powerful oxidizing agent. It oxidizes other cell constituents and this causes radiation damage and death. Were we to plot the amount of fission products liberated during an atomic explosion we would find a double peaked curve. At the top of each curve would appear strontium 90 and iodine 131. These are two of the most troublesome of our atomic fission products. Furthermore, if we were to plot the decay of fission products we would find

that in every seven hours the level of radiation is decreased by one-tenth. For example, if at zero time there were 100 units of radiation present, after seven hours we would find only 10 units present. In another seven hours we would find one unit per, etc. Why then, the problem of strontium 90? It is because, while other elements decay, strontium 90 is being built up. The reaction from Kr. 90 to Rb. 90 takes 33 seconds; from Rb. 90 to Str. 90 takes 2.7 minutes; from Str. 90 to Y 90 takes 20 years. Y 90 turns to stable zirconium in 62 min. This is why strontium 90 continues to be a problem long after other decay fission products have decayed. Essentially we deal with three sources of radiation. The alpha particle is a high energy particle but is unable to penetrate even a sheet of writing paper. It therefore constitutes no fallout hazard unless it is ingested. Beta particles are able to penetrate a sheet of paper but unable to penetrate deeply into the skin. When they fall on skin or tissue they will produce Beta burns but again our main hazard is if they *are* ingested. Gamma rays which are high energy x-rays are able to penetrate almost any thickness of any material and these are the source of danger in fallout areas. For purposes of discussion relative biological effectiveness values are given the three particles. Gamma and Beta are given one each and Alpha particles are given a value of ten. Radiation sickness is usually classified as either acute or chronic. In the acute form we find there is nausea and vomiting, a latent period of one to three days, fever, epilation, hemorraghic diarrhea, nervous derangement and death. In the chronic form we find first a leucopenia, epilation, serility, mutations, cancer, bone necrosis, and catarracts. In either case the onset of symptoms and the type of symptoms will be governed by the' amount of radiation received and the time during which the radiation was administered; that is, quickly or slowly. None of these things we expect to see in the desert bighorn or the deer. We are looking for the long term effect of the strontium 90 which is assimilated in their diet. At the present time on studies conducted on deer there is an average of 8.5 strontium units in the males and 8.2 in the females. In the bighorn we have found an overall average of 4.7. Strontium 90 is reported in strontium units. It deals with so many atoms of str. 90 to each *gram* of calcium in our bodies, actually 1 uu curie of str. 90 to each gram of calcium. It is based on str. compared to calcium. Str. is displacing calcium. In the human the safe tolerance is considered 100 S.U. per gram of calcium and it is built up from there. 100 S.U. in a man is the permissable limit because they figure the average man has 1000 grams of calcium in his skeleton. Each man then is allowed 100 str. units for the whole population. If everyone in the world used as much or ate as much str. 90 as they could, each one of them would get 100 units. Now if you have some people working in a factory who are exposed to str. 90 as industrial workers and there is no population problem, then 1000 units are allowed. That's considered safe, so you see we are really down in the small figures when we are dealing with 8 S.U., because if this were a man he would get to have 100 units and we have 8 in our deer and 4.7 in our bighorns. So you see we won't see too many effects right away. But still we are going to compile the data over the years and let it build up to see what happens in the next 20 years. The people that want this information

are going to be very pleased in another 5 to 10 years when they can go to the Desert Game Range and look at the chart and see what these levels have been. Also, we will add our information on deer from Oregon and Minnesota. The reason I picked those two States is because there is a lot of rainfall up there and we usually get a heavier rain out of str. 90 so they should have good information for us in those areas,

Question: Gary, would you guess then that the str. level would be higher in Oregon or Minnesota than in our area? From worldwide fallout rather than just the local?

Answer: Yes, it will be. It is said the safest place in the world from the fallout is in the interior valley in California where there is hardly any rain.

Question: On these S.U., when I worked for the AEC we used the Public Health system that included sunshine units.

Answer: It used to be that sunshine units were 2.22 disintegration per second. Now we use str. units which is 1 microcurie of str. to each gram of calcium,

Question: In other words, these units can be used the same.

Answer: Yes, I *think* they can be. The thing that we want to know is bits of information that arise in our bighorn sheep study. In 1956 and 1957 we find there is twice as much str. found in'57 as there was in "56.

Question: Is that 4.7 figure an average for the two years?

Answer: Yes. It's really not fair to make a simple average like this. Many other things enter into it but for *the* purpose of group discussion and comprehension this average is the beet way,

Question: On this str. tolerance for a man, does that assume that in his lifetime a 100 S.U. is all he can have?

Answer: That's right. You see, that brings up another discussion that John, Jed and I discussed, If a man has a lifespan of 70 years and he has 100 S.U. over that period that means he is exposed to 100 S.U. for a long period. Whereas a bighorn has *a* lifespan of 10 years, he is only going to be exposed a lesser length of *time* -- 10 vs. 70. Does this mean you can increase the amount a bighorn can take? Lots of things like this have to be figured out. We hope the bighorn project will help furnish this type of information.

Question by Mr. Russo: Is it possible that the amount of str. 90 will build up in the bighorn?

Answer: Yes, if tests were to continue and the bighorn stayed in *this* area, they possibly could increase this amount.

Question: Is it possible to determine how many times an animal has been exposed?

Answer: Yes, it is. When we sacrifice an animal we can tell how much

he had, we can tell how much he got at different intervals, and we can tell how much was laid down in the bone. We do this by taking the long boned and cutting them longitudinally and laying them on a film. The radiation acts just like sunlight to a film and while laid on the film the str. 90 will print its own picture on the film. You can see on film, for instance in March 1955 he got a dose of str. 90, if it was a significant fallout, if there was rain or something, there will be a streak on the film right along there; And a year later another streak would form if fallout occurs. These things not only radiate but leave a pretty good trail and can be followed.

Fred Jones from California! We are sending a collection of deer jaws from all over California to someone in the Atomic Energy Commission.

Farmer: You send them, perhaps, to UCLA, to Kermit Larson. I think they are probably doing Plutonium on these bones. There are a lot of str. 90 studies going on. It's the number one problem. And they just don't have enough data. Ours is just one little study and we hope it will add.

Question - Jed Devan: What about the use of deer antlers?

Answer: Well, you see accumulation of str. 90 is a direct function of the uptake of dietary calcium. If an animal eats lots of calcium like a baby growing up or any young animal he'll *get* more calcium. Thereby he will assimilate more str. *Some* fellow over at Los Alamos got the idea of using antlers because deer grow antlers every year and this means there is a tremendous uptake of calcium. This is a very good way to *get* a rapid picture of str. uptake. Mr. Froman at Los Alamos is the man who would appreciate having any deer antlers sent to him. Just cut *them* up, put them in a sack, and send them to him.

Question: There is a point I would like to bring up about str. I am just *as* scared of it as anyone else. But I think it should be pointed out, *that* we don't have to be too concerned about it yet for we are getting more from comic rays than we are from str. right now. However, these studies should have been started in 1949 and 1950 rather than to wait as you have done.

Answer: If they stop testing now they have figured out what our dosages will be in ten years, twenty years - it won't affect us but might show up in younger generations. The point you bring up is correct. I am sure we all realize we get natural radiation but it is the addition to the total overall radiation burden with which we are concerned. You all realize, I am sure, that with figures like 8 and 4 S.U. we are not at all concerned, but it is the overall addition to other doses with which we are concerned.

Question: What is the relationship on reproduction on this thing if the ewe sheep was carrying 4.5 units, would it have any effect on the lamb?

Answer: No, I would expect no effect.

Jed Devan: Would she be likely to transfer some str. through the milk to the lamb?

Answer: Milk is one of the sources of str. release from cattle and of course the younger generations are the big milk drinkers. That's why this becomes of marked concern. The heavy milk drinkers might assimilate more str. 90.

Question: How is str. 90 absorbed in the body to start with?

Answer: It's taken in with the food.

Question: You mean it falls on the plant or it is absorbed by the plant?

Answer: Both. You see, that's a point that comes up on the sheep study. If it goes on the ground and gets into the root system, it must go into the ground, but how far? But in rocky soil how far can it go? It needs rain to wash it down into the roots. Then if it gets into the roots and comes back into the plant it usually shows up most in rapid growing plants. And with Bighorns, what do they eat? The point is, are they eating just the stuff that falls on the leaves or vegetation. I would think so, but I don't think with the type of soil we have there you would get enough leaching down into the root system.

Question - Mr. Groves: I don't want to change the subject, but I think it has a tie-in here. I recently received a letter from the State Director quite concerned over reports he had heard from the Desert Game Range concerning the malformation of teeth in many of the skulls picked up around there and they immediately blamed this on to fallout. I wonder if you have any concrete information on that?

Answer: We can surely get the information on the malformed teeth because Jed Devan and John Van den Akker are here. Clare Aldous is here and I think Ed Johnson was there when some of the malformed reports, if there were such things, were made. Can I get some help on this?

Answer by Jed Devan: There have been many reports on sheep including dall sheep, that sheep's teeth are like a horse's teeth. Some of the teeth wear down or come clear out and a stage is reached when mastication cannot occur.

Clare Aldous: During our first bighorn conference this subject was raised and I am sure if the people here would read the report we have published it would explain the malformation teeth situation.

I am happy to have been able to speak with you and if you have any further questions I shall attempt to answer them after we have been dismissed.

NEVADA 1958 DESERT BIGHORN *SHEEP*

HUNT HIGHLIGHTS

By Al Jonez, District Supervisor,
Charleston District, Nevada Fish & Game Comm.

Presented by Frank Groves, Director, Nev. Fish & Game Comm.

The completion of the 1958 Bighorn Sheep season in Nevada brought *to* close the sixth legal season in Nevada, Hunting started in 1952 and has continued each year with the exception of 1955. From the standpoint of hunting success, the 1958 season could be classed as a successful hunt year. The total hunter success on the areas open to hunting was 38.9%. The *open* areas were three in number; first, the Pintwater Range in the Desert *Game* Range; second, the Sheep and Las Vegas Range in the Desert Game Range; and third, the Clark and Lincoln County areas outside of the Desert Game Range, Data on the Desert Game Range hunts were gained from records maintained by the refuge,

Hunter success in the Pintwater was 33.3%, the Sheep and Las Vegas Range, 47.2%, and the Clark and Lincoln County area was 32.3%.

A total of 30 legal rams were killed during the hunt out of 80 tags available for the hunt. The hunt was started on November 29, 1958 and lasted approximately *two* weeks, One area, the Pintwater Area, opened on December 19 and ran *to* December 22.

The following table depicts the areas that Bighorn Sheep have been killed in during Nevada's legal hunts:

Area Hunted By Mountain Range	Legal Rams Killed						Total
	Spring			Fall			
	1952	1953	1954	19%	*1957*	1958	
Muddy Mountain	8	14	3	1	0	3	29
McCullough Mountain	1	0	0	0	1	1	3
Mormon Mountains	1	11	0	0	1	1	4
Meadow Valley Range	3	0	0	0	0	1	4
Potosi Mountain	2	0	3	0	0	0	5
Las Vegas Range (Desert GR)	0	0	5	0	0	0	5
Sheep Range (Desert GR)				25	19	16	60
Pintwater Range (Desert GR)					2	3	5
Bird Spring Range					1	1	2
Arrow Canyon Range					1	0	1
Table Mountain						2	2
Devils Peak						1	1
Hart Mountain						1	1
	15	15	11	26	25	30	122

The reason for the different seasons is that the Pintwater Area is in the Las Vegas Bombing and Gunnery Range and clearance to get in the area is hard to obtain for long periods of time; therefore, the season was necessarily short and closely supervised by the Desert Game Range personnel.

The Sheep Range and Las Vegas areas had 35 tags available, and 34 hunters actually hunted. The season was open from November 29 to December 14, inclusive. The hunters were required to check in and out of the area and were given all the verbal assistance possible, but they were on their own as far as hunting was concerned. They were not guided as they were in the past, and it is felt that the hunter success reflects the fact that the hunters were on their own. The 34 hunters bagged 16 legal rams. The highest Boone and Crockett score was an unofficial 171 2/8. The Boone and Crockett trophy class starts at about 150 points.

The Clark and Lincoln area was open for 35 tags from November 29 to December 22, inclusive. The caliber of hunters this year was exceptional, with a majority of the hunters having hunted Desert Bighorn Sheep before. Thirty-four actually hunted and they bagged 11 legal rams. Several hunters passed up rams this year looking for the large trophy head, and did not kill any because they did not find the one they wanted, Highest Boone and Crockett score in this area as an unofficial 171.

The Pintwater Hunt was open for 10 tags from December 19 to December 22, inclusive. Nine hunters actually hunted, and they bagged three legal rams. Highest Boone and Crockett score here was an unofficial 155 4/80

The average weight of the rams killed during the 1958 hunt was 107 pounds.

Spring Hunts

Year	Average Weight	Sample	Range	Area
1952	145.6	(15 rams)	122-175	State
1953	135.6	(15 rams)	109-168.5	State
Fall Hunts				
19%	104.6	(25 rams)	85-124	Desert Game Range
1958	110	(11 rams)	98-130	Desert Game Range
1958	105	(7 rams)	85-13	State

The average age of the rams killed in the 1958 hunt was 8 plus years. The age was determined from the horn annulus rings method.

There is some interest in Southern Nevada by some hunters in going back to the spring hunt as was held in 1952, 1953, and 1954. The major

reason given is that the rams will be fatter and better eating in the spring. Others feel the hunt is better in the fall because the hides make a better trophy during the fall months. Table 2 is a summary of all past Desert Bighorn Sheep hunts held in Nevada, and several facts are quite evident, The best success figure (for the County area) for the spring hunts was 1952, a guided hunt. *The best* success figure (for the County area) for the fall hunts was 1958, a non-guided hunt. From the standpoint of hunter success,,; there is a slight margin in favor of fall hunts. There ark other factors besides hunter success that will have to be taken into account before a determination is made as to which time is best to hunt the Desert Bighorn Sheep in Nevada.

Literature eited:

Hunting the Desert Bighorn Sheep in Nevada by Al Jonez, 1957.
Nevada Fish & Game Commission Completion Reports on Bighorn Sheep.
Records on Bighorn Sheep Hunts, U. S.Fish &Wildlife Service, Desert *Game* Range.

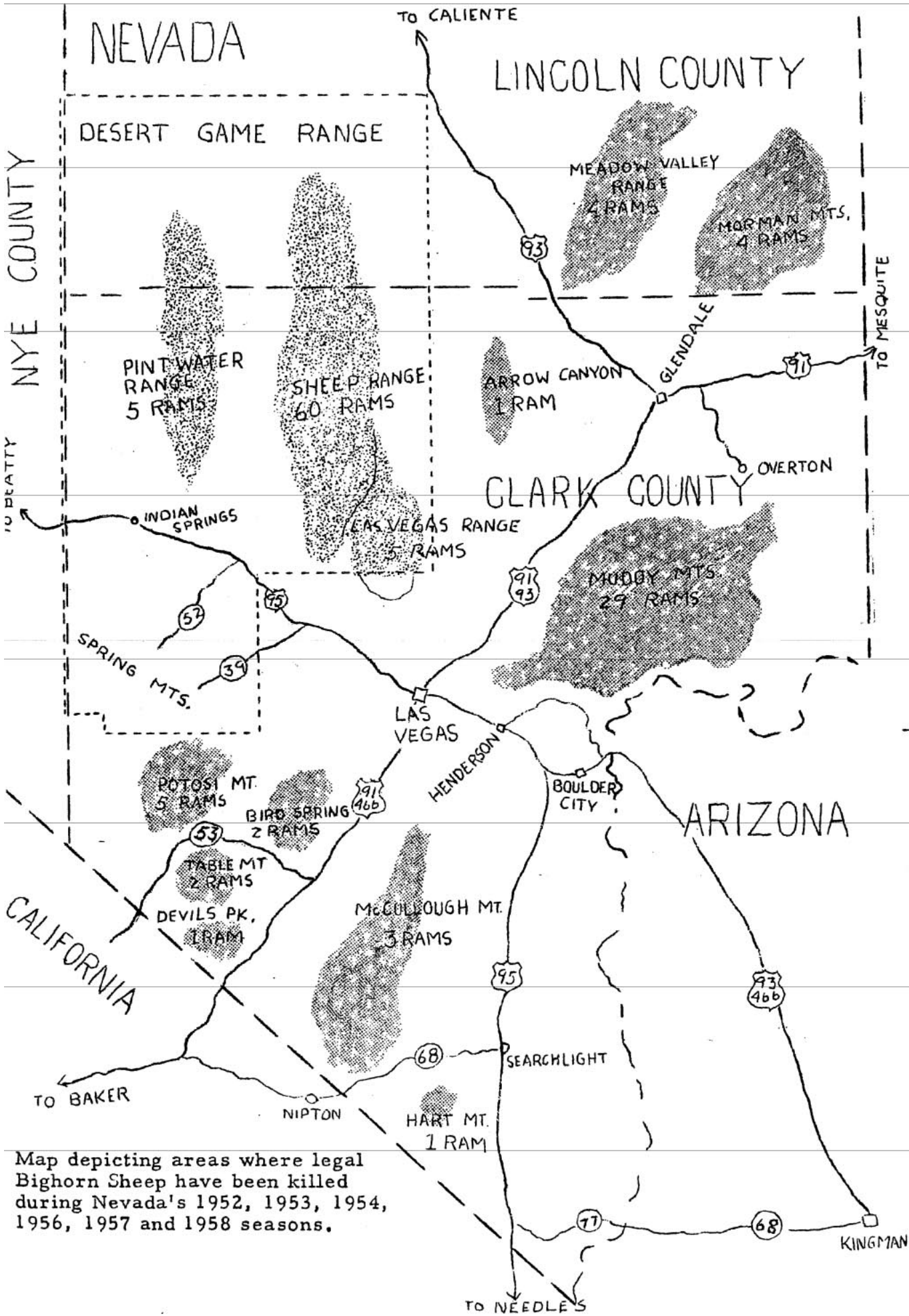
DESERT BIGHORN SHEEP
SUMMARY OF ALL HUNTS

Year	Season (days)	Tags Available (No. that actually hunted)			Total Tags	(No. Successful) % Successful*			All Hunts	
		Pint-water	Game Range	County		Pint-water	Game Range	County	Total No. Succ. Hunters	Total Hunter Succ.*
1952	Spring (18)			50 (48)	50			(15) 31.2*	15	31.2
1953	Spring (25)			60 (53)	60			(15) 28.3	15	28.3
1954	Spring (15)		12 (12)	48 (48)	60		(5) 41.6	(6) 12.5	11	18.3
1955		NO	HUNT	HELD						
1956	Fall (22)		25 (25)	15 (12)	40		(25) 100.0	(1) 8.3	26	70.2
1957	Fall (16)	10 (7)	30 (30)	20 (20)	60	(2) 28.5	(19) 63.3	(4) 20.0	25	43.9
1958	Fall (24)	10 (9)	35 (34)	35 (34)	80	(3) 33.3	(16) 47.2	(11) 32.3	30	38.9
TOTALS	(120)	20 (16)	102 (101)	288 (215)	350	(5) 31.2	(67) 66.3	(52) 23.7	122	36.8

* Success figures based on the number of hunters that actually hunted.

1952-53 were guided hunts.

1954-56 were highly supervised hunts by Fish & Game Personnel and Fish and Wildlife Personnel.



Map depicting areas where legal Bighorn Sheep have been killed during Nevada's 1952, 1953, 1954, 1956, 1957 and 1958 seasons.

HIGHLIGHTS OF 1958 ARIZONA BIGHORN SHEEP HUNT

Warren Kelly, District Leader

ARIZONA GAME AND FISH DEPARTMENT

Arizona has held seven consecutive bighorn sheep hunts. The first hunt was in January of 1953, the second hunt in December of the same year. Succeeding hunts have been in December with the exception of the 1958 hunt which was in November.

For the first six hunts a small part of Yuma County lying North and West of the Kofa Game Range made up the open area. At the completion of these first six seasons, 120 permits had been made available, 117 permits were sold, 115 hunters were afield and 49 rams were taken. The fee for a bighorn permit was $50.00 for residents and $150.00 for non-residents.

Our 1958 hunt recommendations were presented to the Commission and accepted in July 1958. These recommendations gave the hunters of Arizona their largest bighorn hunt to date. Forty permits were made available in two hunts.

Game management units 15, 16, and 44 were designated the Mohave Hunt; Units 41, 42, and 43 were designated the Yuma Hunt. Twenty permits were assigned in each area.

Fees were reduced to $24.00 for a resident and $145.00 for a non-resident by the Arizona Legislature.

Past hunt management in Arizona and Nevada has shown that more information should be made available to the hunters. For the 1958 hunt two illustrations showing legal and illegal rams were sent out to each successful applicant. This was felt necessary since the majority of our hunters have never seen a desert bighorn sheep, Also, each year in Arizona at least one ram was taken that was less than 3/4 curl. The removal of young rams from the herd defeats the purpose of the hunts.

In addition to the illustrations, a letter containing hunt suggestions was sent to each hunter. Also an article on sheep hunting was published in the "Wildlife News", Arizona Game and Fish Department publication.

The 1958 hunt was conducted from November 21 - 30 inclusive. These dates were recommended in hope that the capes would be in better condition and to avoid canflict with the desert mule deer season. This was the first time that bighorn had been hunted in November. Weather for the hunt was clear and mild. Some days were almost too warm for comfort.

Two checking stations were operated; one was at Kingman, the other at Salome. Each hunter was required to check in and out through one of these stations. The checking stations are operated to gather biological information to further bighorn sheep management in the state of Arizona. This information consists of dressedweights, carcus and horn measurements, abnormalities, parasites, stomach samples and blood samples. Other information such as locations of kill, what areas were hunted, predators observed and deer observed is also collected. Another important function of the checking station is to be sure every hunter has checked out when he is through hunting. So far no one has been injured on a sheep hunt and knowing where the hunters are and if they have checked out could save much time and even a person's life.

There was more interest in the 1958 hunt *than* in any previous hunt, *One* hundred and three residents and fifteen non-residents applied. Forty permits were sold, and thirty-seven hunters checked in for the hunt. Eighteen rams were taken; seven in the Yuma Hunt and eleven in the Mohave Hunt, for a total hunter success of 49 percent.

The largest bighorn ever legally taken in Arizona was killed in the Eagletail Mountains by a sixteen year old high school girl. This hunt had four women participants and all were successful. *One* possibility for the success of the ladies (we hate to admit that the fairer sex might be the better hunters) is that the women could not walk nor climb as far as the men on the hunt, hence had more time to glass the country. One of the ladies stated she would sit and glass the country at least five hours each day. Most men hunters have not the patience for this type of hunting.

The 1958 hunt can be considered to be one of the most successful hunts in the history of sheep hunting in Arizona. Table 1 aptly illustrateshow the hunt stands in comparison to previous hunts.

The first citation of bighorn hunt history was issued to a licensed guide for taking a ram he had killed out of the state without a permit. The ram was also taken out of the hunt area before the checking station seal had been attached to the horn, This was also a violation.

The Arizona Game and Fish Department anticipates continuing bighorn sheep hunting in those areas of the state open to hunting in 1958.

It is hoped additional areas will be opened to hunting in the future if survey data so indicates.

TABLE I. *COMPARISON* OF HORN MEASUREMENTS.

Year	Largest Trophy	Smallest Trophy	Average Trophy	Average outside curl	Average Basal Circumference	#of rams killed
1953	102-1/8	56-2/8	82-4/8	28-2/8	13	10
1953	100-2/8	72-3/8	87-7/8	30	13-7/8	10
1954	99	65-3/8	84-2/8	29	13-2/8	12
1955	93-6/8	85	87-5/8	30-2/8	14	5
1956	93-4/8	65-2/8	79-7/8	27-2/8	12-4/8	6
1957	90-6/8	60-6/8	76-4/8	25-5/8	12-4/8	6
1958	102-6/8	74	86-6/8	29-4/8	13-7/8	18

All measurements were taken *to* the nearest one-eighth of an inch.

BIGHORN SHEEP INFORMATION

Season: November 21 - November 30, 1958, inclusive.

Legal Animal: Ram with at least a three-quarter curl.

Bag limit for bighorn is one in a lifetime; therefore, no person who has previously killed a bighorn in Arizona can apply for a tag.

Number of Tags: Yuma Area 20
Mohave Area 20

Description of Areas:
Yuma Area: Game Management Units 41, 42 and 43.
Mohave Area: Game Management Units 15, 16 and 44.

Any resident wishing to apply to hunt bighorn must first purchase a resident Class G combination general hunting and fishing license or resident Class H general hunting license and the number and class of this license must be given on his application. In addition, he must enclose with his application a money order, cashier's check or certified check payable to the Arizona Game and Fish Department in the amount of $20.00 for his resident bighorn tag.

Any nonresident wishing to apply must given in the letter of application the number and class of his valid nonresident Class G combination general hunting and fishing license or nonresident Class H general hunting license or enclose (in addition to $125.00 for his nonresident bighorn tag) $25.00 for a nonresident Class G combination general hunting and fishing license or $20.00 for a nonresident Class H general hunting license. Payment must be made by money order, cashier's check or certified check payable to the Arizona Game and Fish Department.

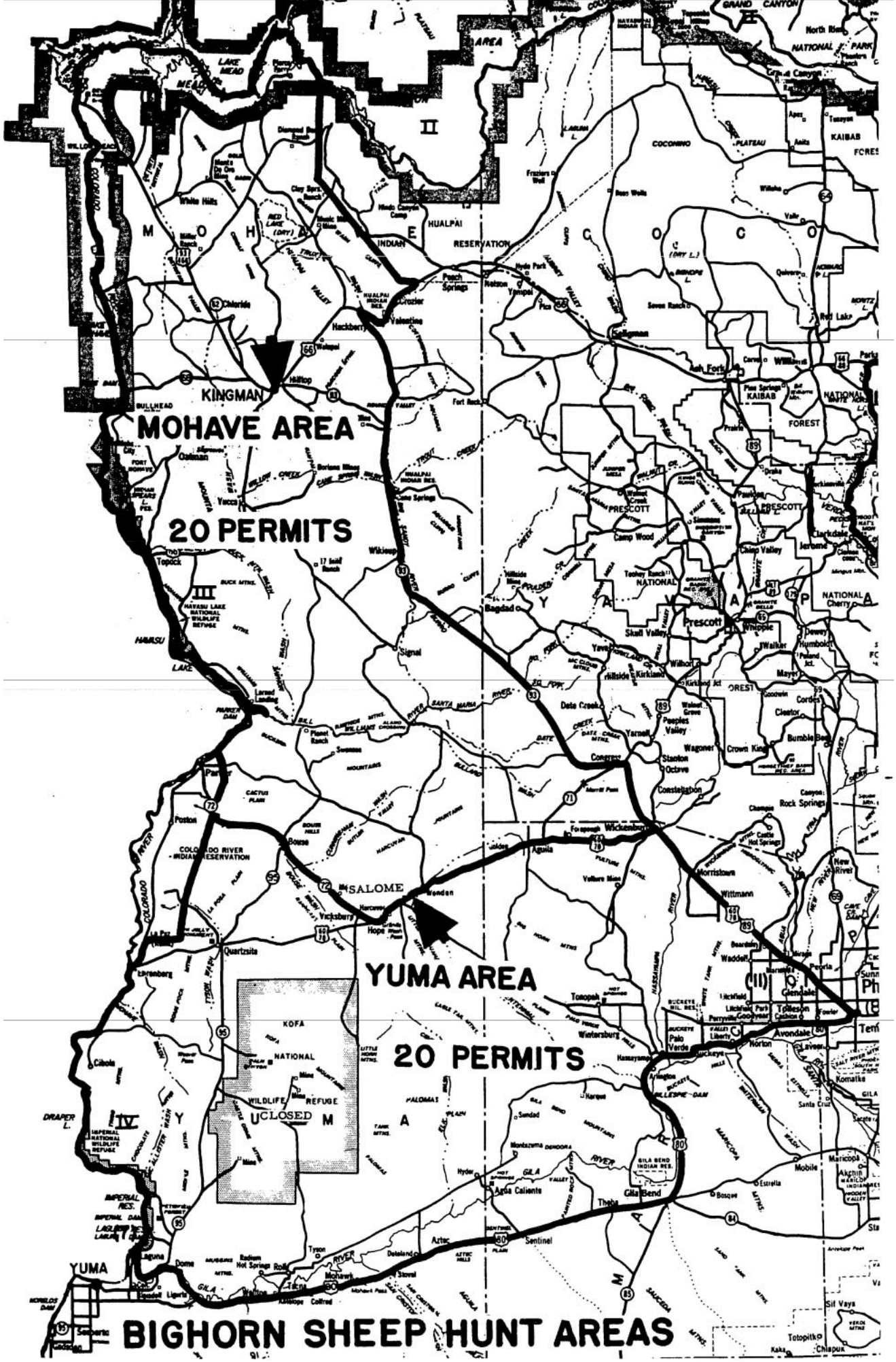
Tags for each hunt will be issued on a drawing basis. Applications for such tags will be made by letter giving name, address and physical description, and will be received in person or by mail at the Phoenix office on or before 5:00 p.m., October 6, 1958. Group application will not be accepted. The envelope must be marked on the outside: "Bighorn Hunt Application" and the area desired (Yuma or Mohave) indicated. Quotas for the various hunts will be filled by public drawing on October 10, 1958 at the state capitol. Tags will be mailed from the Phoenix office not later than October 31, 1958.

Each hunter must check into and out of the area through a checking station. Checking stations will be located at Salome and Kingman. Hunters must check in and out at the same station. Checking station hours will be in accordance with Commission Order P-33, July 1, 1958.

Bighorn cannot be lawfully possessed outside the specified hunt area unless it has the proper seal attached to the horn by the checking station operator. The bighorn hunt area is closed to all other hunting *except* small game and predator hunters with shotgun only, and except that it shall be lawful for the holder of a valid bighorn tag to *take* predatory animals. (Bighorn tag is not valid for the taking of predatory animals after a sheep has been killed.) The use of dogs except for small game hunting is prohibited.

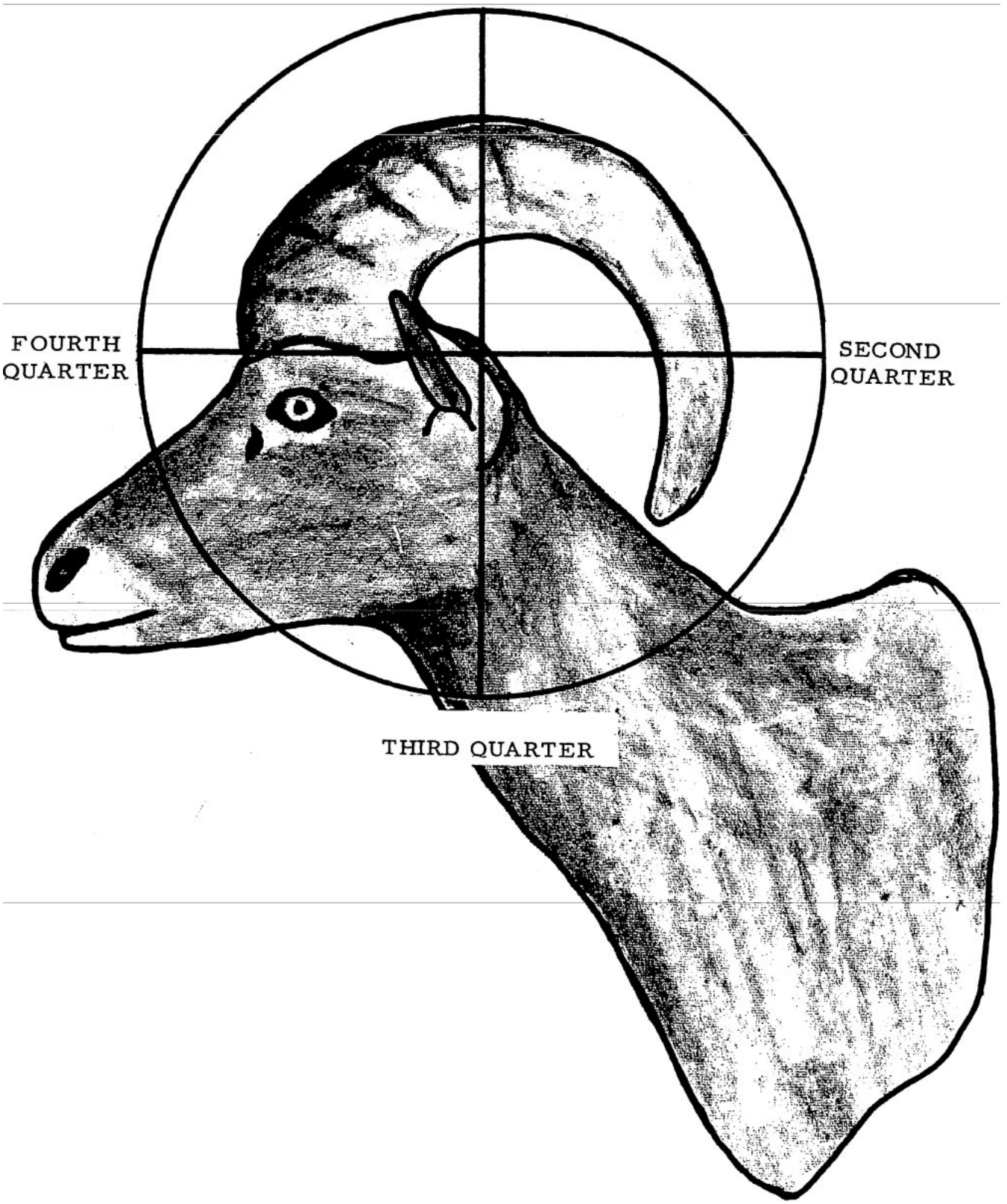
GOOD LUCK!

THE ARIZONA GAME AND FISH DEPARTMENT


MOHAVE AREA
20 PERMITS
YUMA AREA
20 PERMITS
BIGHORN SHEEP HUNT AREAS
KINGMAN
SALOME
YUMA
CLOSED
KOFA
NATIONAL
WILDLIFE
REFUGE
HUALPAI
INDIAN
RESERVATION
COLORADO RIVER
INDIAN RESERVATION
GILA BEND
INDIAN RES.
KAIBAB
FOREST
PRESCOTT
Prescott
Wickenburg
Bagdad
Signal
Hackberry
Chloride
Topock
Parker
Poston
Quartzsite
Ehrenberg
Gila Bend
Agua Caliente
Aguila
Wittmann
Morristown
Surprise
Peoria
Glendale
Avondale
Goodyear
Litchfield Park
Tolleson
Buckeye
Palo Verde
Wintersburg
Tonopah
Arlington
Hassayampe
Salome
Vicksburg
Hope
Vendon
Harcuvar
Date Creek
Congress
Yarnell
Peeples Valley
Wagoner
Stanton
Octave
Constellation
Crown King
Cordes
Cleator
Bumble Bee
Rock Springs
Castle Hot Springs
Mayer
Humboldt
Dewey
Walker
Whipple
Kirkland
Skull Valley
Wilhoit
Yarnell
Aztec
Sentinel
Tacna
Mohawk
Stovall
Roll
Dome
Laguna
Tyson
Deleand
Mobile
Maricopa
Casa Grande
Santa Cruz
Komatke
Estrella
Bosque
Sif Vays
Totopitk
Chiapaux
Kaka
Sonoita
Ligurta
Cibola
Draper L.
Imperial Res.
Laguna Res.
Imperial Dam
Laguna Dam
Yuma
Gila
Colorado River
Mohawk Mts.
Gila Mts.
Castle Dome Mts.
Kofa Mts.
Palomas Mts.
Plomosa Mts.
Harquahala Mts.
Maricopa Mts.
Sauceda Mts.
Aztec Hills
Sentinel Plain
Gila Bend Mts.
Tank Mts.
Hassayampa River
Agua Fria River
Santa Maria River
Big Sandy River
Bill Williams River
Williamson Valley
Chino Valley
Paulden
Camp Wood
Walnut Creek
Granite Mtn.
Granite Dells
Granite Basin Rec. Area
Prescott National Forest
Kaibab National Forest
Coconino Plateau
Grand Canyon
North Rim
Grand Canyon National Park
Lake Mead
Lake Mead National Recreation Area
Havasu Lake National Wildlife Refuge
Imperial National Wildlife Refuge
Kofa National Wildlife Refuge
Colorado River Indian Reservation
Hualpai Indian Reservation
Gila Bend Indian Res.
Kaibab Forest
Prescott National Forest
Williams
Ash Fork
Seligman
Valentine
Peach Springs
Nelson
Yampai
Hyde Park
Supai
Meadview
Pierce Ferry
Dolan Springs
Oatman
Golden Shores
Topock
Needles
Lake Havasu City
Parker Dam
Planet Ranch
Swansea
Bouse
Cactus Plain
Bouse Hills
Harcuvar Mts.
Harquahala Plain
Vulture Mine
Vulture Mts.
Eagle Tail Mts.
Date Creek Mts.
Weaver Mts.
Bradshaw Mts.
Juniper Mts.
Santa Maria Mts.
Hillside
Kirkland Jct.
Prescott Jct.
Paulden
Chino Valley
Jerome
Clarkdale
Verde
Cottonwood
Camp Verde
Clarkdale
Jerome
Prescott
Prescott Valley
Dewey
Humboldt
Mayer
Cordes
Cleator
Bumble Bee
Crown King
Rock Springs
Castle Hot Springs
Morristown
Wittmann
Surprise
Peoria
Glendale
Avondale
Goodyear
Litchfield Park
Tolleson
Buckeye
Palo Verde
Wintersburg
Tonopah
Arlington
Hassayampa
Salome
Vicksburg
Hope
Vendon
Harcuvar
Date Creek
Congress
Yarnell
Peeples Valley
Wagoner
Stanton
Octave
Constellation
Crown King
Cordes
Cleator
Bumble Bee
Rock Springs
Castle Hot Springs
Mayer
Humboldt
Dewey
Walker
Whipple
Kirkland
Skull Valley
Wilhoit
Yarnell
Aztec
Sentinel
Tacna
Mohawk
Stovall
Roll
Dome
Laguna
Tyson
Deleand
Mobile
Maricopa
Casa Grande
Santa Cruz
Komatke
Estrella
Bosque
Sif Vays
Totopitk
Chiapaux
Kaka
Sonoita
Ligurta
Cibola
Draper L.
Imperial Res.
Laguna Res.
Imperial Dam
Laguna Dam
Yuma
Gila
Colorado River
Mohawk Mts.
Gila Mts.
Castle Dome Mts.
Kofa Mts.
Palomas Mts.
Plomosa Mts.
Harquahala Mts.
Maricopa Mts.
Sauceda Mts.
Aztec Hills
Sentinel Plain
Gila Bend Mts.
Tank Mts.
Hassayampa River
Agua Fria River
Santa Maria River
Big Sandy River
Bill Williams River
Williamson Valley
Chino Valley
Paulden
Camp Wood
Walnut Creek
Granite Mtn.
Granite Dells
Granite Basin Rec. Area
Prescott National Forest
Kaibab National Forest
Coconino Plateau
Grand Canyon
North Rim
Grand Canyon National Park
Lake Mead
Lake Mead National Recreation Area
Havasu Lake National Wildlife Refuge
Imperial National Wildlife Refuge
Kofa National Wildlife Refuge
Colorado River Indian Reservation
Hualpai Indian Reservation
Gila Bend Indian Res.
Kaibab Forest
Prescott National Forest
Williams
Ash Fork
Seligman
Valentine
Peach Springs
Nelson
Yampai
Hyde Park
Supai
Meadview
Pierce Ferry
Dolan Springs
Oatman
Golden Shores
Topock
Needles
Lake Havasu City
Parker Dam
Planet Ranch
Swansea
Bouse
Cactus Plain
Bouse Hills
Harcuvar Mts.
Harquahala Plain
Vulture Mine
Vulture Mts.
Eagle Tail Mts.
Date Creek Mts.
Weaver Mts.
Bradshaw Mts.
Juniper Mts.
Santa Maria Mts.
Hillside
Kirkland Jct.
Prescott Jct.

ILLEGAL RAM·

USE YOUR **SCOPE** TO SEE IF HE IS LEGAL

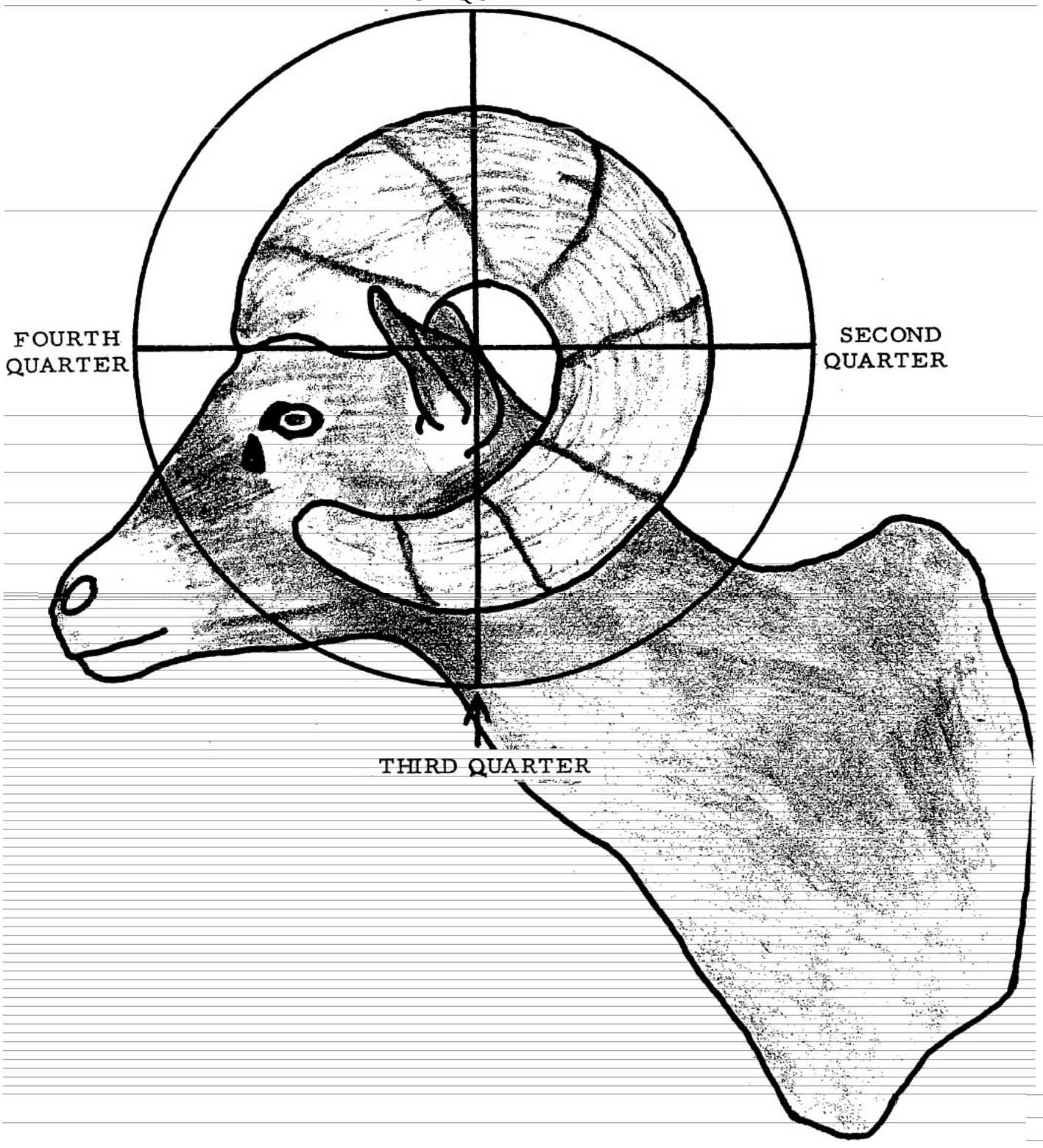


Killing rams of this size and age is defeating the purpose of bighorn sheep management since this ram is still an asset to the herd.

LEGAL RAM MUST HAVE AT LEAST THREE-QUARTER CURL.

LEGAL RAM

USE YOUR SCOPE TO SEE IF HE IS LEGAL



The purpose of the bighorn hunts is to crop the old **rams** from the herd. This **is** the type of **ram** the Department would like killed.

LEGAL RAM MUST HAVE AT LEAST THREE-QUARTER CURL.

BIG HORN SHEEP MEETING

SUMMARY OF DISCUSSION OF 2:10 PM SESSION ON 4-7-59

A question was raised about the legality of taking old rams with broomed-off horns which would not meet the 3/4 curl requirements. The answer given was that they are not legal targets.

The relative merits of hunting in the spring and fall were discussed. It was pointed out that, from the trophy standpoint, the fall was the best time. In the spring, the animals' flesh condition is at its best; however, they are undergoing a molt at that time, making them not too desirable from the trophy standpoint. Old-time meat hunters in Southern Nevada hunted in June as they felt the animals were in best of condition then. Trophy hunting, it was stated, was the justification for the present hunts.

The justification for the present hunts was re-emphasized; that is, the removal of old rams which were going to die shortly, plus giving some hunter a real trophy.

The question was asked if the hunts had been successful in removing old rams. Arizona and Nevada replied that it had been very successful. The average age of rams in lest year's hunt in Nevada was 8 years and in Arizona, 8 to 11 years. It was stated that Wyoming and Colorado feel that animals are in the prime at 3 to 10 years and that they live to 17 years. Their hunts are taking the prime animals and leaving the older ones. An observation of approximately 6-year old ram doing the breeding while older uninterested rams stood close by was cited.

The question was asked if we are not placing too much emphasis on selecting 'old rams in the hunt since the animals are polygamous and they are born in about an equal sex ratio. An opinion was ventured that 1/4 of the ram population could be harvested without affecting the breeding potential. It was further stated that even if some young animals are taken during the trophy hunts; in all probability, It will not hurt a thing.

STATUS OF BIGHORN IN CALIFORNIA STATE PARKS

Dalton E. Merkel, State Park Naturalist

In the California State Park System there are two parks in which the Desert Bighorn would be observed.

Mitchell Caverns in the Providence Mountains of San Bernadine County a t present has only 80 acres. It is not yet open to the public. We do not have any information on the sheep for this region.

Anza-Borrego Desert State Park with over 450 thousand acres, has established camp grounds and manned patrol districts. We are able to keep better check on the fauna of this park because of this ranger patrol system.

Anza-Borrego borders Riverside County on the north and extends south to within a few miles of the Mexican border. Elevations 'range from near sea level to about 6,000 feet above sea level.

This park lies in the northwest portion of the Colorado Desert and has a wide range of vegetative types. In the higher elevations where the slopes are generally covered with granite boulders, there are Coulter Pine, Incense Cedar, Juniper, Yucca, and different plants of the chaparral. In the lower canyons and alluvial fans there are Cacti, Brittle-Bush, Chuparosa, Creosote Bush, Ephedra, Sage, *Agave*, and clumps of native Palms. The washes and valleys have Ocotillo, Creosote Bush, Burrobush, Dalea, Cacti, Smoke Trees, and many annuals.

Water may be found in rock cavities after rains. There are some springs in the park which have water the year around. Some of these spring areas have cattle grazing.

Anza-Borrego is divided into eight patrol districts. Each district has a ranger patrolman who patrols and maintains his area. These men report on the wildlife conditions among other things. Since 1953 there has been at least one patrol in the park, and in 1957 we have had the patrol districts set up. For three years we have been conducting a game census around the water holes within the park boundaries. The men in each district regularly report on the fauna seen around the springs, Below is listed some data for each district on the Desert Bighorn.

District 1: This is the northwest corner of the park and includes Sheep Canyon, Salvador Canyon, Box Canyon, Elder Canyon, and Coyote Creek. There is water in this region all year. A total of 15 sheep have been reported. There has no report of more than 5 sheep seen at one time. This area has been a wayon and jeep road for many Nears.

District 2: Borrego Palm Canyon, Borrego Mountain, Borrego Badlands, and portions of highway 78 east of the Marrows. This district lies in the north central portion of the park. A total of 39 sheep have been recorded seen in Borrego Palm Canyon. As many as 15 have been seen at one time. Sheep have not been recorded seen in the other areas of this district, although some signs have been noted.

District 3: Includes the west slopes of the Santa Rosa Mountains from Hidden Springs to Imperial County line. It extends from Riverside County line to the area of Clark Dry Lake and Font's Point. It has been estimated that up to 12 sheep are in this area. Only 9 have been recorded as seen and not more than 2 at one time, Of interest is an article dated 7 March 1954 from the San Diego Union which states that a survey was conducted by helicopter and 350 sheep were counted. No mention was made as to who made the count.

District 4: Includes the high mountains of the west central part of the park. Upper Palm Canyon, Culp Valley, Upper Hellhole Canyon, Sentenac Canyon, and the Yaqui Well area are in this district. Several canyons on the south side of highway 78 from Sentenac Canyon to the Narrows are included. A great deal of sheep sign has been recorded but only 2 sheep have been noted. There is not much water in this region and the area has a great deal of visitor traffic.

District 5: Lies between Harpers Flat and Imperial County line and south to Deguynos Canyon. It includes the Fish Creek Drainage. Just 3 rams have been recorded. Very little water of a permanent type in this region. Has many visitors in season.

District 6: This district has Blair Valley, Earthquake Valley, Pinyon Mountain Valley, Granite Peak, and portions of the Pinyon Mountains. One ram has been recorded as seen, Some signs are present at times.

District 7: Is in the south portion of the park and includes the Carrizo Badlands, Vallecito Mountains, and Carrizo Valley. No records from this area.

Mstrict 8: Includes the Jacumba Mountains, Carrizo Gorge, Mortero Palms, Indian Gorge, and Bow Willow Canyon. Three sheep were noted in this region and one dead sheep was found in 1958.

It is realized that this data is not conclusive as to the numbers or condition of the Bighorn in Anza-Borrego. It does give an idea of what we are doing in regard to keeping ourselves posted as to what occurs in this park. With the advent of the ranger patrol system we should be able to increase our knowledge of the fauna and, in due time, build up an adequate file of natural history information. We are not a research organization, but we are very much interested in whatever information we can obtain about the sheep in this park. For this reason I am very happy to attend such a meeting as this.

Predation on the Bighorn does not seem to be much of a problem in Anza-Borrego. With the cooperation of the Department of Fish and Game we have just completed a predator scat analyses on 636 scat samples. Of all these samples onlythree contained remains of the Bighorn. These three samples were collected during September. Golden Eagles have been observed but no reports indicate attacks on sheep. Presence or absence of water and human activity seem vv be the most important factors controlling numbers of Bighorn sheep. It is of interest to note that Borrego Palm Canyon has had the largest numbers noted and there is water in this canyon the entire year. Furthermore, the upper three to five miles beyond the nature trail are very little used and there is no vehicle traffic in the whole canyon. Many springs just outside of the park boundary are being developed for human use. Other water areas within the park have been getting increased use by visitors. It should also be noted that several spring areas have cattle grazing. Wild Burro have been seen in the area around Hidden Spring known as Jack Ass Flats. There are supposed to be around nine of these animals. A few scattered tracks of what might have been burro were noted in the Pinyon-Vallecito Mountain area mingled with sheep tracks. In my opinion, the burro is no factor of any importance to the number or condition of the Desert Bighorn in this park,

BIGHORN SHEEP MEETING
Summary of 2:50 PM Discussion on 4-7-59

The definition of the name "Burrego" came in for considerable discussion. It was undecided whether the name referred to domestic or Bighorn sheep when it is used for place locations.

Livestock grazing is permitted on the Borrego State Park it was noted. This was stipulated when *the* State Government purchased these lands from individuals. Eventually it is hoped'that livestock use will be discontinued.

PATROL AND PROTECTION PROBLEMS

Joe M. Wilbanks
Arizona Game Ranger
(Read by Warren Kelly)

I. Public Relations along with Patrol Work

II. Past Violations Gathered through Reliable Information

III. Present Known Violations

A. Young Rams Killed by Licensed Hunters

B. Importation of Bighorn from Lower Mexico

PATROL AND PROTECTION PROBLEMS

Joe M. Wilbanks, Game Ranger
Yuma, Arizona

I. Public Relations along with Patrol Work

Arizona began its first Bighorn Sheep hunt in the hunting season of 1952 on a twenty permit basis; since that time seven hunts have been held in the same area with slight changes to the boundaries.

It has been my good fortune, and responsibility, to have helped conduct these hunts from an enforcement stand point, meeting most of these Bighorn Sheep hunters and giving them much information as to methods and manner of finding Bighorn Sheep and securing them.

Also countless hours were spent in the field traveling with some of these hunters. , From the *comments* made by these hunters, many of which killed sheep, I believe it helped make better public relations between the hunter and the Game Department.

Enough emphasis on public relations can never be made. For an example - the smoothness of the operation of a *Game* Department depends somewhat largely *on the* money they have to operate on; and since most states, like Arizona, have their monies appropriated by the legislature it is of the best interest of the department and the public (which we consider generally the hunter and fisherman) to work toward that goal. Even though from this standpoint the circle is huge, it may well be achieved,

II. Past Violations Gathered through Reliable Information

It seems from the information gathered that up until 1951, the practice of taking Bighorn Sheep out of season was far beyond the control of the, then present, game law enforcement officers, This was due, mainly, to an under-manned staff and failure to receive convictions of those that were apprehended,

Up to *that* period, at least one or more violations were tried in our courts each year, with conviction of only those who pleaded guilty to the charges. Since the year 1951, no violation of Bighorn Sheep has been tried in our courts and only one violation was apprehended. In this case they were "wet Mexicans" working in Maganese Mines and they were turned over to the United States Immigration Service and deported to Mexico.

III. Present Known Violations

An Young Rams Killed by Licensed Hunters

Even though wording of the Arizona laws, concerning the legal size of a bighorn sheep is plain and descriptive, it is sometime hard for an over anxious hunter to take the time that is sometimes necessary to determine the size of the horn. Consequently, we have had illegal rams killed.

Up until the last hunt we have had an illegal ram killed each year, with the exception of 1955. After considerable discussion of the Game department men responsible, it was the feeling that no citation would be issued to the hunter or hunters killing these young rams. Bighorn sheep hunts were new to most of our hunters in the field and many never having seen a sheep before. It is the belief of our Game Wagers that killing these young rams is defeating good game management practice. We have begun work on a plan to stop it altogether. A better descriptive drawing of a legal and an illegal ram was given to each hunter, also a verbal statment, "Don't do it or you will face the charges this year". Consequently, no illegal rams were killed this last hunt and we have hopes *that* this problem has been solved.

B. Importation of Bighorn from lower Mexico

After becoming apparent to an Arizona Game Ranger that Bighorn Sheep were being imported or smuggled from lower Mexico, a nationwide investigation was begun. The findings showed that this was no small business, but somewhat of a large magnitude. Since the closing of the Bighorn Season in 1955, in lower Mexico it was found that approximately twenty (20) heads had been brought into the United States which were considered unlawful. In each instance where it was found a head had been brought in, the hunter was contacted either by a State Game Warden or a U. S. Fish & Wildlife Agent. The hunter stated that all the time he was hunting in Mexico it was not to his knowledge that the license he held was not valid. But in some instances, the hunter became suspicious when he was informed that in addition to his $500.00 guide fee it would cost him another $100.00 to get this animal across the border.

Most of these violations were being made by a guide living in Arizona, who conducted the hunts in Mexico. He was finally brought to trial in Federal Court, entering a plea of guilty and receiving a one year probation period.

It is of great concern of the law enforcement personnel that a violation of this type can take place and the above sentence be given to a violation of this nature.

In another case, where a pilot of an airplane was found to have smuggled a sheep from lower Mexico to the United States, his airplane was confiscated by the United States Immigration and at a later date sold back to him, How this was conducted is not to the writer's knowledge.

It may be asked by many why it is our concern to help lower Mexico enforce their game laws and an explanation is readily given. The chances of apprehending a person killing a bighorn sheep during the time of kill is almost nil by a game law enforcement officer. Therefore, a person may or could kill a sheep in bur country; take it to a taxidermist for mounting; state that it came from lower Mexico; and his chances of getting caught are wry slim.

BIGHORN SHEEP PATROL AND PROTECTION PROBLEMS IN CALIFORNIA

BY
Vernon Burandt

INTRODUCTION

Every article of paper written on Bighorn Sheep mentions the problem of poaching or illegal killing of this animal. While it is true that poaching continues in some areas of California, it is not as common a practice as it was duting the peak of mining operations, or depression years, when the prospector, almost of necessity, lived off the land.

PATROL PROBLEMS

Bighorn Sheep patrol and protection problems are no different in California than in neighboring desert states.

The type of country inhabited by Bighorn Sheep makes adequate patrol difficult. Large patrol areas assigned to Fish and Game Wardens, together with poor roads, many of which are passable only with 4-wheel drive vehicles, make desert patrol a time-consuming job. Patrol of the sheep country in the Sierra, bordering Kings Canyon and Sequoia National Parks, can only be accomplished on foot or horseback. Since a Game Warden's duties are of a general nature, it is quite impossible to spend a large part of time patrolling sheep habitat.

During the hot summer months when sheep are coming to water holes in the desert and are susceptible to poaching, the trout season is also at its peak. Checking lake and stream anglers demands most of the Warden's time during this busy season. Then early fall brings the deer and dove season, which is equally demanding of a Wildlife Protection officer's time. About the only season a Fish and Game Warden gets to spend any amount of time on the desert is during the winter months when most seasons on fish and game are closed. Since enactment of the burro law, winter desert patrol serves a dual purpose.

All reported violations of fish and game laws are, of course, checked; however, with many and varied duties, it is difficult to put out a concentrated effort to patrol desert sheep country.

EARLY HISTORY OF POACHING

Bighorn Sheep are a wilderness species and not tolerant of human disturbance. They are easily killed at their watering places on their desert range. Early day desert dwellers and prospectors took advantage of sheep coming to water and kept themselves supplied with fresh meat at every opportunity, with little respect as to age or sex of animal killed. This

constant poaching nearly decimated the sheep population in some of California's desert ranges, and well could be the cause of extinction of Bighorns in their northernmost California range. It's probable that the rough and inaccessible mountains themselves, together with a few remote water holes, provided a natural refuge and saved the desert sheep from complete extinction.

The time-tried method employed for killing sheep has been for the shooter to conceal himself in a rock blind. These blinds are usually placed near desert watering places; it is then a simple matter to shoot the unsuspecting animal when it comes to drink. In a few places of the desert mountains of California, remains of these rock blinds, together with bleached remains of sheep, may still be found. A little careful searching near these blinds has produced old blackened cartridge cases dating back to the black powder era.

FULLY PROTECTED MAMMAL

Bighorn Sheep are given full protection in California since 1883 when their extinction seemed certain, Bighorns have been protected since that aate and California has never had an open season on sheep, At the present time, Code Section 4700 of the California Fish and Game Code (1957) places Bighorn Sheep on the list of fully-protected mammals. Fully-protected mammals may not be taken at any time, nor may *any* permit be issued to take them.

COMPARISON OF VARIOUS HABITAT AND PROBLEMS

The habitat of Bighorn Sheep, and its use, on the desert ranges differs greatly from the habitat .and'area occupied in the Sierra. Sierra Bighorn have an abundance of water and forage. The necessity of trailing long distances to water or rustle far and wide for forage does not exist. This presents an entirely different problem from the law enforcement angle. About the only time Sierra Bighorns are forced to move is during winter storms when heavy snows force them down to lower elevations on the Sierra East Slope, west of Owens Valley. When this occurs, and Bighorns are concentrated at lower elevations, they are susceptible to poaching, especially in areas near roads. Many of the dead-end roads in the area mentioned are clearly visible from Highway 395, which tends to lessen violations. Bighorn habitat in the White Mountains is also quite different from the desert range; however, the exact conditions of the Sierras do not exist. In the Colorado River Area, water requirements differ from the rest of the desert.

PRESENT DAY VIOLATIONS

Most Department of Fish and Game employees feel that at the present time poaching of Bighorn Sheep is at a minimum. Good times, without a serious unemployment problem, could account for this. Few complaints are received by the Department concerning Bighorn poaching and only occasionally is evidence of and illegal kill found in a remote area. No doubt, poaching will continue to a limited degree at desert springs and in other inaccessible

areas, especially during deer season where deer ranges overlap Bighorn habitat. Occasionally, a thoughtless individual may take a shot at a sheep in an area where the animal has never appeared previously. This is especially true when sheep are attracted by the succulent vegetation growing in washes after desert cloud bursts. Bighorns have appeared near main traveled toads while such feed conditions existed.

Of the few reported violations, recently one occurred in a little-traveled area north of Death Valley when an individual shot and killed a large Bighorn ram, which he claimed had attacked him. An investigation was made after a reliable informant reported seeing the ram's head. Too much time had elapsed and no evidence was available. This was after the man had left the country.

Another reliable sportsman reported that a Bighorn ewe's remains, including the head, were found at an isolated fisherman's camp just out of Kings Canyon National Park on the upper reaches of Georges Creek in Inyo County. From rhe evidence seen, this group of fishermen probably used the animal for camp meat. Several years ago at Mammoth, near San Joaquin Mountain, a Bighorn Sheep was apprently killed for a deer and then it was left abandoned. Various reports of deer season accidental killings of sheep are sometimes heard, but, so far, only a few cases have been made in California during the deer season in recent years.

NUMBER OF ARRESTS AND CONVICTIONS

Time did not permit going through all the records or contracting all the present California Fish and Game Wardens nor the ones retired who made arrests for Bighorn violations.

Information received from the California Department of Fish and Game - Los Angeles Office indicates there have been approximately 12 arrests for Bighorn Sheep violations in the past 25 years.

SUMMARY

Poaching is not as common as in early mining days or during the depression years.

Bighorn sheep are completely protected by law since 1883.

The main problems of Fish and Game law enforcement are:

1. Large patrol areas.
2. During times sheep are susceptible to poaching, other Fish and Game work is at its peak.
3. Different types of habitat; namely, Sierra, Desert and White Mountains, all presenting a different patrol problem.

References: 1956, Russo, John P. - Desert Bighorn Sheep in Arizona.
1957, Jones, F. L.; Flittner, Glen; Gard, Richard - Report on a Survey of Bighorn Sheep in Santa Rosa Mountains, Riverside County.

BIGHORN SHEEP MEETING
***SUMMARY* OF 3:30 PM DISCUSSION ON 4-7-59**

The origin of the name "Bex" was brought up for discussion. Early settlers did call the Bighorn "Ibex." A rumor circulating among some Airzonians is that Teddy Roosevelt was to have imported Ibex and released them in that state.

The subject of piles of bleached bones and skulls of Bighorn in various localities was brought up. Several members of the Council felt strongly that these are the remains of Indian hunting camps.

On the Arizona side of the Colorado River from Hoover Dam to Gold Beach, it was stated that Bighorn numbers had declined from early 1940's to 1948. On the Nevada side, the population was felt to be static or going downhill. About 1951, numbers appeared to be lowest in eastern San Bernardino County in California. The reason or reasons for these conditions was felt to be a long way from being solved; however, the inference was that burros may be the main reason.

The question on the legality of hunting in Mexico was brought up. The Mexican representative stated that he thought Bighorn hunting had been officially closed since 1917. He further stated that they have no financial help to enforce the law, and, at present, there is no law enforcement in the field. Much of the illegal hunting done in Mexico is done by Americans.

HANDLING CAPTNE BIGHORN SHEEP AT THE DESERT GAME RANGE

by G. A. Devan and John B. Van den Akker
Bureau of Sport Fisheries and Wildlife
Las Vegas, Nevada

INTRODUCTION

The Desert Game Range is the largest wildlife refuge in the United States dedicated primarily to the study and management of the Nelson Bighorn Sheep. Since 1936, the studies have been cdntfnued on a more or less sporadic bases, and, through the years, a considerable amount of data have been gained. The idea of maintaining a captive flock of sheep occurred early, and, depending on circumstances, needs and conditions, various numbers of sheep have been held at Corn Creek.

The Corn Creek Field Station is located 26 miles northwest of Las Vegas at an elevation of 3,000 feet in an otherwise typical desert situation. It serves as a sub-headquarters for the refuge. It is an old stagecoach stop and boasts a wonderful spring, trees, grass and some semblance of sheep terrain. Here a seven-acre fenced enclosure confines the seven sheep presently on hand. Sweral personnel live at Corn Creek, and there is adequate care and patrol. It is here that most of the handling of sheep at Desert Game has taken place.

METHODS OF CAPTURE

It seems that most of the conventional (and unconventional) methods of collecting wild sheep have been tried at Desert Game. Snares, padded steel traps, roping from horseback, drugging water holes with chloral hydrate all have been tried. The CO_2 dart gun, now available commercially, is not really a new tool on the refuge, for considerable use of the blow gun using darts coated with flaxedil has been tried. These methods are discussed in more detail in another paper.

Trapping. The most successful method used thus far has been trapping at the water holes. The main disadvantage is that in seasons of relatively high rainfall, the sheep do not come to the traps as readily. When the weather is hot and dry, the traps must be manned continuously, and, unfortunately, it is during this period that the sheep must be handled. It is a period of physiological hazard.

One of the outstanding advantages of trapping is that within limits the site can be selected and access arranged. Equipment may be used to service the trap as well as to transport captured animals. Traps not accessible to trucks may be serviced more primitively, and we have used a home-made stretcher arrangement with some success. Another system includes the use of a single bicycle wheel "deer cart," which, in some instances, could be used by one man. The litter arrangement has the advantage of

Holding an animal comfortably in the "pouch" formed, and, being trussed, the sheep is kept quite immobile. The use of the Stretcher requires two men, of course.

Apparently sheep require some time to resume use of a water hole once it is surrounded with the webbing trap; therefore, the trap should not be removed between seasons, though some damage may result. Nylon webbing, though expensive, is the most satisfactory for all-season use. Woven wire netting has been tried, but the incidence of injury to the sheep is too great. One of our most elaborate traps was abandoned for this reason, Another advantage of the cord netting is that sheep hitting the netting generally become fouled in the comparatively loose sides, thus reducing the chance of injury and enabling easier approach, This is especially important if only one man is working a trap and more than one sheep is caught at a time.

The methods of transporting sheep from the trap to a truck have been noted. Once at the truck, som of our animals, already tied and blindfolded, have been placed on a mattress and moved that way; or a preferred method has been to remove the blindfold and ties, and place the animal in a semi-dark shipping crate. This seems to give an animal a sense of security, and the possibility of shock is lessened. Two ewes were transported successfully in this way from Desert Game to the San Diego Zoo.

TRANQUILIZERS

Various drugs intended to calm the sheep during handling have been tried. Barbiturates have been disappointing in that dosage and effects have been too critical in a hot climate. We have had little success and discontinued their use.

Last season, we did considerable experimentation with the more recent tranquilizers. The results were so rewarding that we intend to make their use standard procedure in handling techniques. Sparine Hydrochloride, commonly used by cattlemen to reduce shipping sickness, is the preferred member of the group. Intramuscular injections of 75 mg per 100 pounds of animal weight is the prescribed dosage. Of course, individual animals vary in their tolerances, but Sparine has wide latitude and there is little danger of over-dosage.

Another tranquilizer, Trilafon, was tried, but it appeared that the results from Sparine were more predictable and stable. It is probable that other satisfactory substances will be developed for capturing and handling sheep, and as new materials become available, they will be tried for adaptation to our use.

CORN CREEK SHEEP ENCLOSURE

The Corn Creek sheep pasture is about seven acres in extent and is enclosed by a seven-foot high hog mesh fence. About one-fourth of the

pasture is separated to provide a ram pasture during lambing time. Due to the limited area of the pasture, this separate ram pan enables a semblance of natural conditions wherein the mature rams are seldom found with the pregnant ewes. In captivity, the rams would harass the ewes and injure the lambs.

The pasture is broken up by rocky outcrops and by a brushy draw. A small cave about 8 ft. wide, 4 ft. deep and 3-1/2 fti high was fabricated out of the soft rock. This cave plays a vital part in the activities of the sheep. Every lamb born at Corn Creek was born in this cave. Any animal that has become ill has used the cave for seclusion. The sheep that have been transplanted to Corn Creek have at first used the cave for concealment.

The first sheep brought to Corn Creek were lambs of about three to four months of age. A lot had to be learned about raising wild lambs as well as about lambs born in captivity, but this phase will be partially covered in succeeding paragraphs. It is noted that when mature sheep ere brought in, the animals already in captivity seem to passify and quiet the new members.

Various types of feeds and feeding have been tried. Leafy alfalfa hay and either whole oats or rolled barley, or a mixture of the two, fed morning and night are the foods used now. The animals are in excellent flesh. Water is available for them all the time, and they use considerable quantities daily. From time to time, all will lick the salt block provided. As mentioned before, this pasture contains also a limited amount of natural food. This has not been over-utilized, and it appears that the sheep depend and prefer their supplement feed. They wait around their feed box morning and night, similar to feed lot cattle. This latter trait helps to start newly-transplanted animals to partially demosticate and to accept the supplemental feed.

Over 20 individual sheep have been handled at Corn Creek to date. Though this nunber us relatively small, it represents only indirect efforts for volume of numbers, It is only now that we contemplate raising a breeding herd just for that specific purpose. The number handled in the wild, of course, is far greater.

Sheep have died in captivity at Corn Creek from three main causes: Trapping and handling injuries can be partially relieved by the use of Sparine and transporting in a crate; or they died because they were extremely old or otherwise affected when trapped. The second type of animal are frequent users of the watering sources.

LAMBS AT CORN CREEK

Death of lambs born at Corn Creek almost invariably can be attributed to handling while still very young. It would appear that a strong nervous

instinct is born into the animal, and that any molesting agitates this high-strung quality. Some of our first lambs born in captivity were handled, we now realize, to the point that it caused their death, The reason for the handling was to obtain weights and measurements, take photographs, and, in a few of the very firth births, to attempt to assist their physical well-being by fortifying them with vitamin shots.

Apparently, we have acted very much like an over-enthusiastic mother with her first child.. Rarely does a youcg lamb die from causes other than handling, and at Desert Game, we now follow a policy of "hands off" for at least several months after birth.

SUGGESTIONS FOR TRANSPLANT

The transplanting of mammals is a newly-tried and as yet not a cut-and-dried procedure. Each species of animal, each set of climatic and edaphic factors, even each transplant of the same animal will vary. It is certain that a successful transplant can be rewarding to all concerned, and, invariably, the project is costly, Considering this, we at Desert Game have formulated what we consider: a logical approach for a successful transplant,

Unless the area chosen for the transplant is close enough to the source of trapping, the sheep should be quieted and rested at a situation similar to the Corn Creek pasture and holding pens. To hold the sheep in a pasture for several months would not be too long. The ideal method would be to retain them until fate in the year when the weather is cool.

The area chosen for transplant should be of suitable habitat, of course, with all of the natural requirements as we know them, We do not believe that this alone is adequate and are quite insistent in our recommendation that a portion of the transplant area should be fenced securely so that the sheep can be retained in the enclosure and kept under close observation for at least one year, two years preferred. The size of the enclosure would depend on the number of animals transplanted, habitat, etc,, but it should be large enough to furnish the requirements of the sheep for the allotted holding time without being detrimental to the range. Further, we propose that, in some situations, some supplemental feeding could be indulged in, though on a tapering-off basis,

The budget makers of most game departments would object to fencing these large tracts of land, especially on an experimental basis, Nevertheless, to transplant any mammal is expensive, and with Desert Bighorn Sheep, the outlay is multiplied, as many of you have learned. To attempt to cut corners and finances, to attempt to hurry the process and not fully follow up on the transplant would be indefensible. It could well be that the use of a fenced-in transplant site, enabling a gradual transition from captivity to semi-captivity to wild, would give answers to questions presently outstanding and might be the difference between success and failure of the venture; therefore, we repeat our recommendation that transplant

sites be suitably enclosed. Incidentally, in some situations, the fence materials could be salvaged and used elsewhere.

SUMMARY

1. Many desert bighorn sheep have been handled at the Desert Game Range, and some have been and are being held at the Corn Creek Field Station.

2. Of the various methods tried for capturing sheep, trapping at the water holes has been the most successful.

3. The use of drugs for the capture of sheep has not been satisfactory, but tranquilizers, particularly Sparine, have been helpful in the handling of captured sheep,

4. Transportation of sheep from the trap to other means of conveyance can be accomplished by various methods. The use of a home-made stretcher has been satisfactory,

5. The use of a semi-dark shipping crate is quire satisfactory for transporting sheep by truck.

6. Holding the sheep in pastures has a partially domesticating effect and is conducive to safer handling.

7. Transplants are costly and should be considered only after adequate study.

8. It is recommended that transplant sites be properly fenced for one or two years after the plant is made. This would exclude competition, permit follow-up studies, and the confinement would encourage a gradual transition to the wild situation,

9. The study of desert bighorn sheep is far from complete, and it is intended that effort toward improvement of handling techniques shall continue, The door is wide open.

DESERT BIGHORN SHEEP COUNCIL MEETING
APRIL 7-10, 1959
DEATH VALLEY, CALIFORNIA

HANDLING AND TRANSPORTING DESERT BIGHORN SHEEP

It must be stated that the writer's experience in handling and hauling desert Bighorn Sheep has been limited to a dozen or so animals and that this has not been done with great success. Efforts by the Arizona and Texas Game and Fish Departments to secure broodstock for restocking purposes have been disappointing as well as costly. Not only have the sheep been difficult to trap, but an excessive number have been lost during handling and transporting.

A minimum of handling is essential in reducing losses of the highly sensitive Bighorn Sheep. A certain amount of bodily contact cannot be eliminated, for the animals must be captured, loaded, transported, and sometimes held on the hauling truck for several hours. In addition, it seems advisable to vaccinate for shipping fever, administer penicillin, and inject tranquilizer drugs.

The following, therefore, is a discussion of the problems encountered during the past three summers while trapping on the Kofa Game Range in Arizona.

Following their capture, the sheep were loaded on a 1-ton truck with hauling compartment, driven to Yuma, and then flown to the Black Gap Wildlife Management Area in Texas, some 600 airline miles away. They were immediately released in a 500-acre enclosure. The period between trapping and releasing was usually less than 24 hours. The actual flight time was only five hours, but, as the trip could not be made at night, the sheep were held overnight on the truck. Three to four hours were required to load, vaccinate, and transport the sheep from the traps to Yuma. This distance averaged 75 miles.

The location of the trap with reference to the hauling truck is of importance. If this distance is more than 100 yards, as it was at most trapsites on the Kofa, then the problem of getting the ssheep to the truck is increased. The very nature of waterhole trapping creates this problem and it cannot be helped.

No great difficulty was had in capturing even the largest ram, once it was in the net corral trap. The trap netting usually became entangled

1/ Biologist, Texas Game & Fish Commission

about the sheep's horns as they rammed into it. Sections of netting sometimes were thrown over the sheep to effect their capture, but usually this was unnecessary. The sheep were then "flanked" or carried bodily to the truck and loaded. Excessive fright and exhaustion and the resulting shock during this operation no doubt was detrimental. At Trap No. 7, situated 200 yards from the truck, two rams were loaded by tieing a rope to their horns, after which the rams were driven to the truck. The man at the end of the 30-foot rope was able to maintain control and to guide them over this distance without trouble. Both sheep were in excellent condition when loaded, although one died three months after release, probably from old age, and the other accidentally choked to death while on the airplane. Both sheep weighed approximately 190 pounds when caught. The further use of this method should be considered unless the sheep can be successfully tranquilized by drugs. One large ram caught at horse tank trapsite was pulled and carried about 60 yards to the truck as there appeared to be no other way of loading it. Excessive daytime heat and fright caused this sheep to die before it gat to the airport. It did not stand in the truck after loading, but remained on the floor breathing heavily. A ram and ewe loaded at the same time showed no signs of weakening, but these animals were much younger and lighter.

When a catch was made, from three to four men were present for loading operations. Single catches were usually made and no difficulty was encountered when one animal was loaded. When multiple catches were made, the animals were hobbled until they could be loaded on the truck. Our experience with hobbling was not entirely satisfactory, however, for at times it seems to increase their struggling. While on the plane, two sheep which were hobbled for the safety of the crew became so excited that one two-year old ram incurred a fatal back injury and a mature ram choked itself to death unnoticed by the crew. Subsequent flights without the use of hobbles were entirely satisfactory as the sheep remained calm in the darkness of the crate.

As the sheep seem to adjust to the confinement of the darkened hauling compartment of truck and eat and drink well, this method of transportation probably would be superior to the plane; however, since the flights amounted to only five hours and only one or two sheep were caught per week, the use of a truck could not be justified.- The trip by truck would take at least 20 hours of continuous driving over a distance of 1,000 miles and the last 25 miles over a rough road. If, however, as many as three sheep could be trapped within a period of three days, the truck would be used.

Each year's experience has been accompanied by changes in handling procedures in an attempt to cut the mortality after capture. Individuals react differently. Some seem to die just from the lack of the will to live. Others are able to withstand considerable suffering and confinement. One ewe, while in the trap, fell and broke off a horn near its skull. Following this, she slipped and fell into the waterhole, and was removed in a state of shock. The following morning, she was flown to the release site, and is still alive and doing well. Another ewe was held in the truck at Yuma for over 24 hours in excessive heat while the plane' was being repaired.

This sheep ate native browse readily while in confinement. It is now at the release site.

Four other sheep were in apparent good condition when released in the pasture, but died from two weeks to three months later. Although the habitat is very similar, the problem of adjusting to the new environment is not easy. Two of the sheep that died were very old, hence it was decided not to transport old animals, that is animals over six or swen years of age. Lambs also were not transported.

Some things that should have been done could not be done on this trapping project, Accidents contributed to the loss of sheep, but a small per cent of accidental injuries always accompany the moving of big game animals.

In conclusion, any suggestions which might help further this program, especially on this important subject of handling bighorn sheep, will certainly be given consideration.

THE USE OF THE CO_2 CAP-CHUR GUN AT DESERT GAME RANGE 1958

by G. A. Devan
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Las Vegas, Nevada

The Cap-Chur gun has a definite place in the handling of mammals. Used within limitations, the technique can serve as a valuable tool.

The practice of collecting with a drug-filled or coated projectile is not a new one. Several investigators have tried to accomplish this through modifications and use of pistol cartridges or shotgun shells. Even here at the Desert Game Range, the dart gun concept is not new, for efforts have been made to adapt for our use the aboriginal type blow gun and darts coated with curare.

Locally, the summers of 1955 and 1956 were extremely dry. Because of this, the bighorn sheep at the Desert Game Range were very docile and calm. It was not uncommon to be able to approach a band of sheep to within 25 or 35 yards and have them stand for several minutes. It was with this abnormal behavior that our search for a tool based on the dart gun principle began. Although extremely dry periods offer the best times to use the dart gun, such periods offer more success through other techniques on the Desert Game Range. Trapping at water holes during dry years is more effective. With limited manpower, any intensive efforts spent on the dart gun would reduce manpower available for the more conventional trapping program at the water holes.

The objective of our trapping, or capturing program, is to tag and brand animals and to bring some into Corn Creek for experimentation or transplant. Either phase requires a fair amount of equipment and, for obvious reasons, should be practiced in localities that would be fairly accessible with a vehicle,

We have considered a mobile field unit capable of roaming the mountains in search of sheep. Such a unit would oonsist of a rider and one or two pack animals plus a saddle horse. Due to the dispersement of the sheep and their relatively way nature, other than during drouth times, it would take considerable time to locate sufficiently cooperative animals that could be stalked or approached to within about 30 yards, the effective range of the dart gun. Mobility of the field unit would be somewhat restricted because food and water are scarce, and all feed for the horses and most of their water must be hauled. At this stage, it appears that more tangible projects could be accomplished, using other methods with the same investments.

Some objectionable 1-imitations of the gun are noted. The ideal range is about 30 yards, while lesser ranges give too much penetration, causing excessive wounding. This is true even when the gun is adjusted

to a low power setting. If the range is much over 30 yards, accuracy is affected.

Even at the ideal range of 30 yards, it takes considerable practice to group shots consistently. The principle of shooting the gun is more like archery than using a rifle. If the aluminum dart misses its target, it is usually damaged in rocky country, and darts cost approximately $5.00 each.

The slowness of loading, or setting up a dart, is not too undesirable if needs can be anticipated; however, it is difficult to transport a loaded dart, especially on horseback, without displacing or losing some of the nicotine alkaloid, The manufacturer recommends that a dart be kept loaded not more than 24 hours, and then it should be scrubbed out with a bottle brush and a detergent. This presents some unfortunate problems.

In using the gun on the Desert Game Range, we have had three puzzling experiences for which we have no explanation. The manufacturer of the dart gun suggests using 400 mg of nicotine alkaloid per 100 pounds of animal weight, In June, we experimented on one of our penned rams at Corn Creek. The animal was a long yearling and weighted about 80 pounds. A dart with 300 mg of drug was shot into its buttock at about 20 yards. Penetration was excessive. No effects were noted on the animal after 20 minutes. Then another dart loaded with 300 mg was shot into the ram's other buttock. After ten more minutes, the ram acted quite sluggish. In another five minutes, we were able to walk up to the animal, catch him and throw him down.

The second unusual occurrence was with a ewe. She weighed 110 pounds and was shot with 600 mg in the buttock at 30 yards. As soon as she was hit, she ran for about 100 yards at full speed and dropped dead. A general post-mortem revealed nothing conclusive.

The third case concerned a long yearling ram that weighed 110 to 120 pounds. After much effort, the ram was stalked to within 35 yards, A large dose of 600 mg of alkaloid was shot into a buttock. At the impact of the dart, or perhaps from the pop of the gun, the ram took off at a trot. This happened in a large open basin, and the ram was observed for approximately 15 minutes when he trotted from sight.

Summary:

The Cap-Chur dart gun has many potentials and will assist in the biological field; however, it has peculiarities which have to be considered, and its use should be by someone who has become adept in the technique. The unit cannot be picked up as an ordinary rifle and used effectively,

The use of the gun at the Desert Game Range is limited, for other methods already employed to meet the same objectives appear more dependable and consistent with our present program.

NOTE: For additional information concerning the availability and use of the Cap-Chur gun and related supplies, write to:

Palmer Chemical and Equipment Co., Inc.
134 Houston St., N. E.
Atlanta, Georgia

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
REGION 4

RECREATIONAL VALUES OF BIGHORN OTHER THAN HUNTING

by
Russell K. Grater, Regional Naturalist

Do you remember your first meeting with a bighorn? Do you remember yet today where it was that you saw it? Was it in the depths of some great canyon, on a steep mountain slope, on a stretch of tundra? Did you get a thrill out of seeing the animal, and do you still experience something of the same thrill yet today when you think of it? Did the sight of the animal make you wish for a camera, a gun--or did you just hope that he wouldn't scare and dash out of sight? The answers to these questions I am sure all of you have experienced at some time or another. Certainly I have.

I well remember the first time I ever saw a bighorn--a magnificent ram. I was a midwestern farm boy, pretty much a tenderfoot in the 'Jest, and I had my first job after college in Glacier National Park. I had hardly landed in the park before I started out to get acquainted with the area and its trail system. I remember vividly yet today the marvelous peaks and flower fields, the heavy forest. I had traveled some distance up a rather steep slope, admiring the beauty of the country, when I finally stopped to really absorb the view and take a picture. I sat down on a rock, got my camera all ready, and about that time I heard a sound on the slope near me. Turning slowly, so as not to frighten whatever it was making the noise, I got my first view of a bighorn ram, The animal had stopped about 50 feet from me and was watching me closely, his head held high, his every action indicating indecision as to whether to run or watch further. As I didn't move, even somewhat fearful that the blinking of my eyes might be all that it would take to send him running, I could see a lot about him that I had only known before through reading a book. To say that I was thrilled is an understatement, The animal was so much a part of his wild environment and the thought kept running through my mind that I was so lucky to be so close. Even after the ram had finally decided that he would be safer a bit farther up the slope, I remained quiet just watching him go. It wasn't until he was well out of range that I remembered that I had a good camera in my hands, cocked and ready for action.

Since that time in Glacier, I have seen many bighorn--in the Rockies, Black Canyon of the Gunnison, Zion, lower Grand Canyon, the Lake Mead country, Kofa Mountains—several areas in all. I have had the good fortune to study and observe them under many conditions, but I have never ceased to find it a real thrill to see one in his own environment.

When I was asked to review the subject of "Recreational Values of Bighorn other than Hunting" at this conference, I was somewhat undecided as to

how I should approach it. After all, "recreation" means different things to different people. To one, it is an activity; to another, a game; to a third, anything giving enjoyment, etc.; however, I believe that to anyone who has experienced bighorn as a part of a wilderness picture, there are certain basic values that are immediately apparent and are recreational in nature.

There is no doubt in my mind but what the bighorn is an animal commanding a broad, national interest. It doesn't matter whether a person is in the land where it lives or in some grade school in a city far removed from the bighorn's home. There is always a decided interest that shows when a picture of a big ram is seen, or a story about bighorn is told. Children, basically our best conservation hopes for the future, are always concerned about the animal and how it is getting along. Older conservationists remember well the fate of the Audubon's Bighorn and the somewhat precarious status of the Sierra Bighorn, and show an understandable concern about other species. Thus, we find a "build in" interest when visitors come to bighorn country, and it is this interest that forms the basis for "recreation" as I use the term today.

Visitors to our National Parks and Monuments and the National Forests are invariably impressed with the striking aspects of the natural scene. It is only to be expected that they picture animals as a part of the wilderness scene — although you might be excused for questioning this statement if you have seen as many people trying to treat wild bears like zoo animals as I have in the last 28 years! Perhaps I should say that "normally" wildlife is considered by the public to be as much a part of the natural scene as rock formations, forests or rivers. Much would definitely be lost if they were not there. To the bighorn falls the distinction of being regarded as somewhat of a unique form of wildlife, thus deserving of even more than the usual amount of interest.

Seeing a bighorn may affect visitors in several ways. First, there is the inspirational value. There is no substitute for the thrill that one gets at seeing such a magnificent creature. There is often a sort of spiritual tie in that you *get* with your Maker as you see the fine results of His handiwork. There is something of a feeling of reverence at having had the opportunity of seeing such a creation. Perhaps there is a desire to express feelings that rise to the surface--poets and writers have put such emotions into words, enriching our world of appreciation in so doing. There is surely no way in which anyone can truly measure the inspirational worth of such an experience in the life of a child who meets this creation of nature for the first time. What basic effects will it have upon this child's thoughts and actions hereafter? This is an intangible, but very real, benefit of inspirational recreation.

Then there is the aesthetic in this form of recreation, All nature is beautiful in its own way, but the bighorn has been given special values. The ram is truly a thing of beauty, complementing its surroundings in a way easy to see and appreciate. Its lines donate strength, the sweep of its

horns are well proportioned. Its sureness and grace are beautiful to watch. Everything about it seems to emphasize that it belongs, that the scene would not be the same if it were not there.

It is when we get into the realm of understanding the animal that we find the interest base broadening rapidly. Visitors to an rea such as Death Valley are intrigued and amazed at how such an animal can live in what, at first glance to the uninitiated desert traveler, seems to be such a harsh and uninviting country.

There is first the question that must always be answered as to where it lives. Most visitors wouldn'b be surprised to be told that it lives among the pines and other evergreens among the Panamint Mountain highlands. They would expect it to choose a well-vegetated region where shade and water could be expected. To find, however, that it is the more barren, rocky, mountain areas that attract the majority of the bighorn is in itself a source of wonderment. While not done in Death Valley--and the reason is obvious why not--in some of our parks, conducted hikes are taken into bighorn country specifically in the hope of seeing some of these animals. The result is that sometimes so many folks go along to see the bighorn that the animals get out fast, a bit unnerved at all the commotion. Usually, however, the objective of the trip is realized and the hikers see what they came to see.

In the process of seeing where the animal lives, the visitors learn something about how it lives. A skilled naturalist can show them a variety of interesting items, all of which go toward building up some well-defined impressions of what a bighorn is and how he gets along in the world. The visitor learns something of food requirements and gets acquainted with some of the plants used. This, in itself, is an important secondary benefit, as the plant life of the area might well have been passed over without notice had it not been for the bighorn. The animal's problems, family life, the story of the formation of small bands and why this is so, these and many other interesting facts can be unfolded for the interest and enjoyment of the hiker as he travels through sheep country.

The habits of the bighorn furnish still another facet of interest. I recall very well at Rocky Mountain National Park one time when I had a group out on an all-day hike and we spotted an age-old argument that I am sure several of you have seen. Out on a relatively flat-topped ridge were two huge rams. There was no doubt in anyone's mind as to what was taking place as these two old warriors met head-on in combat. The sounds of the fight could be heard for some distance and the animals were so engrossed in their difference of opinion that my party was able to get within a couple hundred yards of'the contestants. Never have I seen a group of hikers more fascinated by a drama in nature, and the questions came thick and fast. Here was recreation, but quite different from that usually experienced.

Almost always, one question about bighorn leads to another and another, and new worlds of interest unfold. Folks want to know what enemies a bighorn has and how he protects himself. Can he outrun his enemy and if he

can't, what then? Can he use his choice of terrain to help defend himself? What happens to the lambs? Does the ram protect his family? These and dozens of other questions broaden the scope of interest. Sometimes something happens that changes well-established impressions. For example, I had a group of visitors out on a boat tour at Lake Mead one time and I took them up into the Boulder Canyon area. Here the slopes drop sharply into the lake, and sometimes sheer cliffs rise above very deep, water filled canyons. Such a place is a canyon known *as* Wishing Well--perhaps eome of you have been there. Sometimes, if the boat pilot would keep his motors idling as he moved slowly into the narrow part of the Wishing Well, one or more bighorn might be seen on the ledges above. This particular day, we saw a ram all right, but it was a dead one. It was floating in the water, well up in the canyon. An examination showed that it had simply died by drowning, Apparently he had fallen from the top of the high cliff into the lake and was sufficiently injured that he couldn't swim out. There wasn't a single visitor on the boat that didn't express astonishment that a bighorn had actually lost its footing. After all, these folks had read in more than one publication that a mountain sheep is always sure-footed. Thus, ideas quickly changed and the bighorn became a creature with real problems of survival, and subject to the same fatal mistakes of other animals.

Similarly, the problem of survival in a competitive world took on real meaning to a number of hikers who accompanied me to the top of Fortification Hill, overlooking the lower basin at Lake Mead. Doubtless, several centuries had seen the bighorn ranging the slopes of Fortification Hill, obtaining their food from the sparsely-vegetated, cooler canyons and getting their water from the nearby Colorado River or from springs. Today, of course, all this has changed. Man has created Lake Mead and the river is no more in this area. That, in itself, wouldn't be bad from the standpoint of the sheep, but another element has also entered *the* picture. The slopes and washes of Fortification Hill swarm with wild burros and the bighorn have been hard-pressed. Gone are the springs, trampled and contaminated by the-burros. Gone too is much of the available food, To maintain themselves, the bighorn have withdrawn to the top of Fortification Hill. Here there is a considerable amount of forage, but no water. Every few days, the sheep apparently go to the lake for water--a distance of about 2-3 miles by trail and some 2000 feet below the top of the mountain--drainк their fill and then return. Only to one who has followed this sheep trail through the steep rim rock that completely surrounds Fortification Hill does it become completely evident why the burros have never gotten to the top. So, today the bighorn on Fortification Hill remain on their "Island in the Sky," surrounded by burros, but holding their own. To the visitor to Lake Mead, this is an absorbing story and one that always produces a real feeling of pleasure that bighorn can survive against considerable odds if they have the opportunity.

To the photographer, the bighcrn offers a type of recreation that is becoming more and more popular. Practically every visitor's car these days has one or more cameras in it. To get a picture of a bighorn in his wild setting is a highlight of a vacation outing. I have seen numerous visitors in a bighorn country work for hours to get a reasonably close shot of a ram or a small band. There is a real sense of achievement in so doing. As a

photographer told me one time: "It isn't too difficult to get a bighorn in the telescopic sight of a high power rifle, but it's not so simple to get close enough to one to get his picture with a standard lens." It would be interesting to know how many Kodachromes are shot each summer of mountain sheep (or at least a picture is taken of where the sheep are supposed to be standing), but it must run into a considerable figure. I believe I would be safe in saying that there are as many or more bighorn hunters with cameras as with guns.

A bighorn experience is definitely qualitative. It helps to instill in people a deeper appreciation of what nature has to offer. To achieve it usually takes visitors into country that is different, introducing them to still other values in the field of wilderness. The spiritual and recreational values of these wild lands to man are unquestioned; the loss of any part would be a sociological loss. Bighorn, in their native environment, are definitely an important part.

Sometimes I encounter an opinion that there is "non-use" of such animals as bighorn where they are not harvested. To feel this is so only indicates a lack of understanding as to what the advocates of natural *areas* believe is important in this type of use. Bighorn, as an integral part of this natural scene, are "used" over and over again, but no numerical loss is experienced. The greater the use, the greater the benefits; and the benefits are growing, as each year sees additional thousands of persons coming in contact with nature. Recreation means "diversion; play; to provide amusement"; it also means "refreshment of the strength or spirits." The bighorn can satisfy either definition--it all depends upon how you care to use him.

THE DEATH VALLEY BIGHORN PROJECT

Ralph Welles, Naturalist
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The purpose of this paper is to explain to some extent the nature and the scope of the bighorn project being carried on in Death Valley at the present time. In order to do this most properly I should like to refer to the table of contents of the report we have just finished on our work to date. Here are 235 pages of single-spaced typewritten material including a dozen charts and a map of distribution. For those who are reluctant to read detailed reports there is a picture story of 112 illustrations with suitably simplified captions closing the book.

This report represents work and since "work" is an unsophisticated word it might be well to here emphasize the fact that our approach to the problem has been, and is, an unsophisticated, ungadgeted effort to find out how bighorn live in Death Valley.

Our method has been simple: Whenever we have made contact with a band of sheep, we have made every effort to maictain that contact as long as possible whether it meant hours, days, weeks or months. Our only gadgets, high-power field glasses, long range lenses, and notebooks, to record on film and paper our observations of the details of their daily lives.

This type of work cannot be paid for with money -- cannot be done within a forty hour week. Eight hours a day, five days a week with Saturdays and Sundays off is an admirable schedule designed for the protection of the field worker but the bighorn are not concerned with this -- they come and go as they please and the final measure of the field worker's success will derive from his willingness to come and go with them.

Sometimes, in order to understand what someone is doing it may be necessary to understand why he is doing it. In our case it is simply a deep-seated interest in our work, of recognizing what needs to be done and doing it regardless of what it takes to do it. We are not saying that everyone should adopt this attitude toward his work, but we are saying that this type of work is not likely to get done any other way.

We began this project inadvertently during our first visit to Death Valley in January, February and March of 1950.

The Nelson bighorn was being featured in the Park Service interpretative programs as "one of our most interesting mammals, who cross from one mountain range to another in the vicinity of Badwater."

The complete absence of any further information about them aroused our interest to the extent that we spent six weeks of our time in an increasingly determined effort to see at least one of the elusive creatures if it was at all possible.

We gave up the search with the warm weather of April and decided to apply ourselves to the literature on the Nelson bighorn during the summer, thus acquaint ourselves with its habits and be prepared for a more intelligent search the next winter.

We discovered that there was, practically speaking, no literature on the species available anywhere. This heightened our interest to the extent that we spent *a* major portion of the next two winters in a fruitless effort to learn something about them.

We could find no one who knew where to look, who could tell us what they looked like, what they ate, where they had lambs, when the famous Eights between rams took place, or any of the phases of the life history of an animal which you would expect to be common knowledge in an area which had been set aside as a sanctuary for it.

On the other hand, their behavior and whereabouts became such a mystery that we began to wonder if there were actually any of them *left.* The fact that during this entire period we had *not* talked to a single person who had seen a sheep in several years added considerable substance to this idea.

Finally, however, in March of 1352, we found one Nelson bighorn ewe in Echo Canyon, and were able to observe her for an hour as she climbed the canyon wall to the tip of the highest peak.

Our enthusiasm was revived, and a second phase of our project began.

We had been hearing that sheep were much easier to find at the Desert Game Range near Las Vegas in Mevada, and we now decided that since it had taken us three winters to find one sheep in Death Valley we should go to the Game Range and see how long it took to see one there. We arrived in the latter half of March.

The personnel of the Fish and Wildlife Service at the Game Range were very cooperative and gave us the use of Joe May Camp for ten days. There, in a joshua tree habitat at about 5000 ft. elevation, we saw at least one bighorn every *day,* climaxed by one day's ~~total of~~ forty-five.

We followed, observed and photographed sheep all day every day, and at night we read a stack of unpublished manuscripts about sheep by Oscar V. Deming, the Game Range biologist.

We began to learn from what we saw and read. We learned that we were there in the lambing season and that the rams had withdrawn into

a separate band in a separate territory. We saw nine of them, all mature, at the top of Wildhorse Pass, in the pinyon and juniper country, and wondered why there were no young rams with them.

We learned there was such a thing as "baby-sitting" and we saw it, twelve lambs playing and resting on a high cliff in the care of two older eves, while all the other mothers fed in the dense (and to lambs, dangerous) vegetation in the wash below.

We saw there were leaders among them and wondered how they were chosen and how they ruled until, as time passed, we saw that they didn't rule at all, but led by example.

We re-read some of the few pamphlets and articles we had been able to collect, and began at once to see differences between what was written and what we were seeing. For instance, E. H. Ober (1931) had written that bighorn lambs were born twins and snow white. We could find neither.

Ernest Thompson Seton (1927) had placed the mating season in December, but here in March we were seeing lambs with horns showing and so much greater growth than others that they could *be* no less than two months old, so the mating season of these desert sheep had to begin long before December, because lambs were born in January.

Seton also mote that "the lambs up to 6 months old often bleat exactly a.s do the domestic kind; but I never heard any sound from the old sheep except a loud snort or 'snoof'." This was hard to reconcile with the fact that we were hearing ewes call their lambs every day.

So, day by day, the difference between what we were reading and what we were seeing grew to such proportions that we eventually came to the inevitable conclusion that we had apparently stumbled into a virgin field of research; that the life history of the desert bighorn, Ovis canadensis nelsoni, was unknown; that writers on the subject were rehasing legend and hearsay.

Nothing had happened to change this picture much by December of 1954 when I was in my second season as a Ranger-Naturalist in Death Valley National Monument.

Dr. Thos. Clements had just published a booklet on the Geology 04 Death Valley, in which he stated what still seemed to be the total story at the local level, "Desert bighorn sheep live in the mountains on both sides of the valley, and are known to cross from one side to the other, but have been seen by relatively few persons.:'

We had, in the meantime, made other trips to the Desert Game Range and were now doing a weekly interpretive program during the winter season on the bighorn, which was stimulating a great deal of interest in both the resident and visiting population and was bringing to us many reports from persons who had at some time seen sheep in Death Valley or neighboring terrain.

We knew by now that conclusions from the study being made by Oscar Deming at the Game Range would not necessarily he applicable to Death Valley because of the contrasts between the two areas, exemplified by the fact that in three years search in Death Valley we had found one sheep, while at the Game Range we had counted over one hundred in less than a week. A much greater population made possible by denser vegetation due to higher elevation, cooler climate and greater rainfall.

We also knew by now that, incredible as it seemed, no one had ever spent twelve consecutive months in Death Valley for the sole purpose of studying wildlife survival in one of the hottest and driest areas on earth. The field, from a research point of view, was untouched. We decided to go into it.

No government funds, equipment or man hours were alloted to the project, however, until December, 1954. Meanwhile, sight records of bighorn were reaching us with increasing frequency. We were, in addition to our own week-end excursions, making a concentrated effort to check all other reports reaching us. Through the early spring of 1954 we had received five reports of sheep in Furnace Creek Wash, usually several days after they had been seen. We failed to locate any of these. During the fall of 1954 we began to get reports of sheep in the Badwater area, and the old story of bighorn crossing the Valley at that point once more went the rounds.

I was on duty at the Death Valley Museum at Furnace Creek Ranch when a young man who was about to leave turned back at the door and said, "By the way, I just got a good picture of some of your goats a while ago, down there at that low place, you know ---". This was - at 4:00 p.m. I closed the Museum, collected my wife and our cameras and at 4:30 we were photographing a band of six bighorn, bedding down about a hundred feet above and 100 yards to the north of Badwater. We stayed with them until long after we could see, listening to an occasional sheeze or a rock falling down in the darkness.

We went back to headquarters at 6:00 p.m. and at 7 I gave an interpretive program at the Ranch. An hour before dawn we were back at the bedding site waiting for daybreak and an answer to the question we had carried with us through the night, Will they be there in the morning? They were, and the present intensive phase of the Death Valley bighorn study had officially begun.

An evaluation of our method of approach to bighorn research in Death Valley might be more effective if it included a resume of previous studies and their results.

In February, 1355 Mrs. Welles and I were in the Cottonwood Mountains assisting Regional Biologist Lowell Sumner in a burro survey of that area when we learned from him that a series of three bighorn

surveys had been made under his direction in Death Valley beginning in 1938 and ending in 1940, and that other sporadic efforts had preceded these. We had never heard of these studies and it was with some difficulty and Lowell Sumner's assistance that we eventually Located these reports, and were able to make use of the valuable information recorded there.

Some of that information was not fully understood until we went further back to the first report of any work done in the Monument area:

1. Dr. Edward Nelson, 1891, establishing the type locality and taking type specimen of the Nelson Bighorn in the Grapevine Mountains. Very common there then, very scarce now. Why?

2. Joseph Dixon, Dr. Joseph Grinnell, 1917, found the greatest sheep concentrations at Nevares Spring and in Hanaupah Canyon. They believed the vertical distribution rarely reached below the 1000 ft. level. Mrs. Welles and I lived with a band of bighorn near Badwater below sea level for several months.

3. January 1935, A. E. Borell visited 26 springs, saw no sheep, but much evidence of poaching; found the burros ranging at lower levels and did not believe they conflicted with the bighorn.

4. October 1935, Joseph Dixon visited 20 springs, saw no sheep, accepted as trustworthy sight records of thirty sheep in one band at Quartz Spring, forty-two in another at Dodds Spring. We have no official record of either sight or sign at Dodds Spring-for many years.

5. September 1939, first organized sheep census in the Monument's history, with Field Naturalist Joseph Dixon and Regional Wildlife Technician E. Lowell Sumner in charge, With rain falling in some area of the Monument every day, seven men visited 21 areas in 14 days, saw twenty-seven sheep, fresh tracks of thirty-eight more, made no estimate of the total population. The most encouraging result was lack of evidence of poaching. Plans were laid for more intensive efforts in 1939.

6. July 1939. As in 1932 the California Division of Fish and Game gave wholehearted cooperation to Wildlife Technicial Lowell Sumner and the Monument staff in a prodigious effort scheduled for two weeks beginning July 20. In spite of the earlier date for the census, rains overtook them again on July 25, and by the 30th "Rain in varying degrees of intensity was falling almost universally throughout the Death Valley ranges. Whether or not the bighorn had been restricted to the water-holes prior to the rains, our observations definitely established that the precipitation thoroughly scattered them so that further water-hole census were out of the question for 1939."

They persisted, however, and counted thirty-five sheep, which with thirty-one counted the month previously by Don Curry, made sixty-six.

"The Panamint Range south of Emigrant Wash was not covered at all during this survey due to the vastness of the territory involved and the difficulty of accessibility.

"In the areas covered by the 1939 survey, the total number of bighorn estimated from sight records, tracks droppings and beds was approximately two hundred and eight. Due to the scattering of the animals by rains during the survey it is believed that this figure should be increased by at least fifty, If we use this figure and if we assume that the total number of bighorn in the Cottonwoods, Grapevines, Funerals and Blacks approximates 258, and if we make the further assumption (which seems reasonably well justified from the data already at hand at Death Valley National Monument) that there are at least as many more bighorn in the Panamint Range south of Emigrant Wash, then the total number for Death Valley National Monument must be in the neighborhood of 500.

"Among the factors adversely affecting the bighorn population, by far the most serious is the competition for food and water to which the animals are subjected by a large and increasing population of burros. It appears that if the burro population is not placed under reasonable control, the Service will be found with a choice of either raising burros or bighorn as the chief wildlife crop of the Monument."

A burro control program was initiated, which by 1951 had eliminated 1377 animals from competition.

7. January 1941. Lowell Sumner and members of Monument staff censured the Cottonwood Mountains for the third time. They saw no sheep, made no estimate, "The present investigation has definitely proven that, at Least during the winter of 1939-40, the bighorn have remained at altitudes up to 8000 feet during the fall months and subsequently have moved downward only enough to escape the snow and inclement weather of midwinter."

The case against the burro became even blacker. "As we continue to study the Death Valley bighorn situation we are more and more impressed with the probability that the chief obstacle to the recovery of the bighorn to their original number lies in the ruination of their range by domestic stock."

8. June, July, August 1940. Acting Park Naturalist Wilbur Doudna and members of the Monument staff visited 18 springs, saw 20 sheep.

9. May 1953. Biologist Lowell Sumner took to the air over the Cottonwoods, visited key springs on the ground.

"The exact status of the bighorns will require prolonged and intensive field observation. However, it appears that the animals are at the present time not in acute danger. They may well have hit a low point in 1949 and 1950 due to climatic difficulties, but if the competing wild burros can be held down during the next few years, the bighorns should at least regain the numbers that they had up to the outbreak of World War II."

During the period of 1939 to 1951 Park Service control methods had eliminated approximately 1400 burros from the picture.

Where are we now?

Our attitude toward our lack of knowledge of the bighorn sometimes reminds me of the general attitude toward money during the Depression. Nobody has any, so why worry? The relaxed "we're all in the same boat" attitude prevailed for several years and many people remember it as one of the most comfortable periods of their lives -- through no fault of their own they were relieved of the responsibility of being successful, It was easy-going and comfortable.

So it is easy going and comfortable as long as we all keep saying 'We don't know anything about bighorn -- no one does." It's relaxed and pleasant and keeps us from facing our responsibilities,

It seems to me, however, that the Bighorn Council is about to jar us into maturity. Sooner or later we will be forced into admitting that we do know something about sheep because if this Council continues to function it will force us into accepting our responsibility for learning something about them,

We are already beginning to come to tentative or limited conclusions regarding many phases of bighorn life history, but positive conclusions drawn from our present study will be few. A basis for such conclusions must be built on repetition of incident to a point where further repetition becomes a predictable and consistent segment of the survival pattern of the species,

In the past we have enjoyed saying that the only consistent thing about the bighorn was his inconsistency. This was convenient but untrue. It would have been more accurate to say that the most consistent thing about the bighorn Is our inability to understand him. What he does is as consistent to his way of life as what we do is consistent to ours. The pattern is there when we learn to see it. To deny this would be to deny the functioning of natural laws.

We have been like a man who has come across a segment or two of a jig-saw puzzle and tries to complete the picture unaware that most of the segments are missing. A single, isolated, unrepeated observation of a bighorn lamb nibbling at a creosote bush is like one piece of a jig-saw picture, and until we know where it fits we can't know what part it plays in the complete picture. Observing a band of ewes and lambs for one hour, one day of one season on the protected slope of one mountain does not fix a rendezvous with the same band of ewes at the same time and place every year thereafter,

One visitor's observation of a band of bighorn on the fans below sea-lwel at Badwater in 1954 added nothing to the bighorn story in Death Valley. They had been seen there before as "they crossed the floor of the Valley' from one mountain range to the other". But by going and staying there with them for most of the winter, piling one series of day-long observations on another for several months began to produce so many new segments of the puzzle that we wondered why the source had not been tapped before.

With repetition of observations we began to learn to evaluate what we were seeing and to weigh the reports from others in the light of this evaluation.

In order that you may weigh this report of ours in the same manner certain things have been included in it.

The footnotes at the bottom of each page indicates not only the number of times each observation was made, but which page of which of our sixteen progress reports contains the reference indicated,

The section entitled Chronology of the Present Study is a record of the time spent in actual observation including dates, location, number of animals, age class and sex, and number of hours observed,

Some of the most revealing data was obtained during a 30-day period of uninterrupted observations at Nevares Springs where we finally began to put the pieces of our picture together,

The first chart is a complete record of the sheep seen at Nevares Spring from August 11, 1957 through September 10, 1957. It gives the date of each observation, the maximum temperature of each day, the number of animals observed, their age class and sex, the time of arrival and departure of each band or individual animal, and the total hours of observation of each unit. Individual animals 47, 27R; 11E, 9L.

Should you wish to make your own correlation between bighorn activity and the weather, the complete government weather record for the immediate area, including the preceding and suceeding months follows the first chart.

Figures C-1 and C-2 are rather startling records of the ground temperature for 1957 and 1950. The high of 190° would certainly have an effect on vegetation, surface water and all wildlife activity.

The line graph of the hourly record of drinking time surprised us in some respects. We swept the sign away from the springs before leaving at night and inspected them as soon as light permitted. No bighorn watered in the night during the entire 30 days. They began before sun-up between 5 and 6, reached a peak between 6 and 7, tapered off to nothing between 12 and 1, climbed somewhat between 1 and 2, dwindled to 0 between 7 and 8, with no observations of drinking after sundown.

Figure E is a record of the time each group spent with their noses in the water. Whether they drank during the entire time we have no way of knowing. Here is the summary:

Average drinking time in minutes

Average ewe	-- 6.8	Average ewe and lamb	- 6.
Average lamb	-- 3,	Average ewe, 1 & r	- 6.1
Average ram	-- 4.2	Average over all	- 5.3

Figure F establishes fairly conclusively how often the individual animals of this area came in to drink: an average minimum of every third day and an average maximum of every fifth.

We had the good fortune of 2 1/2 months full time observation of a bighorn lamb in the wild. Figure G is a record of available data on nursing time and frequency variation from birth to 2 1/2 months of age.

Distribution maps, census charts, and forage plant lists complete the compilations made possible only by the "prolonged and intensive field observations" urged by Lowell Sumner in 1953.

Notes of Wednesday Afternoon Discussion Periods
Bighorn Ecology

Discussion on Ralph Welles' paper

Question - Kelley: Has temperature and water consumption been correlated?

Answer: Yes, a reflection is shown. They come to water most during the hottest time.

Question - Monson: How can you tell individual sheep apart in the field?

Answer: Field recognition comes by recognizing individual traits in morphology - abnormal or normal.

Question - Jones: Can we get a copy of your paper when it is published?

Answer: Yes.

Question - Moore: Do you have deer in the locality?

Answer: Yes, an insignificant amount.

Question - Gene Gerdes: When is your highest lamb mortality?

Answer: It appears during late fall to early spring,

Question - Kennedy: Do you find yearling groups by themselves?

Answer: Occasionally.

Question - Monson: Do you have a picture of when the sheep broke ice to drink?

Answer: No.

Comment by Jones (California): Credit should be given to Mr. & Mrs. Welles for doing a specialized job well done.

(Jones made the motion that Welles' paper should be printed by N.P. S.)

Fredine: The N.P.S. will publish Ralph's paper.

Question: What is the sheep population of Death Valley?

Answer: At present we do not have a method to actually and fully derive a total population. A conservative estimate would be 540 to 800 with a maximum of 1200 head.

Question - Monson: Does your population fluctuate?

Answer: Yes, lambing percentage and lamb mortality, the season of census and other factors enter into the picture.

Question - Monson: Did you get the population of 540 on a drought or hard year ever?

Answer: No - sheep disbursement and low seen population occur during good years. The excellent vegetative growth caused the disbursement and a low population is observed.

Question - Farmer: What is the health status of your sheep?

Answer: Excellent teeth with no elongation, They appear excellent. Lambs die, of course. It appears primarily from complications of pneumonia. Most dead sheep found are 10 to 11 years of age.

Question - Fredine: How long would it take a man to finish a complete ecology study on your bighorn?

Answer: Never, They vary so much, as do patterns, conditions and years that one man would have difficulty in getting the complete picture seen and analyzed in his lifetime.

MAN'S EFFECT ON BIGHORN IN THE SAN JACINTO - SANTA ROSA MOUNTAINS

Lloyd Tevis, Jr.
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Division of Biology

To me, and I imagine to all of us, the desert bighorn is very much a symbol of wild areas still uncluttered by concentrations of human beings, So it seems rather incongruous that a thriving herd should adjoin a sophisticated desert resort area teeming with humanity.

In the Coachella Valley for a distance of forty miles from Palm Springs to the "fabulous" new "Riviera" on the shores of Salton Sea, an extraordinary number of "enchanged" subdivisions, "heavenly" golf courses, swimming pools and polo fields are being developed and in many places jammed against the base of the San Jacinto - Santa Rosa mountains -- whose steep and arid, lower slopes support the largest continuous population of bighorns in California.

Less than a mile from Palm Springs, where in spite of the desert climate mink coats blossom out at night, there is an undisturbed water hole -- one of a number frequented by the sheep and necessary for their survival during the hot summer months.

From poolside in Palm Springs, with bathing beauties and starlets about you, it is possible by using binoculars -- if you have that keen an interest -- to watch bighorns on the slopes above. Last year an old ram stepped across the slope-determined line between wilderness and city and, wandering through the streets, caused tremendous excitement, alerted the police department, and next day had his photographs splashed across the front page of the newspaper.

The San Jacinto - Santa Rosa herd inhabits a narrow belt on the eastern side of the mountains from the lower reaches up to about the four thousand foot level. It is this proximity of their range -- the best bighorn habitat in California -- to an exploding human population that is the basis for the coming and probably grave problem of man-sheep relations in these mountains.

Before the advent of the white man, Indians roamed over all the region. Today agave roasting pits and potsherds can be found even in the most out of the way places; and rock slabs on which food was ground are common in the vicinity of water holes. According to Dr. Carl Hubbs, the kitchen middens contain bones of bighorns, indicating that the animals were hunted successfully.

When the white man replaced the Indians, cattle were run on part of the range, and man on horseback became a new and important element in the scene. That was the heyday of killing bighorns with the rifle --

and of an intense interest in the species. Some residents made a profession of taking hunting parties back into the mountains; illegality merely added zest to the sport.

Then as poaching gradually died out, until today it is negligible or non-existent, and a long drought eliminated most of the cattle, interest in bighorns waned. It seems extraordinary but it is a fact that most modern deer hunters who wander down into the sheep range from the black-tail habitat immediately above, do not know that there are bighorns anywhere in the country. If you want information about the species you have got to get it from the old-timers. The "young blooda" who are replacing them, Indians or otherwise, are not interested.

Thus in recent years, when resort-promotion has become big business in the valley and millions of dollars are made in land speculation, the sheep would seem to be completely and safely in possession of their rugged hillsides. They look down on teeming humanity, but they are less disturbed by mankind than ever before.

The outlook for the future, however, is not good. The reason is this: with the exception of the southern terminus of the fifty mile long but compressed - two to three miles wide - range, the land occupied by the herd is neither in National Forest nor in State or National parks. Instead, it shows a checkerboard pattern of land ownership, with every other square mile section as public domain, or, in a few instances, Indian Reservation. All the intervening sections are private, originally deeded to the Southern Pacific Railroad Co. This means that at least half the sheep range and many of the vital water holes are subject to the whims and wishes of a variety of different owners.

By its very ruggedness and the scarcity of water, the terrain would seem to be safe from serious intrusion by man - until you examine the maps in any real estate office in the Coachella Valley. Then you will find that a few years ago a number of speculators bought up quite cheaply all mountain land which was still available. They looked ahead to the future and a possible fortune from subdividing.

A few people acquired acreage with the idea of saving it for the sheep and other wildlife. Randall Henderson of Desert Magazine did this - and Philip Boyd, a Regent of the University of California.

Last Spring I talked to a man who for a long while owned a section on which a key water hole is located. Unlike the speculators, he loved the land and intended to establish some sort of a preserve for the animals and plants. They very suddenly last summer before a plan could be formulated, he died. The executors of the estate have offered the section to an adjoining land owner for $75,000 - more than one hundred dollars an acre for totally undeveloped, rough, arid mountainside! The latest word is that a syndicate is going to buy the property, develop what water they can find - thereby drying up the water hole - and subdivide.

The site of another important water hole has been proposed as a County Park. Although the intent is to keep it as a nature preserve, I

suspect that in the long run popular demand for picnic tables and camping facilities at such an attractive place will sway the County Supervisors to the detriment of the sheep.

As the valley floor becomes more and more congested and an overwhelming demand continues, especially from nearby Los Angeles, for small home sites in the desert, covetous eyes have turned to the desert slopes of the mountains. It might seem that abundant water would be essential for human developments, but it is not. A subdivision has gone in just above the sheep range. It has modern, quite fancy houses with all the conveniences we take for granted - except running water. Each home owner has to haul his water from a single community well of very limited capacity.

A section of public domain thrown open by the government for so-called five acre or jackrabbit estates has been almost completely occupied, even though no water is available. Moreover, to get to his parcel of land, each owner had to construct a steep road costing more than the shack and outhouse which he then built.

Steepness and ruggedness of terrain is no protection against the bulldozer gone wild. One man who owns part of the rock-bound lambing area described by Dick Weaver and John Goodman at the first meeting of this Council is now driving a road right into it: He plans to build a house and develop water from the nearby dry creek.

Looking ahead into the future, we can see that forces are in operation which can destroy ultimately the bighorns of the San Jacintos and Santa Rosas through appropriation of the water holes, spoiling of the lambing areas, and general disturbance by mankind.

At the same time and on the hopeful side of the ledger, there is renewed interest in bighorns. Mr. Frank Bogert, mayor of Palm Springs, considers them to be an outstanding asset to the resort area; and his views are shared by Mr. Warren Slaughter, president of the chamber of commerce. The Palm Springs Desert Museum receives innumerable inquiries about the best places to see bighorns; and one water hole in particular is visited frequently by photographers. Illustrated articles about the sheep sometimes appear in local newspapers and magazines so that it is not unusual for a ram on his rocky lookout to share photographic honors with a millionaire in his golf cart. A Palm Springs business man whom I took on a hike into the bighorn range was so excited by the sheep, which seemed to be everywhere, that he kept exclaiming, "Why, this is better than Africa!" The Palms to Pines highway goes right through a bighorn concentration area. If you talk with a tourist who was lucky enough to see the animals there, you will find that it was a highlight of his desert vacation.

Not only tourists are intensely interested. Many residents who have learned about the sheep are thrilled to realize that so magnificent a

wild mammal lives close by, giving a special prestige to the resort area; and they have set themselves up as watch dogs over the herd. Witness the clamor that resulted when the California Department of Fish and Game tried to eliminate Game Refuge 4D, which had been established for the benefit of the sheep. The hue and cry was so great that the Department had to backtrack quickly, even though it knows full well that the Refuge is of little or no value as far as survival of the herd is concerned.

In thinking about what can be done from the standpoint of preservation, I believe we have to accept two basic premises. One is that we cannot stop invasion of the range by man. All we can hope for is to channel it along the least objectionable lines and then try to accommodate the sheep to the changes. The other is that the San Jacinto - Santa Rosa herd can never be subjected to legal hunting of any sort, not only because of the hazard to the public - there are going to be just too many people around - but also because of the storm of protests which would come from the now quite considerable number of influential people who do not want the herd molested by gunfire,

The fact that the sheep can never be hunted does not mean that they are any less in need of skilled management. Quite the contrary. In fact, I stress management, because, unlike the National Parks where at least in the wilderness sections the best policy may be to leave nature alone as much as possible, the vastly different situation in the San Jacinto and Santa Rosa mountains calls for positive and immediate action. So far the only person who has been doing anything to help the herd is Richard Weaver of the California Department of Fish and Game whose water development program undoubtedly has contributed to the splendid way in which the sheep are coming through the current, protracted drought,

I would like to see a wildlife manager assigned full-time to the herd. If the California Department of Fish and Game cannot do this because hunting is not the ultimate goal, then it should be done under the California Department of Natural Resources or by some other means. There is no reason in the world why management of wildlife for recreational purposes other than hunting should not also have its place in the sun.

It requires a radically new viewpoint and a different concept of objectives from those which are taught in classes in wildlife management. When you manage bighorns for hunting, you look upon the old rams as a shootable surplus whose removal would benefit the herd. That is not the case when you have photographers in mind. Then the old ones are the prized animals to be preserved as long as possible. And a limited hunt, even if in time it improved the general health and vigor of the herd, would defeat the main objective of management because the surviving animals then would be wary and more difficult to observe.

In general, the modern hunter cares only about the trophy or meat he will bring home and is quite happy with any policy which will increase numbers of sheep and, hence, his chances of success. The photographer and observer, on the other hand, are interested in the bighorns as an

integral part of the natural scene. To them, water hole development involving removal of vegetation, such as willows, is not necessarily good, even if it benefits the sheep, because of the harm it may do to birds and other animals which utilize that vegetation. Similarily, blasting out the rock face in a canyon or the erection of cement dams should be undertaken only as a last resort, because unless the wildness and natural beauty of the scene is preserved the bighorns seen there might just as well be in a zoo,

Unquestionably, wildlife management on private lands and public domain guided by objectives of this sort will prove even more difficult than management for the benefit of hunters alone. It is a real challenge. It will require skilled technicians adept at public relations, at home in the out-of doors, and able to make careful life history studies of their charges.

When applied to the San Jacinto - Santa Rosa herd, management will have to deal with two main categories of problems. One is habitat protection and improvement. The other is how to gain the public support necessary before anything really effective can be done about the habitat.

Mos conservationists feel we should publicize the herd as little as possible, at least not give out the best places where the animals can be seen, The mayor of Palm Springs is very careful about whom he tells how easy it is to approach rams with an automobile in Chino Canyon - for fear that someone will grab a rifle.

I think that is the wrong approach. Only by advertising the sheep and making it easier for people to see them can we gain the essential support to assure their preservation. I even would risk giving out the locations of the water holes, though we do not know how much human activity these particular sheep will tolerate at those sites.

In some places outside the San Jacintos and Santa Rosas, such as Stubby Sp ings in the Joshua Tree National Monument, certain sheep have become so tame that they will almost push photographers out of the way when coming in to drink. That may not be a healthy situation, for if the animals get too tame they cease to be wild creatures and then there is no point in preserving them outside of zoos. In this connection, I sometimes wonder if our use of the terms "cropping" and "harvesting" has not contributed to the deterioration of modern hunting practices, as was discussed yesterday, by implying that wild game is no different from domestic stock and should be managed and hunted accordingly.

At other water holes, some bands of sheep will not tolerate people at all; and, as a result, mortality among lambs may be high. In order that people could watch and photograph sheep without being seen, it might be a good idea to experiment with stonework blinds constructed some distance from water holes but from which people could get a good view of the animals. Guided tours night bc conducted to these vantage points. Also I would like to see signs along the Palms to Pines highway

telling the motorist that he is coming into bighorn habitat and explaining the importance of water holes and lambing areas. The biggest and most important job right now is to educate the land owners and the public about the facts of life of the bighorn.

As it is, to suggest doing away with Game Refuge 4D is to stir up a hornet's nest of opposition; yet, paradoxically, it is almost impossible to make the same people realize the seriousness of the current threat to the habitat. They can see that shooting kills, while the consequences of habitat destruction seem vague and indefinite.

If the real danger can be brought home to enough people then it should be possible to go ahead with an effective program of preservation and improvement of the habitat. First, we should try to persuade the Federal Bureau of Land Management not to release any more of the public domain in the San Jacintos and Santa Rosas for jackrabbit homesteading. Secondly, we should strive to have the Anza-Borrego State Park extended north as far as possible along the eastern slopes of the Santa Rosas. And thirdly, every effort should be made to acquire or lease those sections of the public domain which contain water holes or important drainage systems. In this latter undertaking, conservation organizations such as Desert Protective Council and Nature Conservancy could be of great help,

It may be too late to save many of the water holes on private land, but at least whenever a water hole is destroyed, it could be replaced with an artificial one, the water being piped in to the site. Most subdividers and home builders, realizing the esthetic appeal of the bighorns, would go along with this.

As to whether or not the sheep could accommodate themselves to the penetration of their range here and there by roads, houses, and subdivisions - along the checkerboard pattern I have described - that is a major question. I think that the evidence indicates that with hard work and plenty of imagination a plan could be devised and put into operation to make it possible for both man and sheep to utilize the same general area. We shall need, though, to know a lot more about the herd, not only about the degree of human activity the animals will tolerate at water holes and elsewhere but also about all phases of their natural history in these particular mountains.

In this respect we are fortunate. The University of California at Riverside has been given 2 1/3 sections of land in the Santa Rosas, including one of the best water holes, and is applying to the Federal Government for additional sections. On that land it is going to establish the Deep Canyon Desert Research Station, which I venture to say will become the country's most important center for research on desert biology - and with bighorns right there in large numbers, important work is sure to be done on that species of animal.

There are few areas anywhere which are more ideally suited for yielding information about the effect of man on wild sheep. Beginning now when the effect there is practically negligible, students of the animals will be able to record the reaction of a prosperous, non-hunted herd as more and more of its habitat is changed by man. Furthermore, the narrowness of the sheep range creates a favorable condition for tagging studies.

Fifty-one years ago, when even the desert floor around Palm Springs was wild, Dr. Joseph Grinnell explored Deep Canyon on land now owned by the University. He wrote: "... it was the immediate vicinity of Deep Canyon which ... was the metropolis of the sheep. On the steep walls and nearby mesa a few hundred yards back from the rim, 2500 to 4000 feet altitude, well worn trails, footprints, and feces were plentiful. In places it looked as though a herd of domestic sheep had been over the region." (Grinnell and Swarth. 1913. An account: of the birds andmammals of the San Jacinto area of Southern California. Univ. Calif. Publ. Zool., 10: 197-406.)

Tody the same description -- of fresh sign in abundance -- fits the scene even though the heavily traveled Palms to Pines highway closely parallels Deep Canyon and cuts right across the very mesa mentioned by Dr. Grinnell. Let us hope that in spite of additional man-made changes which are coming, Grinnell's description will still apply a hundred years from now.

Discussion on the paper by Lloyd Tevis

Comments by various men indicated the encroachment of man on sheep habitat is a realistic problem. Palm Springs, with its flow of people to the desert for homesteading is one problem area.

Monson indicates that prospectors on the Kofa Game Range are detrimental if for no other point than that they build roads and open up the country.

Comment by Fredine: The infringement of man on even an inviolate area, as Monuments and parks, can be a realistic thing. Our guard should always be up for infringement. Kennedy indicates that military infringement on San Andreas N.W.R. was and is a problem.

Jones comments that very little interest is shown in bighorn in California. So far it has been impossible to generate hunting interest.

BRIEF NOTES ON THE PRESENT STATUS AND DISTRIBUTION OF BIGHORN SHEEP IN MEXICO

by
B. Villa R.
Mexico City, Mexico

Cowan, in his paper entitled "Distribution and Variation in the Native Sheep of North America" published in 1940, states that "Information regarding the status of O. C. weemsi and O. C. cremnobates in Lower California and mexicana in the Mexican part of its range, has been unobtainable".

Eighteen years after the above statement was made nothing has been added to the knowledge of the situation of desert bighorn sheep in Mexico.

But in November of 1957 and in 1958, with the cooperation of several institutions interested in the conservation of wildlife in North America, through the efforts of Dr. A. Starker Leopold, to whom I extend my gratitude, it was possible to initiate a field survey on the basis of the following items:

a) To learn the numbers and distribution of surviving animals.

b) To examine in the field the habitat needs of the species and to assess existing habitats and effects of land use upon them.

c) To study ecological relationships of pronghorn and bighorn, with emphasis on predation as a possible limiting factor.

d) To study the amount and effect of illegal hunting on the animals.

e) To propose a plan of conservation of these animals.

As you might know, the pronghorn and bighorn were once abundant in the arid regions of northern Mexico. Originally the range of the pronghorn extended as far south as the state of Hidalgo. Even up to the late 1800's pronghorn were numerous in Durango and the northern states. Bighorns were confined to the desert mountains and were never as abundant as pronghorns. However, they too were locally common up to the turn of the century.

Since 1900 these two species have declined steadily in numbers, until today both are limited to scattered local herds and even these are shrinking. Complete legal protection has not stemed the drift toward extinction. The reason for the decline is not fully clear, but certainly illegal hunting and range competition by domestic livestock are involved,

The Mexican government is anxious to preserve these species and we are working toward this end at the present time. The first point of our program is as follows:

By traveling all over the former area of distribution of the bighorn sheep in northern Mexico, sometimes by plane, sometimes by truck, on burro back or walking mostly, we have come to the conclusion that the population of the species O. C. mexicana is greatly reduced.

Bighorn sheep probably occurred formerly in most desert ranges of western and northern Coahuila, at least as far south as the Sierra de la Paila. From reports received from older residents, bighorns were more at home in the arid rimrock of the foothills and less elevated mountains than in associations of oaks or conifers at the higher elevations. The gradual reduction in number and their final disappearance has been the result of both hunting and competition with livestock, chiefly goats.

Rollin H. Baker said in 1956 that bighorn sheep were known with certainty to inhabit only a few places in the State; one place was in the mountainous area to the north, west of San Lázaro. In 1958, looking for them, we obtained only vague information from the residents.

Another place where bighorns have been reported in recent years is in north-central Coahuila, but at the present all indications are that no bighorns now live in the Sierra del Carmen and associated mountains.

A third area where bighorn sheep were reported is the Sierra de los Hecheros in the extreme northwestern Coahuila. In our field survey we failed to find *them* in this area.

Nevertheless, we hope that some small bands we were unable to observe still might be found somewhere in the rimrock mountains of the State. This will be a fortune and the starting point for the re-establishment of the former population in the area.

In Chihuahua, bighorn sheep were reported in the parts of the Sierra de los Hecheros which are in this State. Reliable reports from several sources at Sierra Mojada and at Jaco and Camargo tell of a sizable band in the Rancho La Ventura in the Sierra del Diablo. We were unable to see these animals. From the rest of the State no bighorn shee were reported to us, not even from the vicinity of Lake Santa Maria, the type locality of the species.

In Sonora we were informed of a band formed by 60 individuals in Sierra Punta Cirias, southeast of Puerto Libertad. We saw many fresh tracks and fresh pelets as well as indications of recent occupancy of resting places in these rough mountains.

In the mountains of Sierra del Marmol, Los Mochos and Sierra del Chino, there are 20 individuals; in El Chamito or Sierra del Alamo, some 15.

In Sierra del Antimonio, and in Sierra del Viejo we saw several specimens, most of them yearlings.

In Cerro Julio of *the* Sierra de Santa Maria, exist a group of 30 individuals, most of them young specimens.

In all, in this part of the Northwestern Sonora, there are about 200 specimens, subject to the heavy pressure of poachers and poor habitat conditions, especially those derived from the long draught of the last several years.

In the Pinacate mountains, once a good bighorn sheep country, all indications are that the animals have been exterminated or almost exterminated,

Mr. Joe Espinosa, from Sonoyta, informed me that not long ago, around 1948, before the construction of the road Santa Ana - Mexicalli - Tijuana, he saw a good group of about 500 individuals thriving on the vegetation of the bottom of the craters. My assistant, in July and August of 1948, accompanied by Mr. Espinosa, saw only tracks of a far, but hunter camping sites in many places, tire tracks everywhere and some native hunters.

Finally, in Tinajas Altas there are some specimens, according to information from the residents; perhaps these animals are those that cross the border pass from the American territory into Mexico. The fate of these animals could be, I hope, the starting point of the restoration of good bands in this area.

O. C. cremnobates and O. C. weemsi in Baja California still exist in quantities that give hope to open, in the near future, a short hunting season.

In the Sierra de Santa Isabel only we saw a fairly good population of about 150 specimens.

To the south, in the isolated areas of the Sierra de Calamajue in the vicinity of La Paz it is claimed that a big number of bighorn sheep exist. Conservatively, I estimate something around 2,000 head, a good number after all, an optimistic view as to the future of these interesting animals in Mexico,

PHOTOGRAPHING THE BIGHORN

by
Mrs. Ralph E, Welles
U.S. National Park Service

"The lucky photographer is the ready photographer:'

It is the camera in your hand that takes the picture; it isn't the camera you left in the car a couple of miles back, or the camera that happens to be in the bottom of your back-pack as you climb around that rock outcropping and suddenly see a full curl ran posed just for a second against the sky,

If you want pictures of wildlife, you and your camera must be ready. Or try to be! Between the unpredictable actions of the animal, and your own, it *can* be a pretty exciting business.

In fact, it would probably take all night to run through the slides we have on hand that illustrate what not to do, On what not to do in' wildlife photography I feel it is safe to say that I qualify as an expert. It's the reason, I guess, that I'm standing here now talking to you insead of Ralph,

But how to start and what to do. First, equipment: Like everything else, the best you can afford, of course, Avoid bargains of unknown make. Get one piece at a *time* and learn how to use it. Get a light meter and wear it on your belt - until you learn to use your own hunch meter anyway,

So let's start where most of us start -- the standard lens camera -- - a small one that takes either black and white pictures or color slides and is handy to carry around in a leather case with a shoulder strap. It doesn't take us long, does it, to find that the normal short lens doesn't see an object as large or as clearly as our own eyes do, Now if we can have the lights off (S.) we wish you would all try to help us find the rock wren that is perched on one of these boulders overlooking Butte Valley and was the reason for taking this picture. Well, we couldn't find it either.

Have you tried taking pictures of bighorn with this camera? If you were lucky enough (S.) to find them outlined against the sky (S.) or to get in very close, the animals will stand out pretty well. But more often than not bighorn taken with a standard lens will come out something like this (S.) or be so completely loot in the scenery that even your loyal relatives and closest friends won't tell you they can find them in the picture. To photograph animals large enough to see much detail with this regular camera usually takes great patience and a long time to hang around close to the sheep until by stages they accept you as a new member of the band. The appeal of this sort of thing is quite limited. Unless you should just happen to be interested in animal behavior, of course. To be sure, you can get better pictures of bighorn with short lenses, providing you can wait long enough. But to chronicle the life history of the bighorn this way would need a couple of life times.

To illustrate taking pictures of bighorn with a regular camera: A man stopped at Wildrose Station a couple of years ago and told Bill Myers that he had just come from Surprise Canyon in the Panamints and had seen 25 sheep in the narrows of the canyon and had taken pictures of them. Bill told him about us having an ear to the ground about sheep, and knowing that 25 at one time would be a pretty startling thing around these parts: he suggested the man write Ralph, which he did. The man said he had even had time to take a light meter reading and that he had good shots. He went to a photographer and had enlargements made and sent us the best of his slides of 25 sheep. (S.) Well, there you are. We feel we can laugh with you about this because really we are laughing at ourselves. Just for instance, the largest band of sheep we had seen in Death Valley to date is pictured here (s.). The label says "Red Butte and 11 sheep". And this next one here (S.) reads, "Mike watching 11 sheep".

This particular instance of familiar failure due to the lack of readiness on the part of the photographer occurred because Ralph had climbed up across a canyon where it took both hands and both feet to move, leaving no way to carry anything but a standard camera. In a way these pictures might be considered a failure but in another they were not entirely because we eventually -- 3 years later -- used them to study the terrain and climbed up to where the band had been and discovered a very significant pot-hole and foregoing area that had drawn them there in the first place.

Shortly after these 2 pictures were taken we had an illustration of one of the "big ones that got away", which seems to happen as often in photography as it does in fishing. From the band which had been foraging on the Red Butte about a mile and a half above one animal, apparently attracted by our activities below began to come down to see what we were doing -- or whatever it is that makes bighorn do this sort of thing. As she approached Mike and Ralph on the black ridge she turned off and went down into the canyon (S.). I was coming up the bottom of the canyon out of sight and she may have done this in order to keep all of us in sight at the same time, because, as you know, it makes bighorn nervous to lose sight of someone in their vicinity. As it was, something spooked her (s.) and she crashed down across the canyon and up the other side onto Red Ridge and came on down to see what I was doing (S.). In order to illustrate the relative results of different length lenses you will notice here that at this point she is about the same distance from where Ralph took this picture with a standard lens as she is from me, here, down in the bottom of the canyon, Keep in mind her size here and in the next picture taken at almost the same time (S.) with the 500 mm. lens. She is roughly about 50 yards away here. Later she came down, plunged across the talus about 15 yards from me and up on the black ridge again and headed straight back up the mountain (s.) as you see here. This picture, taken again with the standard lens isn't much of a picture-of a sheep but as far as Death Valley study is concerned it is quite valuable to us in that it was the first picture we had had of bighorn in this relationship to Death Valley because up to 1954 it had been taken for granted that sheep never fed down on the west face of the Black Mts. and that they only came down to "cross the Valley floor from one mountain range to another". Of course in this picture she looks a lot farther away than she actually was. If you look closely you can see that she was on an old trail and

that the trail leads off down the ridge. Ralph and Mike were observing her from above on the same trail all the tine until she walked'up to within 30 feet of them, then suddenly (S.) broke into the familiar bounding spooky run and ran around them just 30 feet away, which they later paced, and proceeded to climb back up the mile and a half to the Red Butte where she joined the others again.

In order to bring animals and birds up close so that we can see what they really look like we use the telephoto lens. (S.) Here are four telephoto lenses mounted on Leica cameras, with reflcx housing for focussing. Left to right they are 150 mm., 300 mm., 640 mm. and 500 mm. Here is that 640 mm. in action, by the way, 36 lbs. on the shoulder. You can pick up a good lens second hand for less than a new one of inferior quality. (S.) Here's how that first picture was taken (S.).

If you are not going into it seriously, and simply want to get better, closer pictures of bighorn and other wildlife, the 135 mm. has two advantages. It is small end can be carried in a separate leather case and can be quickly exchanged with your regular lens; also the amount of magnification in a 135 mm. lens will usually give you a sharp picture without the use of a tripod. Resting the camera on or against a rock is a good idea if there's one handy, hold your breath while you press the trigger and hold the camera absolutely lwel as you shoot it. (S.) Even a prize shot won't be really good if it isn't: sharp. (S.) Here's another. (S.) And another. And we could go on and on -- but let's put a sharp picture on while we talk about the next size lens (S.), the 150 mm., which gives, of course, a slightly larger magnification. Have you browsed around in camera stores looking at these? It doesn't cost a thing to look lenses over and compare them. If you really get interested it could be handy to know what you want and have the information ready in case the family should ask you all of a sudden what you want for Christmas. It would be too bad to have to say "Gee, I dunno" and just keep on getting the same old neckties.

From the 150 mm. the next logical jump is to a 300, and if you do it's a public admission that the bug's got you. You must be your own teacher. From now on you cpcrate strictly by trial and error, You hope you won't have to use a tripod. They're such a nuisance and so cumbersome. How about mounting the 300 mm. on a gunstock. Sounds like a good idea. Yes, we tried that, too. We didn't get very sharp pictures and found we had a piece of equipment just about as unwieldy as a tripod in the hands while climbing and hard to get at in a hurry if carried in a sling arrangement on your back. (S.) This, by the way, is the first picture we ever took of a bighorn ram, and it's taken with the 300 mm. mcunted on a gunstock, while the sneaky photographer lay uncomfortably behind a bush that looms large and out of focus in the foreground. It was number one on the roll and is light struck at the top because it was loaded hastily in too strong light. (S.) The bush is still there when the photographer got up on one elbow to get the rest of the band. Could be sharper. Ralph (S.) got the same outfit from another position around the hill with his 640 mm.

lens. (S.) Then they turned and ran and here we have another picture taken from the angle so common in bighorn photography -- another "rump shot". The stack of fuzzy pictures kept growing. We gave up. We use a tripod. (S.) I just had to stick in this picture taken on a bighorn trail leading to Virgin Spring to show you what can happen to a person when he becomes convinced that tripods are necessary.

The Leitz outfit that makes Leica cameras (that's what we got started with) claims a 400 mm is the longest lens to give satisfactory results. However, (S.) the lens we use the most is a 500 mm Zeiss, although it does "vignette" -- that is, the corners of the picture are somewhat darkened. We have become used to this, probably forgiving it because the rest of the performance of the lens is satisfactory. And it is in spite of the fact that it is only f8.

That brings us to exposures, and it can readily be seen that with an f8 your time must be worked around it. Depending on the light (S.), you might use in a single day anywhere from one second at f8 before sun-up here to (S.) 200th of a second at f8 under maximal light conditions in the middle of the day (S.). We call this shot the "ghost lamb". If your background is in focus and the animal is moving it shows action. This little guy was going so fast it hardly stopped him at all.

In photography, as in just about everything else in life, you seem to have to sacrifice something to get what you want. In using telephoto lenses the thing we must sacrifice is the so-called "depth of field". (S.) That is, backgrounds are thrown out of focus. This is distracting sometimes. One way to get around this -- if your ready photographer is really lucky -- is to find your sheep above you and take them against the sky -- a beautiful blue background which always looks in focus. (S.) Or standing against a cliff, which makes a reaatively plain background. (S.) Or standing in front of a shadow which gives the animal a background, That travertine shelter made a pretty satisfactory setting, but it always seems as though if something is good you see ways it could be better, You get eye strain trying to see that ram lying there. You You find yourself wishing hiss head had been in the sun, too. Oh, well! Sometimes at sunset ycu can find shadowed areas for background, (S.) but if the shot is something you want anyway, you Just take the picture, not caring too much where it is as far as surroundings, background and so forth are concerned. In fact your lack of depth of field is actually an advantage here, separating the subject from the background not by color but by focus and lack of focus. (s.) A distant out-of-focus background like this serves as a sort of a back-drop sometimes. In order to get detail in the shadowed areas it is necessary to burn out the background. Your exposure here is for the shadow. (S.) And if you are lucky enough to be able to work in close with your tlephoto, you don't even notice the background.

(S.) When Ralph and I first became interested in the desert bighorn in Death Valley, and later when we managed to accumulate some

photographic equipment so we could photograph them, we found that we were not too successful in locating any sheep in Death Valley to take pictures of. In fact, the truth is: We looked constantly with cameras at the ready and we couldn't find a single one! Yet we always felt if we just kept on looking (S.) at the foot of some rainbow we'd find them.

It seemed almost as difficult to find written material about the bighorn as it was to locate the elusive animals themselves. The legends concocted by early writers kept being repeated by others. Did you ever read this one written about the Castle Dome country above Yuma by a J. Ross Browne in 1869 for Harper's? I quote:

> "The country is one of the roughest ever trodden by Coot of man. I think it must have been designed for mountain sheep, which are said to abound in the vicinity. These animals have prodigious horns, upon which they alight when they tumble down the cliffs. How they get up again is difficult to conjecture. My own impression is that they were born there, and are pushed over by other sheep."

End quote.

How could we locate these mysterious creatures that everyone who knew this rugged country talked about, but few had ever seen? The bighorn and how they live was by now irresistibly fascinating to us.

So we landed with our equipment at the Desert Game Range. Biologist Ock Deming had just come (S.) back down to Corn Creek headquarters with a ewe he had found dead up near Joe May camp. (That's Lloyd McKibben with him there.) We were a couple of unknowns, so we brought out some of our equipment to prove we were on the level and had a reason to want to go back into the mountains on the Game Range. Ock observed us for some time and his glance finally focussed on the 640 mm. lens. His only comment: "It would be <u>cheaper</u> to get closer!" Ock Deming, by the way has taken outstanding pictures of bighorn without the use of long lenses by waiting in blinds at the springs in summer and getting right in there with the sheep.

Permission was granted for us to use Joe May camp. The last day we were there we saw 45 sheep that one clay. Our record in Death Valley is 12 in one day, twice, in two different locations. (S.) Here is part of the band of 18 we saw up in the Big Wash.

Don't forget the importance of water in desert photography. For the photographer, that is. Particularly in summer. We may not know yet how much water the <u>sheep</u> need to get along, but we know how much <u>we</u> need, and you will never know in advance how Car the sheep will lead you and your camera up a mountain on a summer day. Also, get your film in to be processed as soon as you can after your pictures are taken, because exposed film is much more likely to be damaged by heat, according to Eastman.

Hunting with a camera has a special kind of excitement about it, whether you are taking pictures to fill out the story of the bighorn and how they live or whether you just hope to find sheep in one of those seemingly (S.) inaccessible rugged settings far back in the mountains, (S.) looking beautiful, relaxed and strong, and you want to remember it and show it to people. (S.) Their presence makes the mountains come alive.

You have all heard that organic materials can now be dated by the so-called "Carbon 14" method, providing the natural setting is a dry one. Bighorn droppings which were found lying on the lowest level of Danger Cave near Wendover, Utah, were tested by scientists by "Carbon 14". The age of these droppings was found to be 11,000 years. That's quite a few generations of bighorn. They belong to these mountains.

Here is a trick we'd like to share with you, if you haven't thought of it already. Did you ever get a roll back with a good picture on one end or the other that didn't completely fill the frame? (S.) Like this? It's number one on the roll. Instead of throwing these tag ends away they can often be mounted in so-called "mercury mounts" (S.) that are this size. This particular picture illustrates another trick, too. It is a duplicate that Ralph made by re-photographing the original. He worked out a gimmick that does the job very well. It happened the juice was low here the day he made this copy though, and it's darker than it should be, but it's very handy sometimes to be able to make your own copfes.

Let's stop and go back a minute. We thought it might be fun to show you a picture of the very first sheep we finally found in the Death Valley region. (S.) Here she is -- a ewe all by herself up in Echo Canyon. Nothing as a picture, but of historical interest to us now, of course. (S.) We watched her feed up to the top of this mountain, then drop out of sight. (S.) Here's another historical shot in the story of the bighorn in Death Valley. It was *taken* by Matt Ryan on a day in June a couple of years ago when he and Ralph climbed up to an unmapped spring plastered way up on the side of Tucki Mountain, in the Panaments. See Stove Pipe Wells Hotel down there at sea level? It took them six hours to climb up there and two hours to slide down. It turned out to be a real sheep hang-out, and no burros and no people, apparently, since prospecting days. Matt took some black and whites up there, too, with his Polaroid Land camera, but he can tell you about those when *this* section of the program is over.

But, to go back again, on December 10, 1954 at 4 o'clock, Ralph was on duty at the museum at Furnace Creek Ranch and one of a group of young fellows casually turned to Ralph as they were leaving and said "Oh, by the way, I just got a good picture of some of your goats a while ago, down there at that low place, you know--".

In half an hour Ralph had collected me and our cameras and we were (S.) taking pictures of a band of six bighorn bedding down about a hundred feet above and 100 yards to the north of Badwater (S.). It was already long after sundown but we kept trying, anyway. An exposure of a whole second makes the ewe on the left go out of focus as she butts the one on the right. This (S.) is where they were bedded, taken the next day (S.) and here we can see how close it was to Badwater, with the usual people walking around it feeling as low as they'll ever be, (S.) and now we are looking north up Death Valley from where the sheep had bedded down the night before.

So it was then that the study phase of our bighorn photography began, and it is a good time too, Eor me to change places with Ralph, for it was here that we found that there really were bighorn left in Death Valley -- and here is Ralph to tell you about it. Thank you.

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