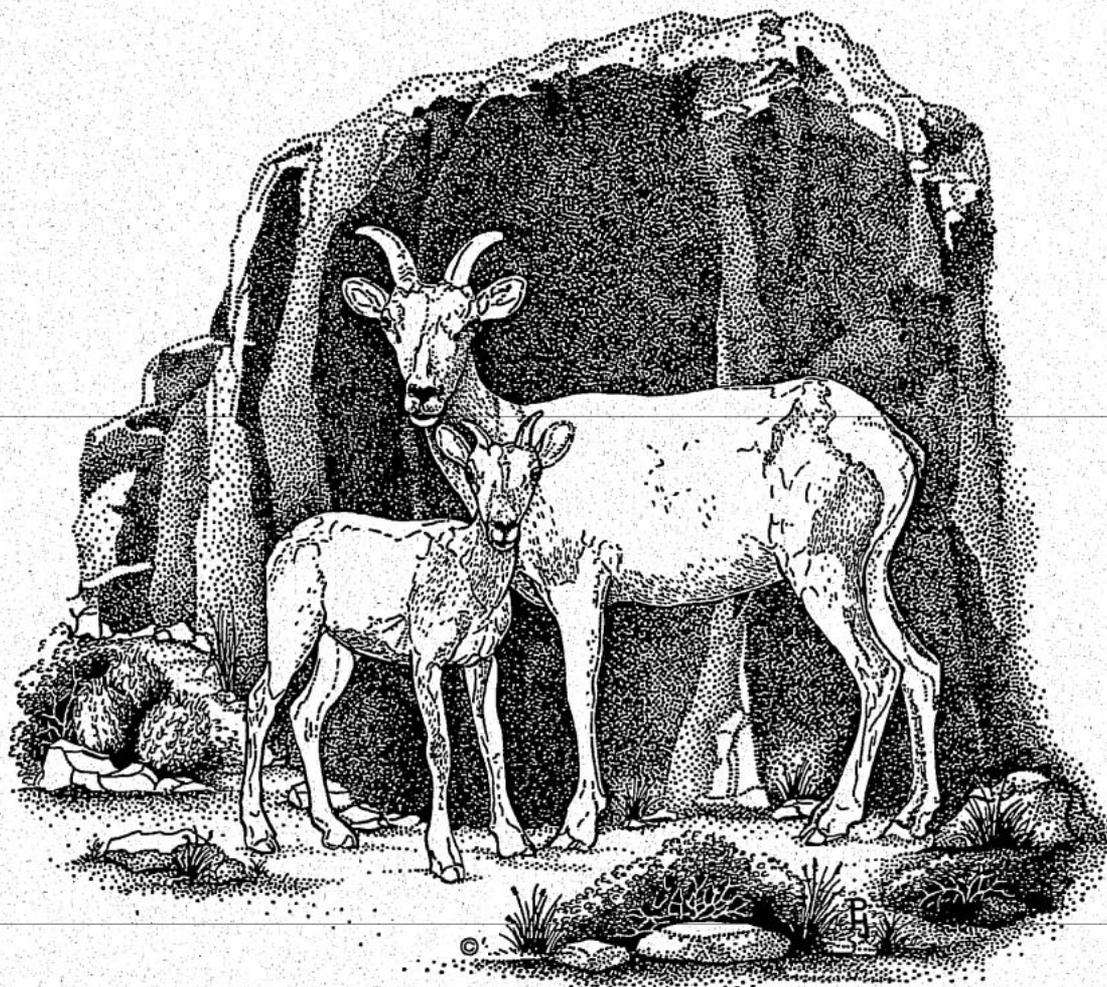


DESERT BIGHORN COUNCIL

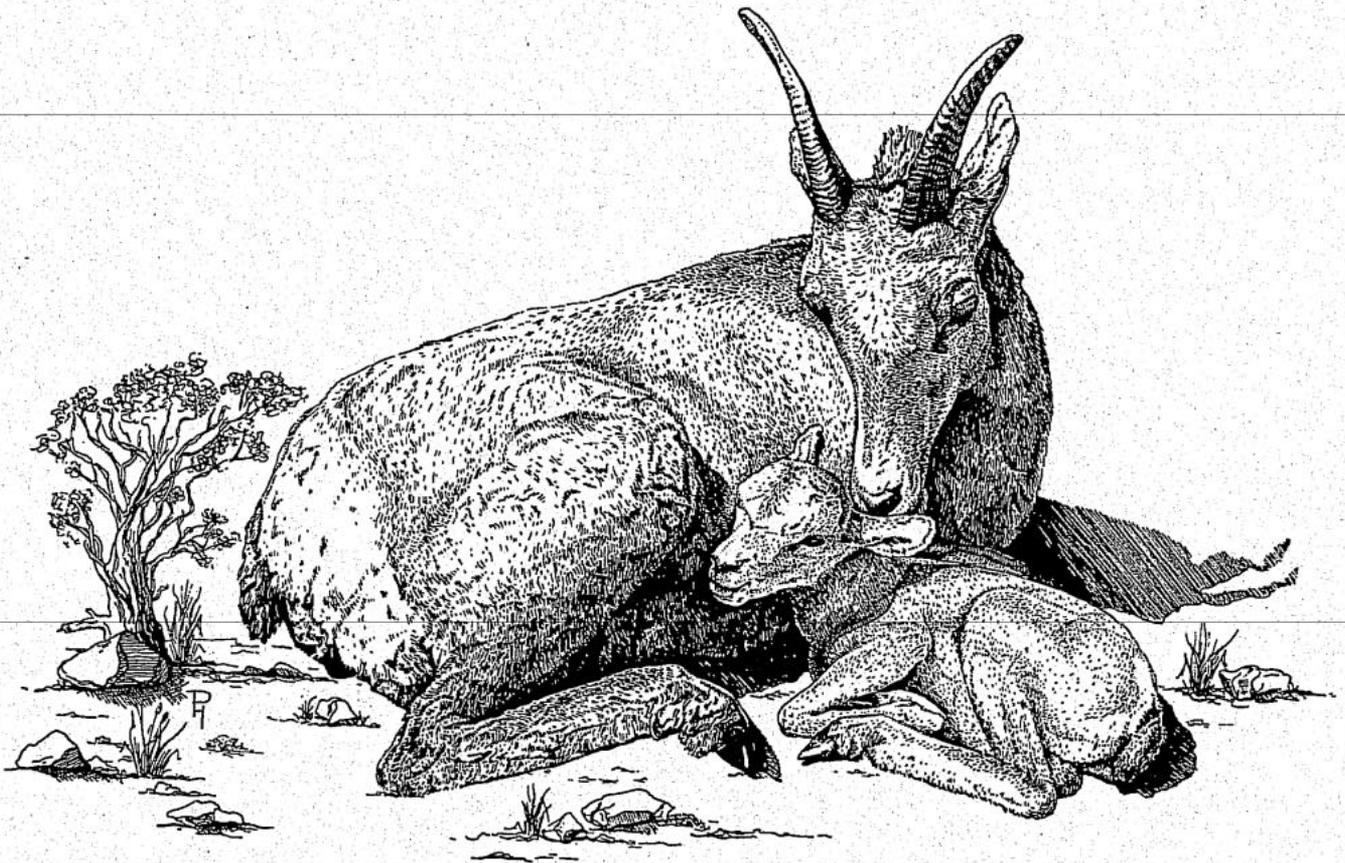
TRANSACTIONS



VOLUME 44

2000

This Volume of
The Desert Bighorn
Council Transactions
is Dedicated to the Memory of
Linda Seibert, 1946 – 2000



**Desert Bighorn Council
2000 Transactions**

**A Compilation of Papers Presented
at the 44th Annual Meeting**

**Bullhead City, Arizona
April 5-8, 2000**

Jonathan D. Hanna, Editor

Arizona Game and Fish Department
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DESERT BIGHORN COUNCIL

2000

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Special thanks to the Foundation for North American Wild Sheep for their
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The Desert Bighorn Council--have we made a difference?

Keynote address, Desert Bighorn Council

Bullhead City, Arizona

6 April 2000

William R. -Rick- Brigham

Wildlife Biologist, Bureau of Land Management

Ray Lee asked me to prepare a brief history of the Council for presentation here. How many of you in the audience were born after 1957? (show of hands--about half) That is the year the Council was formed--so about half of you are younger than the Council!

Organizational History. The Council was formed in 1957 by interested biologists from several fish and game agencies. A constitution was developed by 1959. In 1962, a Technical Staff was formed to start work on a comprehensive, up-to-date book on desert bighorns. The Tech Staff currently functions by providing input to land use and management agency proposed actions, legislative proposals, and hot issues such as embryo transfers, preparation of the Guidelines For Management of Domestic Sheep in Desert Bighorn Habitat. It is made up of biologists from land management and game and fish agencies and the private sector. The Council was incorporated in Nevada in 1980, with help from Wayne Capurro, a Reno lawyer who was also a hunter and conservationist. The Technical Staff became the Council's Board of Directors. With help from the father of then-Secretary Treasurer, Bill Dunn, the Council was granted tax exemption by the Internal Revenue Service under section 501c3, in 1988. In 1993, Brigham prepared an Operations Manual, which outlines the duties of each officer and committee in the Council except the Awards Committee. This was done to provide for a smooth transition between officers and committee chairs, since they change frequently, and this is an all-volunteer organization. At the urging of Kevin Hurley of the Northern Wild Sheep and Goat Council, this Council applied for and was granted membership in the Western Association of Fish and Wildlife Agencies (WAFWA) in 1999. By having WAFWA sanction, Council members who work for game and fish agencies should be able to get travel funds and authorization more easily. The annual meeting of the Council rotates between Arizona, Nevada, California, Utah, Texas, New Mexico, Colorado, and occasionally old Mexico, to give local biologists an opportunity to attend and participate in the meetings.

Getting the Word Out. This is done in two ways: the first was publication of the book *The Desert Bighorn-Its Life History, Ecology, and Management*, which was published in 1980 by the University of Arizona Press at Tucson. The second way is that the Council prepares and distributes annual Transactions. A Transactions Editor was established in the 1960's, and is a volunteer position. There are three types of papers presented in the Transactions: individual state reports, which follow a standard format; opinion pieces/discussion of new untried methodology; and peer reviewed/refereed technical papers. Indices have been prepared twice for the transactions: a stand-alone version for the years 1957-1971; and one covering the years 1957-1983, which was published in the Transactions (vol. 33, 1989).

Awards. There are three types: the Ram Award; Honor Plaque; and Award of Excellence. There are also Certificates of Appreciation, which are presented occasionally. Dick Weaver will have more to say about these later in this meeting.

Brochures were prepared, updated, and disseminated in the 1960's, in 1983 by Warren Kelly and Brigham, and in 1998 by Darren Divine, the current Secretary-Treasurer.

Hansen-Welles Memorial Fund. Dr. Charles G. Hansen was an early stalwart in the Council, a U.S. Fish and Wildlife Service biologist in charge of the Desert National Wildlife Range. He met an untimely demise in an aircraft accident while looking for desert bighorns in Utah. In 1984, the Council established the Hansen Fund, which is comprised of federally insured certificates of deposit. The original funds used to purchase the C.D.'s were from individual donations, royalties from the sale of the Council's book, contributions from the Desert Bighorn Council Ewes (a group of biologists' wives, headed by Doris Weaver. The Ewes have sold T-shirts, mugs, prints by Pat Hansen, carvings by Warren Kelly, etc. for decades). Accrued interest from the C.D.'s is used for stipends for students and researchers working with desert bighorns and their habitats. An application form is found in one of the late transactions, and the Technical Staff makes the actual grant.

HAS THE COUNCIL MADE A DIFFERENCE? Following are many of the Council's accomplishments:

- Rendezvous. The annual meeting provides a formal and informal venue where members share ideas, concepts, new methodology, etc. including the benefit of cross-fertilization of ideas.
- Annual Meeting: Rotation has allowed many biologists and managers to attend, who would not be able to do so otherwise.
- Guidelines for Capture of Desert Bighorns were published in the 1973 Transactions and updated in the 1982 Transactions.
- Preparation of the chapter on Desert Bighorn Sheep by individual Council members, as presented in the 1975 *The Wild Sheep in Modern North America*, sponsored and published by the Boone & Crockett Club.
- Guidelines on Habitat Requirements published in the 1980 Transactions.
- Guidelines for the Management of Domestic Sheep in Bighorn Habitat published in the 1990 Transactions. These guidelines were prepared at the request of the Interior Department's Bureau of Land Management (BLM). They were adopted as guidelines following a 1992 meeting attended by representatives of the Council, the BLM, the U.S. Forest Service, several wildlife veterinarians, and the American Sheep Council, and issued as an information bulletin. In 1998, following a second similar meeting, they were issued as BLM policy for all BLM managed public lands, under a formal

Instruction Memo.

- BLM Interim Management Guidelines for Wilderness Study Areas. The Council sent several letters to the BLM acting Director in 1993 and 1994, identifying major disparities in interpretation of the BLM guidelines between BLM wilderness specialists and wildlife biologists, among BLM wilderness specialists at various levels within the BLM, BLM managers on adjacent management units, and BLM management between states. The Council's comments and constructive criticisms caused the BLM Wilderness Management Staff to revamp the Guidelines, making them much more restrictive for on-the-ground management than prior versions. The BLM Wilderness Management staff deleted entirely the U.S. Department of the Interior policy on management of resident wildlife by state game and fish agencies. No BLM biologists were consulted during preparation of the 1995 guidelines. Following a chorus of protest from state agencies, WAFWA, and BLM non-wilderness personnel, the guidelines were revised, resulting in a more pro-management document (vs. a more preservationist document).
- U.S. Fish and Wildlife Service listing of California Bighorns as a category 2 candidate species. The Council was stonewalled by USFWS after 3 Freedom of Information Act requests in 1994 and 1995 to find out why the California bighorns were even considered as a Candidate species. The Council offered to share its knowledge, but was never contacted by USFWS.
- Embrvo Transfer Position Statement published in the 1996 Transactions. This proposal was developed by Texas A& M University researchers. Under the proposal, fertilized desert bighorn eggs would be carried to term in domestic ewes. The Council noted among other things that bighorn behavior could be modified to remove wariness to hunters, and that "designer sheep" (big horns = big trophies) would be a probable result.
- 1999 North American Wild Sheep Conference. Held at Reno, it was a joint venture between the Council and the Northern Wild Sheep and Goat Council. Transactions should be printed and distributed in 2000. Kevin Hurley of the Northern Wild Sheep and Goat Council deserves much credit for the idea, and being a prime motivator.

Resolutions. The Council in:

- 1963 opposed introduction of exotic ungulates with a thorough environmental analysis, several years before the passage of the National Environmental Policy Act-NEPA;
- 1964 requested the U.S. Secretary of the Interior to delegate management authority to regulate and control public use to the land managing agencies;
- 1967 endorsed retention of desert bighorn habitat in public domain (=public lands) under the Classification & Multiple-Use Act;
- 1967 requested the land managing agencies to control feral burros;
- 1967 endorsed development of water for desert bighorns in a bighorn habitat management proposal;

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- 1972 urged permanent identification of legally taken bighorn heads and horns, to aid wildlife law enforcement;
- 1980 supported the state of New Mexico listing of desert bighorns as endangered, but did not support federal listing;
- 1981 encourage the state of Texas to re-initiate the Texas Desert Bighorn re-establishment program;
- 1982 recommended to California that the California Department of Fish and Game develop a goal-oriented management program for desert bighorns;
- 1982 recommended to California that desert bighorn management be transferred from the California State Legislature (!) to the Department of Fish and Game;
- 1982 supported reclassification of 11 roadless areas within Anza Borrego State Park to California State Wilderness status.

Has the Council made a difference? Yes! Through the annual rotating meeting; The Technical Staff comments, position statements and guidelines; The book--best of its kind when it was published; the North American Wild Sheep Conference; The Transactions--getting the word out; Help to Mexico in the form of expertise on surveys, plus financial assistance; and YES to motivating people-- participants come away from these annual meetings charged up and revitalized, to fight battles for bighorns for another year.

I have talked with you about the Council's history, what it has done that it *has* made a difference in the grand scheme of wild sheep management. Here are several things I would like to see for the future:

- Consider a Council website or tier off some other wildlife or wild sheep organization, keeping in mind that this Council is an all-volunteer organization and it takes time to maintain web sites once they are established.
- E-mail is a meat tool! We are starting to use it for distributing the Council's newsletter *Bleats and Blats*. I used it extensively when working with several other folks to prepare for the North American Wild Sheep Conference. It can mean faster responses to hot issues. And it is cheaper than the telephone and fax.
- The Technical Staff should continue to provide input to land use plans/planning documents, as needed, such as the North and East Colorado Desert plans. It should actively provide input to federal wilderness legislation, which may be upcoming for Nevada, and should continue to provide input to wilderness management plans as these are developed by land management agencies following wilderness designation, especially in the southern California desert. Legislative proposals for Nevada's Black Rock Desert are also in the works, and should be commented upon.
- The Council should revisit the 1967 (Transactions) Research Needs paper presented by Dr. Charles Hansen, compare it with information developed since then, including that presented during the North American Wild Sheep Conference and see where we are and what is left to do.

More active participation in the Council by the U.S. Fish and Wildlife Service would be appreciated, since USFWS has the lead in preparing recovery plans for the peninsular bighorn sheep, and since USFWS stonewalled the Council in the mid 1990's, for reasons as yet unexplained.

- Revise the 1980 Habitat Management Guidelines and publish in upcoming transactions.
- Publish Ramev and Wehausen's mountain sheep (re) classifications in the Council Transactions, so members will have easy access to them, and to get the word out to all Council members.
- Continue to make more financial grants through the Hansen-Welles fund.

Last, I leave you with these thoughts: Always keep in mind the following question posed many times by Dick Weaver: "What is best for the sheep?" and a statement from the late Bill Graf (an early Council member): "We know enough to manage sheep-we must have the *will*."

We, the Desert Bighorn Council members, individually and collectively-you and I, ARE **THE WILL!** Never forget that!

Thank you.



Future of Desert Bighorn
Visioning Session on Management, Desert Bighorn Council
Bullhead City, AZ
6 April 2000
Eric M. Rominger
Contract Bighorn Sheep Biologist—New Mexico Department of Game and Fish

Are we, the DBC, capable of speaking with a unified voice on issues regarding the future of desert bighorn sheep? Let's find out.

Big-game management seems to be the subject of less research today than 10-20 years ago. At the most recent AZ/NM-TWS meeting only 5 papers out of 60 were on ungulates... 1 on bighorn with 5 on herps, 5 on owls, and 4 on bats.

I am going to spend ~15 minutes outlining 3 areas of future management involving controversial issues... I want people to pick out a topic for which they have particular knowledge (or at least an opinion) and then I will go back through these issues again; asking for audience input. We will then spend approximately 25 minutes on each topic.

Perhaps the biggest question relates to what level of management are we willing to promote in our quest to keep desert bighorn in the ecosystem or reestablish bighorn into the ecosystem?

1. Numerical Decline or Under-occupancy

Despite successes of AZ and NV...we find NM, CA, TX, CO, and parts of MX and UT with low or no density bighorn. Even AZ and NV might be capable of 2X their current numbers. It is thought that 30-50,000 desert bighorn could be deployed tomorrow if the bodies were available and critical constraints (mostly domestic sheep issues) were resolved. But this would be the annual output for >1400 years at the largest captive breeding facility!

How far are we willing to go to put animals back into the system?

- i. Translocations—there are biologists and animal rights groups that feel risking the lives of individual bighorn in transplants is unethical and indefensible...a recent editorial in the newsletter of the Society of Conservation Biology stated this and out of > 3000 SCB members only 1 person disagreed with the statement enough to write a rebuttal.
- ii. Translocation with bighorn meeting some genetic criteria—some advocate that it is imperative that augmentations come from genetically similar stock...what if no bighorn are available?

- iii. Translocation with available bighorn---some advocate that ecologically and politically it is more important to have bighorn in the system than to have a particular set of genes in the system...is the systematic division of subspecies or races an artifact of academia and therefore a hindrance to recovery of bighorn?
- iv. Captive breeding...state run?
- v. Captive breeding...privately run? What will be the role of private facilities in recovery of desert bighorn populations... TX and MX versus other states?
- vi. Advances in reproductive technology
 - a. induced twinning within bighorn sheep?
 - b. embryo transfer to domestic sheep?
 - c. artificial selection for Nramp gene?
 - d. artificial selection for horn size?...the amount of money you will eventually receive for an auction tag is directly proportional to this variable...ask Ray Lee
 - e. cloning?
- vii. Predator control...Ever? Never? Why are so many states facing this problem with lions? That they coevolved comes out frequently but do we know this? Are deer the buffer or the root of the problem? Do beef calves keep lion numbers artificially high? Is this an artifact of habitat decline?
 - a. offending animal
 - b. short term intensive
 - c. long term intensive
- viii. New management actions in bighorn habitat with lion predation
 - a. keep deer numbers very low
 - b. only run steer operations
 - c. high levels of predator harvest
 - d. understand the health issues well enough that interstate transplants are safe and commonplace (to replace populations extirpated by Lions)

2. Habitat Loss

Human encroachment... very little is probably going to be done to preclude the development of private lands even if detrimental to bighorn but how much habitat might we recover through the elimination of domestic or exotics, or recreate with fire?

Mitigation will primarily occur on public lands...exceptions are TX and MX where there essentially are no public lands.

Woody vegetation encroachment...in declining populations in Sonoran and Chihuahuan desert systems this is hypothesized to be the ultimate cause despite proximate causes like predation. Woody vegetation encroachment has been documented in EVERY historical photographic sequence taken...but like rust...

In Mojave ecosystem is this considered a problem?

To what lengths are we willing to go to recover bighorn habitat?

- i. Reintroduction of fire
- ii. Physical manipulation of stands using hand crews
- iii. Removal of cattle pre- and post-burning to build fine fuels
- iv. Are we going to write-off blocks of desert bighorn habitat because of constraints on manipulations to set back succession? i.e., radio-towers, condos, etc.

What about water? Can we put something together that is more than anecdotal? In some places if fire removed tree/shrub overstory you might see natural water return. Maybe we're spending our money in the wrong place?

3. Political Decisions

1. Is Federal Listing good or bad for desert bighorn?
- ii. Have the CA populations benefited or are they expected to benefit (1) financially or (2) biologically from ESA listing?
- iii. Are other states concerned about populations becoming federally listed? Who petitioned the USFWS for the listings in CA?

4. Whoever yells loudest...and most intelligently, can add 1 more issue to this list.

TECHNICAL REPORTS



NOTE: THE FOLLOWING TECHNICAL REPORTS ARE PRESENTED IN THESE TRANSACTIONS AS AN ABSTRACT ONLY AT THE REQUEST OF THE AUTHORS.

POPULATION DYNAMICS OF AN INCREASING DESERT BIGHORN SHEEP POPULATION ON THE NAVAJO NATION

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KATHLEEN MCCOY, Navajo Fish and Wildlife Department, P.O. Box 1480, Window Rock, AZ 86515

JEFF COLE, Navajo Fish and Wildlife Department, P.O. Box 1480, Window Rock, AZ 86515

During a three-year period, an isolated, indigenous desert bighorn sheep population increased from 31 to 56 individuals (an 81%) increase. This herd inhabits the San Juan River Canyon on the Navajo Reservation in southeastern Utah. Year 1 plant growth and forage availability was excellent due to above average precipitation related to El Nino weather patterns and light cattle grazing on the bighorn range. Year 2 precipitation was near average through June, but summer and fall were dry and cattle heavily grazed part of the bighorn range. Year 3 was dry except for good monsoon rains in July and August. Lamb production and survival as a percent of ewes (age 2 and older) was in 1997, 87% and 67%, respectively; in 1998, 67% and 71%, respectively; and in 1999, 62% and 46%, respectively. Average annual mortality of ewes age 2 and older was 3.5%. Average annual mortality of yearlings was 0%. Average annual mortality for rams age 2 and older was 15%. Productivity was directly related to forage availability. Declines in productivity were due to fewer ewes producing lambs. The decline was greater for 2-year-old ewes than for older ewes. Excellent survival of lambs, yearlings, and 2-year-olds and good survival of adult ewes were important factors in the herd increase.

FURTHER CRANIAL MORPHOMETRIC ANALYSES OF NORTH AMERICAN SHEEP

JOHN D. WEHAUSEN, White Mountain Research Station

ROB R RAMEY II, Denver Museum of Natural History

Our previous presentations on this subject have concentrated on a test of the validity of the Peninsular subspecies and an analysis of variation and patterns in bighorn sheep from the Great Basin north. This presentation will begin with a large-scale look at all North American wild sheep and eventually will focus on the desert region and test the hypothesis that the Mexican bighorn subspecies represents a distinguishable group. Finally, it will return to a large-scale view of what subspecific divisions within bighorn sheep can be supported by current genetic and morphometric data and will consider related biogeographic questions.

BIGHORN SHEEP POPULATION IN THE SAN GABRIEL MOUNTAINS: POPULATION DECLINE OR DENIAL

STEVEN TORRES, California Department of Fish and Game, Sacramento, CA 95814

VERN BLEICH, California Department of Fish and Game, Bishop, CA, 93514

STEVE HOLL, Jones and Stokes Associates, Inc., Sacramento, CA 95818

Since 1976, the California Department of Fish and Game, the United States Forest Service, and the Society for the Conservation of Bighorn Sheep have conducted annual helicopter surveys of bighorn sheep in the San Gabriel Mountains of Los Angeles and San Bernardino counties. This population was once the largest in the southwestern United States, with an estimated population of 740 animals in 1980. In 1982, a slow decline in the population began, and continued until 1988. Since 1989, the population has declined at a higher rate, and is now estimated at only 125 to 150 bighorn sheep. This research has implications with regard to long-term population monitoring efforts and the detection of significant declines. Limitation identifying a serious population decline as distinct from a natural population cycle/fluctuation or survey error will be reviewed and discussed. Long-term population monitoring efforts facilitate generating hypotheses, but unless critically reviewed and designed, limit testing for causative factors to direct a recovery effort.

CAUSE-SPECIFIC MORTALITY OF DESERT BIGHORN LAMBS NEAR AN URBAN INTERFACE: A PRELIMINARY REPORT

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Between 1985 and 1997, annual recruitment in the northern Santa Rosa Mountains (NSRM) of California varied from 0-27 lambs/100 ewes and averaged 9 lambs/100 ewes. In 1998 and 1999 we radiocollared 16 desert bighorn lambs (*Ovis canadensis*) in the NSRM as part of a 5-year study of cause-specific lamb mortality. Lambs were captured using a hand-held netgun from a helicopter and were sampled, radio-collared, and released at the capture site. Body weights for the 21-45 day-old lambs ranged from 6.8 - 13.6 kg and neck girths ranged from 20.3 - 22.2 cm. All lambs rejoined their dams shortly after release and no capture-related mortalities occurred. Through daily monitoring, we recorded 9 lamb mortalities. Deaths were attributed to bobcat (*Lynx rufus*) or coyote (*Canis latrans*) predation (56%), direct or indirect effects of urbanization (33%), and mountain lion (*Puma concolor*) predation (11%). Eight mortalities occurred within 300 meters of an urban interface. Respiratory disease was documented in several lambs and may have predisposed lambs to predation. Our preliminary results suggest that direct and indirect effects of urbanization, including altered habitat use, are the primary causes of chronic low recruitment in this population.



DESERT BIGHORN ON PUSCH RIDGE

JAMES C. DEVOS, JR., Arizona Game and Fish Department, 2221 W. Greenway Rd., Phoenix, AZ 85023

The desert bighorn sheep (*Ovis canadensis mexicana*) occupied most southwestern mountain ranges prior to European settlement. Due to a variety of factors including introduction of diseases, competition for food resources, excessive harvest for subsistence purposes, and land alterations, many bighorn sheep populations were extirpated or greatly reduced in population size in the early 1900's. The Santa Catalina Mountains, in central Arizona was one of the last mountain ranges in Arizona where commercial harvest occurred. Until the early 1970's, a large population of bighorn sheep persisted in this area. Researchers documented a number of changes that were occurring in the area of the mountain occupied by bighorn sheep including increased vegetative cover due to fire suppression and increased human presence. I wrote a report in 1978 that predicted the extirpation of this bighorn sheep population unless active management, including the reintroduction of fire and limiting habitat encroachment by human, was implemented. Few of these recommendations were implemented and bighorn sheep no longer are a viable component of the mountain system where they were once abundant. In the Tucson

Basin, there were several groups of bighorn sheep that comprised a metapopulation and, in all likelihood, in a short period of time, all of these groups will be extirpated

HUMAN INDUCED MIGRATION AND HOMING BEHAVIOR OF A DESERT BIGHORN RAM IN THE WHIPPLE MOUNTAINS, CALIFORNIA: OR HERMAN THE TRAILER PARK RAM

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On 7/12/99, a mature desert bighorn ram (9+years old) was reported causing a disturbance at a resort property located approximately 1 mile south of Parker Dam, on the Colorado River, San Bernardino County, California. This animal was subsequently monitored and the decision was made to capture, examine, and move the animal to an area approximately 10 miles northwest in the Whipple Mountains. The animal returned to the original capture site within 4 days. A second capture was made on 8/20/99 and the ram was examined and then transported (via helicopter) approximately 110 air miles northwest to Old Dad Peak. This ram was last recorded in the Old Dad Peak area on 9/27/99. On 11/4/99, the animal was confirmed to have returned to have returned to the original capture area along the Colorado River. The potential movement path of this animal will be reviewed, and management policies and conservation implication will be discussed.

PUBLIC INTERVENTION IN WILDLIFE RESEARCH – A CASE HISTORY

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Abstract: Arizona Game & Fish Department proposed to study disease, nutritional quality, and predation by mountain lions (*Puma concolor*) as variables possibly contributing to an observed 65% decline of a small population of desert bighorn sheep (*Ovis canadensis mexicana*) in a Wilderness Area. Special interest groups intervened through legal consultants and challenged the project based on the opportunity for public comment and professional merit of the project. They also opposed use of a helicopter in designated wilderness to capture desert bighorn and removal of mountain lions from the study area by lethal methods other than sport hunting. This opposition resulted in delayed Federal Aid funding and required development of an Environmental Assessment regarding that portion of the project proposing the removal of mountain lions. Problems associated with potentially controversial research projects should be addressed early in the planning stages. Project personnel should develop a sound legal base from which to operate and should provide broad and extensive opportunities for public review of and comment on proposed investigations.

Key Words—Arizona, desert bighorn, *Ovis canadensis mexicana*, mountain lions, *Puma concolor*, financial support, public intervention

INTRODUCTION

Individuals and special interest groups have contributed significantly to wildlife management and research in Arizona. Nowhere has this volunteer assistance contributed more than through development of water sources, translocation, and population recovery of desert bighorn. However, intervention through ballot initiative, public referendum, or legal challenge by special interest groups recently has emerged that might have a broad influence on controversial research programs in the future (deVos et al. 1998, Whitaker and Torres 1998). During 1999, the Arizona Game and Fish Department (AGFD) proposed and initiated a 4 year desert bighorn research project that encountered substantial opposition by special interest groups. This opposition resulted in delayed federal funding and required development of a full environmental assessment regarding that portion of the project involving the removal of mountain lions from the study area.

THE RESEARCH PROJECT

Impetus for the proposed research was an apparent decline since 1994 of a desert bighorn population (Figure 1) located in the Four Peaks Wilderness Area in the Mazatzal Mountains of central Arizona. The Arizona Game and Fish Commission included the proposed research project as an agenda item in January 1999. Project scoping in March 1999 recognized 3 variables that might influence the observed population decline, and the proposed investigation would address each of these: disease, nutrition, and predation by mountain lions.

Disease

Numerous studies have suggested that disease contracted in association with domestic livestock, particularly domestic sheep, or mule deer (*Odocoileus hemionus*), possibly contributed to rapid and prolonged declines in desert bighorn populations (Lange et al. 1980, Sandoval 1980, Foreyt and Jessup 1982, Wehausen et al. 1987, Bleich et al. 1990, Desert Bighorn Council Technical Staff 1990, deVos 1989, DeForge et al. 1995, Martin et al. 1996). During 1995, 60% (9/15) of bighorn captured and collared with radiotransmitters in the proposed study area had clinical symptoms of contagious ecthyma. Presence of a domestic sheep driveway at the western edge of the study area that is used by sheep ranchers during spring and fall may have been instrumental in transmission of the disease to desert bighorn (Lance et al. 1981). Also, the parent source for the original translocation (Kofa Mountains) had desert bighorn that were seropositive for contagious ecthyma (deVos 1989), and

this pathogenic organism may have originated from the translocated animals.

We proposed using net gunning from helicopters to capture and place radiocollars on 15 desert bighorn sheep and recapture individuals at least twice yearly to collect disease samples.

Nutrition

Changes in nutritional quality or quantity of forage available to desert bighorn might result from factors such as interspecific competition (Walters and Hansen 1978, Dodd 1989) and impacts of weather patterns (Douglas and Leslie 1986, Wehausen et al. 1987) that influence forage productivity (Beatley 1974, Coe et al. 1976, Smith and LeCount 1979). Species potentially competing with desert bighorn on the study area include cattle, deer, and feral burros. Distribution of cattle and burros, versus desert bighorn, on the study area are dissimilar (AGFD, unpublished data), consistent with results of Dodd and Brady (1986) for cattle and desert bighorn in the Sonoran Desert. Dietary overlap between desert bighorn and deer or feral burros might influence competition (Dodd and Brady 1988, Dodd 1989), but Krausman et al. (1979) observed little dietary overlap between feral burros or desert mule deer and desert bighorn in southwest Arizona.

Median annual rainfall within the study area during winter has declined more than 35% between 1994 and 1999, compared to the 1975-1999 and 1989-1993 periods. In comparison, median rainfall during the critical period of November to April (Smith and LeCount 1979, Wehausen et al. 1987) declined more than 50% below the long-term and 1989-1993 levels during the drought of

1994-1999. These results suggest that lower nutritional values and lack of primary production occurred coincident with the observed decline in the desert bighorn population (Coe et al. 1978, Holt et al. 1992). We proposed collecting pellet groups and vegetation samples monthly to estimate seasonal adequacy of diets following procedures of Holt et al. (1992).

Predation

Recent investigations (Wehausen 1996, Creeden and Graham 1997) have implicated predation by mountain lions as a major factor influencing some desert bighorn populations. During 1995-1996, two-thirds (67%; 10/15) of mortalities of radiocollared desert bighorn within the study area were known or probable results of mountain lion predation. Moreover, 60% (6/10) of these desert bighorn exhibited clinical symptoms of contagious ecthyma. As part of the present study, AGFD proposed removing 75% (n = 12) of the estimated resident mountain lion population on the study area, using sport hunting or other lethal methods.

FUNDING AND PUBLIC OPPOSITION

Partial funding for the investigation was received from the Arizona Desert Bighorn Sheep Society in April 1999, when they provided about 40% of estimated total budget for the proposed project. The AGFD first applied for Federal Aid funds to fully meet the estimated total budget required for the study in late April 1999, and revised applications were requested by Federal sources during May, July, August, and

September 1999 and in February 2000. Federal personnel requested greater clarification and detail in the Project Statement component of each revised application.

This unexpected delay in obtaining Federal funding for the research project was associated primarily with intervention by legal consultants on behalf of special interest groups. Legal consultants requested public records from AGFD on 5/26/99, and information was provided. The U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS), and AGFD each received a letter (July 12, 26, and August 3, 1999, respectively) from legal consultants requesting that the research project be terminated and intimating the threat of litigation. Major areas of concern by legal consultants focused on:

1. Insufficient opportunity for public comment
2. Illegal use of a helicopter in a Wilderness Area
3. Substantial animal mortality
4. Limited value of investigation to wildlife science

The AGFD disagreed with all of these points, based on the following information:

Insufficient opportunity for public comment

The AGFD mailed 270 announcements of the Commission meeting in which the research project was included as an agenda item. In addition, nearly 100 persons received descriptive information about the project via an AGFD

newsletter. Informational faxes also were sent to more than 140 local and national media sources, resulting in extensive coverage at the national and statewide levels. As a result, AGFD received 3 letters of opposition to the proposed project.

Helicopter use

The USFS approved limited but adequate use of helicopters to capture, radiocollar, and collect disease samples from desert bighorn for purposes of the investigation. This approval was based on the AGFD's assessment that a helicopter was the minimum suitable tool to accomplish the captures with minimal risk to both humans and desert bighorn.

Animal mortality

Net gunning from helicopters is a widely used technique for capturing desert bighorn sheep and results in negligible injury or direct mortality of individual animals. The AGFD increased the mountain lion bag limit for sport hunting to 12 animals total during the 1999 season for the study area. Snaring (Logan et al. 1999) was intended as a backup procedure to remove mountain lions from the study area, should sport hunting prove inadequate to achieve the desired harvest of 12 animals. We believe that removal of 12 mountain lions from the study area will have no significant long-term effects on the population and that the population will recover rapidly from any short-term influences. The mountain lion population in Arizona is approximately 2,500, and there is an estimated 62,000 mi² and 10,700 mi² of occupied and high

quality habitat, respectively in the state (AGFD 1995). Twelve animals represent 75% of the total population estimate for the study area (AGFD, unpublished data), and removal of 50% or less of local populations has resulted in rapid movement of transient animals into vacant habitat, with little long-term influence on population sizes (Lindzey et al. 1992, Cunningham et al. 1995, Logan et al. 1996). Management of fish and wildlife resources is the responsibility of the state, and there are no statutory restrictions prohibiting the above methods of mountain lion removal.

Professional merit

Much research on desert bighorn has lacked strict experimental design, yet has been funded by Federal Aid programs. This research overall has contributed meaningfully to preponderance of evidence and our understanding of ecology of the species (Lee 1989). Strict experimental protocol is seldom available to researchers investigating desert bighorn, and natural history or case studies are an important component of conservation biology (Shaw and deVos 1989, Schrader-Frechette and McCoy 1993). Assessment of study design by legal consultants was not based on a final study plan.

PROJECT STATUS

In late March 2000, the USFWS approved Federal Aid funding for all aspects of the proposed research, except for lethal harvest of mountain lions by non-sport methods, 1 year following our initial application for Federal Aid funding. Categorical exclusion for lethal

non-sport harvest of mountain lions was considered justified, based upon an Arizona Assistant Attorney General's review of project documents. The review further said that there was a likelihood that AGFD would prevail in a legal challenge, but conducting an Environmental Assessment was the legally safest approach. As a result, AGFD has initiated a full Environmental Assessment of lethal removal of mountain lions within the study area.

CONCLUSION

Potentially controversial research investigations, such as those involving desert bighorn and harvest of mountain lions in Wilderness Areas, may lead to public opposition. Potential problems should be addressed early in the planning stages of such projects. Prior to applications for funding, project personnel should develop a sound legal base from which to operate and should provide broad and extensive opportunities for public review and comment regarding such proposed investigations. Opportunities for public review should include public meetings and also should further address special interest publics such as environmental groups, consumptive and non-consumptive users, and ranchers.

As public agencies, state wildlife resource departments are responsible to the general public, who has the right to know and criticize or support management and research efforts. Failure to adequately address, early in studies, public, management and legal issues for potentially controversial projects may delay or negatively impact funding and performance of research.

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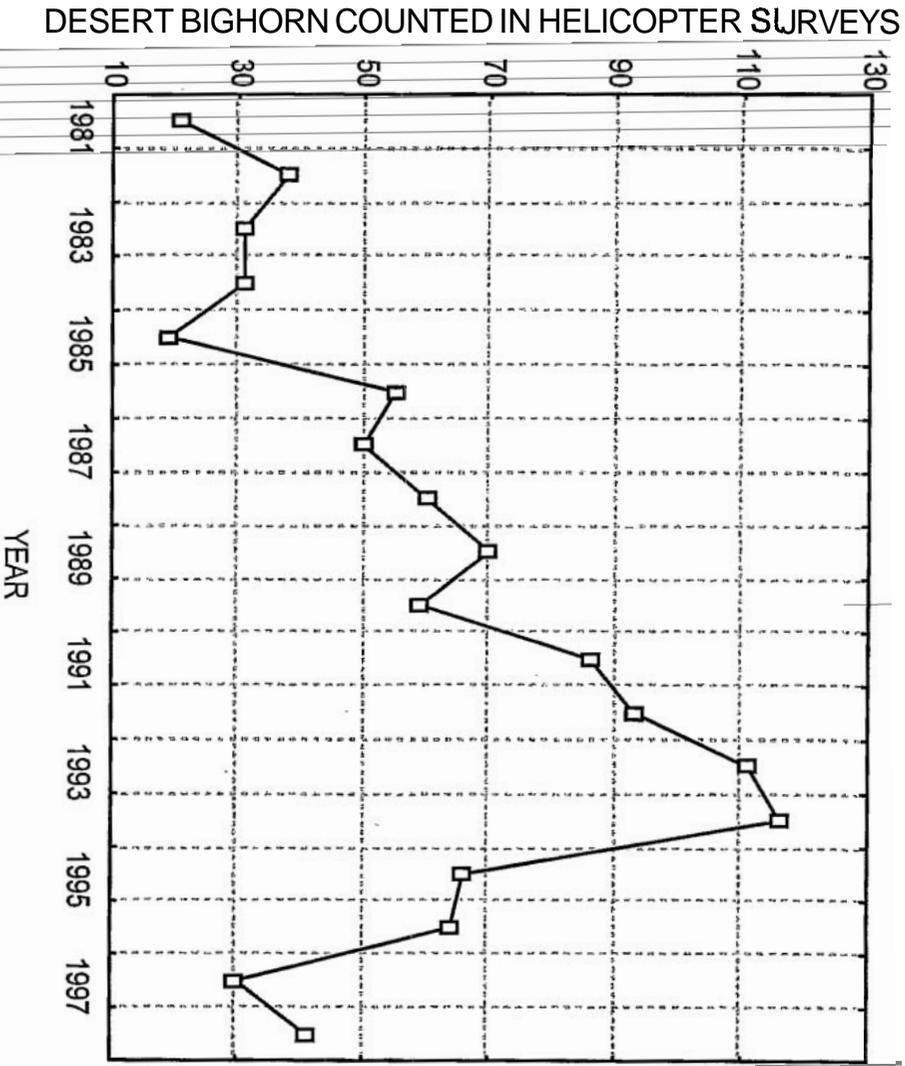
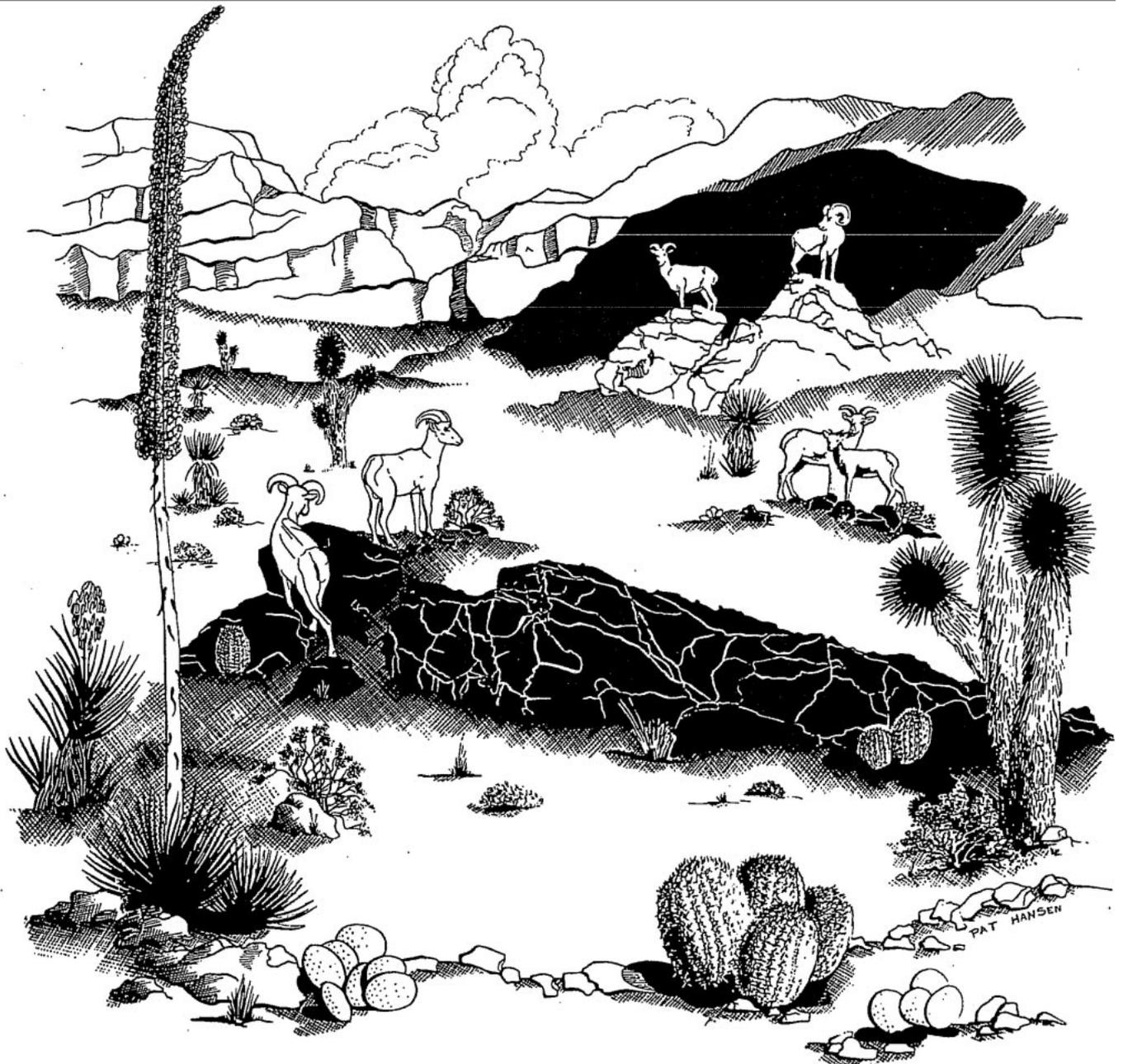


Figure 1. Total counts of desert bighorn observed during fall helicopter surveys on the proposed study area, 1981-1998.

STATUS REPORTS



ARIZONA'S BIGHORN SHEEP IN 2000

RAYMOND M. LEE, Foundation of North American Wild Sheep, 720 Allen Ave., Cody, WY 82414

POPULATIONS

Estimates of Arizona's desert bighorn sheep (*Ovis canadensis mexicana* and *O. c. nelsoni*) indicate a relatively stable population of approximately 6,000 animals. The 1999 desert bighorn sheep helicopter surveys produced 1,240 observations. While this is well below the record survey level of 2,838 in 1994, this is more a reflection of decreased survey hours rather than a decline in bighorn sheep numbers. Due to budgetary considerations, much of Arizona's bighorn sheep range is now being surveyed on 3-year intervals. The 200.2 hours of helicopter survey resulted in 11.5 sheep/hour. Survey results yielded ratios of 52 rams, 25 lambs, and 15 yearlings:100 ewes.

The Rocky Mountain bighorn sheep (*O. c. canadensis*) population, estimated at nearly 600 animals, continues to expand both in numbers and range. The 24.3 hours of winter surveys resulted in the observation of 349 animals. These survey results produced ratios of 35 rams, 38 lambs, and 13 yearlings:100 ewes. These values are well below historic levels.

RESEARCH

The AGFD is currently involved in 1 bighorn sheep management study. This study is an attempt to determine the cause for a decline in bighorn sheep numbers near Saguaro Lake (Ted McKinney will give a paper on the trials and tribulations of

modern day research). We are beginning a water development study on the Yuma Proving Grounds, which may have ramifications for bighorn sheep management.

HABITAT IMPROVEMENTS

The AGFD, primarily in cooperation with the Arizona Desert Bighorn Sheep Society, conducts 6 to 10 habitat improvement projects annually. These projects are usually water developments, but also include fencing modifications and prescribed burns.

TRANSPLANTS

Since 1980, a mean of nearly 70 sheep has been transplanted annually. In 1999, 65 desert bighorn sheep were captured in the Black Mountains near lakes Mead and Mohave and released at 3 locations - 22 near Jumpup Point on the west side of the Kaibab Plateau, 22 in the Grand Wash Cliffs, and 21 went to Utah for release into the Escalante - Grand Staircase National Monument.

Since 1957, Arizona has translocated 1,374 bighorn sheep - with 99 going to Colorado, 67 to Utah, 29 to Texas, 23 to New Mexico, and 9 to various Zoos and Universities. Of the 33 game management units in Arizona which are open to bighorn sheep hunting, 16 received bighorn sheep transplants. Thirty-five of the 109 permits occur in these populations established from transplants. Arizona is now actively looking for a source of Rocky Mountain bighorn sheep for release near Bear Mountain in Unit 27.

HARVEST

Bighorn sheep permits remain the most sought after hunting permits in Arizona. There were a record 8,408 applicants (5,899 resident and 2,509 non-resident applicants) in 1999 for the 109 regular season permits. This application rate represents over 77 hunters applying for each permit, with individual unit odds varying from as low as 20:1 to 433:1, depending on the unit's accessibility and harvest history.

As a result of this year's survey, permits for the 2000 season were decreased from 109 to 103, with the 2 special fund-raising permits remaining. A permit in Aravaipa Canyon is now available, after three years with no permits and the Catalina Mountains will have no permits offered for the first time in many years. This shows the dynamic nature of bighorn sheep populations and their susceptibility to adverse conditions.

During the 1999 hunting season, 110 hunters participated, harvesting 104 rams in 745 hunter days for a 95% success rate. The mean age of the harvest was 7.4 years and the mean score was 157. Ages ranged from 3.5 to 12.5 and scores from 63 6/8 (a one horned ram) to 186 1/8. The 1999 season produced 22 animals (22% of the harvest) qualifying for the Arizona Trophy Book (min. score of 162 Boone and Crockett points). Of these rams, 11 (11 %) scored >170 points. During the last 5 years, these trophy harvest percentages have been 38% and 19%, respectively.

Last year was a particularly good year in Arizona for bighorn sheep harvest. It was the second best year ever for both harvest and hunter success, after 1995. It was the third best year ever for both number of hunter days (after 1996 and 1998) and

number of permits (after 1994 and 1995).

These record numbers can be traced back to the exceptional rainfall and productivity years of the early 1980s. This resulted in the large numbers of rams and the high scores observed in the harvest 10 years later. With the poor climatic conditions through the early 1990s, the future for permits and scores is not positive.

For the 16th consecutive year, the Arizona Game and Fish Department and the Arizona Desert Bighorn Sheep Society entered into an agreement whereby the Society auctions 1 permit (at the Foundation for North American Wild Sheep convention) and raffles another to raise funds for bighorn sheep management projects. In 1999, these 2 permits produced nearly \$300,000. To date, these permits have produced over \$3,000,000. Arizona's bighorn sheep management program is dependent upon the funds derived from these permits.

2000 - STATUS OF BIGHORN SHEEP IN MEXICO

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INTRODUCTION

Due to marked declines in bighorn sheep populations, most western states closed their bighorn sheep hunting seasons near the turn of the century. California was the first in 1878. This action was followed in Arizona when the first game laws enacted by the Territorial Government in 1887 provided punishment for the unlawful taking of bighorn sheep from February to October. In 1897, an amendment to the Penal Code was made to close the bighorn sheep season until such time as judged appropriate by the State Legislature. New Mexico closed its hunting season for bighorn sheep in 1889, Texas in 1903, Nevada in 1917, and Mexico in 1921.

Bighorn sheep in Mexico were first referred to by Jesuit missionaries in 1702. Bighorn sheep hunting seasons were closed from 1921 to 1931. A season was reopened for 1 year in 1931 and then closed again until 1944. By 1963, 50 permits were being issued. Permit levels peaked at 110 in the 1970s.

Mexico has always been a popular area for bighorn sheep hunters. The world's largest desert bighorn sheep skull, scoring 205 118 points, was found in Baja California. The sport harvest record for Baja California is 192 5/8 and for Sonora is 187 3/8.

BAJA CALIFORNIA

Presently there are 14 distinct bighorn sheep populations in Baja California with an estimated 2,500 peninsular bighorn. Bighorn

sheep hunting was stopped in Baja California by Presidential decree in 1990. Following surveys conducted in 1992 and 1995, one permit was authorized for Baja California for the 1998 season. It was auctioned by the Safari Club International for \$125,000, but was never issued. Political and social pressures in Mexico have kept Baja California closed to bighorn sheep hunting - and perhaps always will.

BAJA CALIFORNIA SUR

Presently there are 3 distinct bighorn sheep populations in Baja California Sur with an estimated 500 *weemsi* bighorn. Baja Sur was closed to bighorn sheep hunting in 1995.

In Baja California Sur, 6 permits were issued for 1996. Four of these permits were for the Vizcaino Biosphere Reserve - an internationally designated protected area. These tags are available only through raffle or auction, typically producing \$60-\$70,000 per tag. The differences between these 2 states shows the individuality of the bighorn sheep programs within Mexico. Permits were reduced to 5 in 1997 and subsequently increased back to 7 in 1998 and 1999. A total of 12 permits are available for 2000.

SONORA

Presently there are 27 distinct populations of bighorn sheep in Sonora with an estimated population of 2,500 animals. In southern Sonora, the mean observation rate during helicopter surveys has consistently averaged 40 animals per hour. Observation rates in both Sierra Viejo and Sierra Kun-Kaak have consistently exceeded 90 bighorn sheep per survey hour. By comparison, in Arizona, helicopter survey observation rates average fewer than 10 bighorn sheep per hour.

In Sonora, one transplant occurred in 1975 from the mainland to Tiburon Island. This transplant of 21 animals eventually resulted in a large population of bighorn sheep on the Island. In 1996 and 1997, during 3 transplants, nearly 150 animals were removed from the island for release on the mainland. In 1999, an additional 60 animals were removed, with 20 going to the mainland in Sonora and 40 scheduled to go to Chihuahua. Due to political pressures, these animals remain at a facility in Sonora.

The Mexican Government issued 7 bighorn sheep tags for Sonora in 1996. These permits sold for up to \$60,000 each and 6 sheep were harvested. There were 13 permits authorized for 1996, 25 for 1997, 43 for 1998, 55 for 1999, and 65 for 2000. The value of these permits has decreased to about \$30,000.

CURRENT

During October 1999, during 14 days of flying with 26 different Mexican biologists, we classified 797 bighorn sheep. In Baja California, we classified more animals in less time than in the 1995 survey, which had compared favorably with the 1992 survey.

A total of 282 animals was classified in 21.8 hours for an observation rate of 12.9 animals per hour. In Baja California Sur, we classified a record number of animals - 27% more than in 1997 in 27% fewer helicopter hours. In Sonora, 384 animals were classified, which compares favorably with the statewide surveys conducted in 1992, 1993, and 1996.

Portions of Sonora have now been flown annually since 1992, portions of Baja California Sur since 1996, and Baja California in 1992, 1995, and 1999. Of some interest is that Baja California bighorn sheep were found as high as 5,077 feet in the southern parts of Sierra Santa Isabel and in Baja California Sur sheep were found as high as 6,170 feet.

The total number of hunting permits in Mexico is now 77, still well below the 110 of the 1970s, and probably reflective of the relative bighorn sheep populations.

In some areas, it has been difficult to implement "traditional" bighorn sheep management plans in Mexico due to the economic value of these animals - permits have sold for as high as \$200,000. Some programs are designed to return money directly to local people (often indigenous peoples) making this a self-directed program. Mexico's program for the management of bighorn sheep calls for local people to become involved in the conservation and management of bighorn sheep - allowing for some use of the resource, while promoting bighorn sheep conservation and recovery. This type of wildlife management will be essential to the maintenance and recovery of wildlife populations in less developed countries.

STATUS OF DESERT BIGHORN SHEEP IN NEW MEXICO, 1999

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SYNOPSIS

In New Mexico, desert bighorn sheep (*Ovis canadensis mexicana*) continue to be listed as a state-endangered species. In 1999, there were an estimated 241 desert bighorn in 7 free-ranging populations. Since 1994, excluding transplanted bighorn (n=109), the estimated population of New Mexico desert bighorn sheep has declined from 215 to 133 (Table 1). During this period mountain lion (*Puma concolor*) predation has been the cause of 73% of all adult radiocollared desert bighorn mortality (n=46), and 87% of known cause mortality (excluding unknown cause mortality). Of 7 desert bighorn populations in New Mexico, 6 are in decline including the San Andres population, which has apparently gone extinct (Table 1). It is assumed that predation rates would have been higher if ≥ 7 depredating lions had not been removed from 3 desert bighorn ranges between 1997 and 1999. In November 1999, 27 rams were captured from the Red Rock Wildlife Area, and released into 5 extant ranges.

During autumn 1999, helicopter surveys were conducted in all desert bighorn ranges in New Mexico except the San Andres Mountains (Table 2). Helicopter survey data, combined with ground observation data, accounted for 183 desert bighorn. Total helicopter count-time was 22 hours and mean observation rate was 7.0 bighorn/hour (range=1.4-10.8/hr/range). Currently 78 desert bighorn sheep have active radiocollars (38% of the estimated adult population).

Transplants/capture

In November 1999, 27 desert bighorn rams were captured using the helicopter net-gun technique and removed from the Red Rock Wildlife Area (RRWA). All rams were radiocollared and released into 5 extant populations to enhance monitoring efforts. There were 12 rams transplanted into the Peloncillo Mountains, 3 in the Little Hatchet Mountains, 3 in the Alamo Hueco Mountains, 3 in the Ladron Mountains, and 6 sentinel rams in the San Andres Mountains. No mortalities occurred during the capture or transplant.

In addition, 34 desert bighorn ewes were captured and radiocollared in 5 extant populations to increase monitoring efforts. Of these, 16 were in the Fra Cristobal Mountains, 6 in the Peloncillo Mountains, 8 in the Hatchet Mountains, 2 in the Animas Mountains, 1 in the Ladron Mountains, and the only known ewe in the San Andres Mountains was captured. A 2 year-old ram was captured and radiocollared west of I-25 in the eastern foothills of the Black Range. It was assumed that this ram originated from either the Fra Cristobal or Ladron population. If from the Fra Cristobals, it traveled approximately 100km crossing the Rio Grande and I-25. If from the Ladrones it traveled 160km through 3 mountain ranges. The ram initially joined a group of feral Spanish goat-ibex hybrids on the Ladder Ranch and eventually mixed with a group of pen raised pygmy goats near Monticello, NM and was euthanized.

BOOTHEEL METAPOPULATION

The Bootheel metapopulation in southwestern New Mexico and southeastern Arizona is composed of populations in the Peloncillo Mountains of Arizona and New Mexico, the Animas Mountains, the Hatchet Mountains, and the Alamo Hueco Mountains. The estimated size of this metapopulation is 188 including 40 in Arizona and the 18 rams released in 1999.

Peloncillo Mountains

The New Mexico portion of this population is estimated to be 67 including the 12 rams released in 1999. Arizona Game and Fish personnel observed just 20 bighorn during the 1999 helicopter census in the Arizona portion of the Peloncillo Mountains.

Animas Mountains

Bighorn continue to persist in the Animas Mountains. During the helicopter census and the net-gun capture only 8 bighorn (no lambs) were observed.

Hatchet Mountains

A total of 48 bighorn was observed in the Little Hatchet (n=24) and Big Hatchet (n=24) mountains. This population is estimated to be 61 including 3 radiocollared rams transplanted in 1999.

Alamo Hueco Mountains

Four bighorn sheep were observed in the Alamo Hueco Mountains. We estimate the Alamo Hueco population to be 7 including 3 radiocollared rams transplanted in 1999. Only 1 lamb has been documented since 1997.

NON-BOOTHEEL POPULATIONS

Ladron Mountains

A total of 26 bighorn sheep was observed in the area of the Ladron Mountains and the population estimate is 32, including 2 surviving rams transplanted in 1999. However, 42 bighorn have been transplanted to the Ladron Mountains.

Fra Cristobal Mountains

The Fra Cristobal population increased to 52 and is the only population in New Mexico that has increased. However, only 40 adult bighorn are present after transplanting 44 in 1995 and 1997. Turner Endangered Species Fund continues to support a full-time biologist monitoring these bighorn sheep.

San Andres Mountains

In September 1999 the last known ewe in the San Andres Mountains was captured and placed in a holding-pen until it was determined to be clinically and serologically scabies free. This ewe was then released from the holding-pen. In November 1999, 6 rams (4 with satellite collars and 2 with VHF radiocollars) were released throughout the length of the San Andres Mountain range to initiate a sentinel ram project designed to locate any extant bighorn sheep unknown to biologists. As of December 1999, no extant bighorn were documented.

Red Rock Wildlife Area Captive Population

The population estimate in the Red Rock Wildlife Area was 102 desert bighorn sheep prior to the removal of 27 rams during the transplant. This removal reduced the number of rams below the number of ewes for the first time since 1992. The recruitment of lambs continued to be extremely skewed towards males with 15 of

17 yearlings recruited bking males. It is hypothesized that this skewed sex ratio is a function of a long-term nutritional constraint and NMDGF has initiated a feeding program in the spring of 1999 to try and alter the sex ratio of progeny. At least 2 mountain lions were known to have entered the breeding facility and 6 known kills were discovered (5 rams and 1 ewe). One lion was killed within the facility. The post-transplant population at Red Rock Wildlife Area is 75.

RESEARCH

Point Lorna University initiated research on the behavior of desert bighorn within the Red Rock facility in 1999. Sex ratio of the 2000-2004 progeny at Red Rock will be monitored to measure the response to the supplemental feeding program. All bighorn sheep captured in 1999 were tested for presence of microfilaria of the nematode (*Elaeophora schneideri*) in microscopic analysis of a tissue biopsy. No bighorn tested positive for these microfilaria (W. Boyce, unpubl. data). Sentinel rams will be captured at 4 month intervals to ascertain their scabies status in an attempt to determine if bighorn are susceptible to scabies infestation from a source other than conspecifics.

HABITAT IMPROVEMENT

A prescribed fire, specifically to improve desert bighorn sheep habitat, was conducted on the San Andres National Wildlife Refuge. Additional prescribed fire is planned for habitat in the Hatchet Mountains, Ladron Mountains, and again in the San Andres Mountains. Land management agencies involved with prescribed fire to benefit bighorn sheep include the U.S. Fish and Wildlife Service, Bureau of Land Management, and the U.S. Forest Service. BLM replaced or repaired bighorn sheep waters in the Peloncillo and Hatchet Mountains.

HARVEST

In 1999, a single ram (B&C 170-green) was harvested in the Peloncillo Mountains in the fifth annual hunt. In 1998 and 1999 only the public draw hunter harvested a ram in the Peloncillo Mountains as the FNAWS auction hunter chose to hunt Rocky Mountain bighorn. New Mexico initiated a raffle license in 1999, which may be used for desert bighorn sheep if the FNAWS auction hunter chooses to hunt Rocky Mountain bighorn.

Table 1. Population estimates of wild desert bighorn sheep herds in New Mexico in 1994 and 1999.

Year	New Mexico Desert Bighorn Sheep Populations					Total
	San Andres	Peloncillo	Hatchet	Alamo Hueco	Ladron	
1994	40	60	60	20	35	215
1999	1	45*(**)	54**	5	28**	133**

* Including an estimated 10 bighorn in the Animas Mountains that are thought to be originally from the Peloncillo population.

** Excluding bighorn transplanted in 1997 and 1999.

Table 2. Synopsis of the 1999 desert bighorn sheep surveys in New Mexico.

Herd	Observed Total (lambs)	Ewes	Estimate	Ram:Ewe:Lam b	Bighorn/ hour	Count Time
Ladron	24 (3)	9	30	133:100:33	8.1	2.9
Peloncillo	46* (8)	22	55	59:100:36	7.9	5.4
Animas	8 (0)	6	10	33:100:00	7.3	1.1
Hatchet	48 (10)	24	60	58:100:42	6.7	7.2
Alamo Hueco	4 (0)	2	5	100:100:00	1.4	2.9
Fra Cristobal	53 **(12)	23	53	65:100:52	10.8	2.5
Total/Mean^	183 (33)	86	213***	74:100:37	7.0	22

* Includes 3 rams photographed near Granite Peak but not observed in helicopter survey.

** Includes 26 bighorn not seen during the helicopter survey but known to be present.

*** Including the single ewe observed in the San Andres Mountains, statewide estimate=214 (not including 27 rams transplanted in November 1999).

DESERT BIGHORN SHEEP MANAGEMENT IN TEXAS - A 100 YEAR REVIEW

CLAY E. BREWER, Texas Parks and Wildlife Department, Elephant Mountain WMA, HC 65 Box 80, Alpine, Texas 79830

MICHAEL D. HOBSON, Texas Parks and Wildlife Department, Elephant Mountain WMA, 1600 W. Highway-90, Alpine, Texas 79830

POPULATIONS

Existing rock art sites serve as evidence that desert bighorn sheep (*Ovis canadensis mexicana*) historically occupied most of the arid mountain ranges of the Trans Pecos region of Texas. Bighorn numbers during the late 1800s, were estimated as high as 1500 animals. By the early 1900s, Texas bighorn populations had declined or were extirpated from much of the historic ranges. Bailey (1905) estimated the population at 500 animals and described 16 mountain ranges that supported bighorns. Davis and Taylor (1939) reported sightings from only 11 mountain ranges and estimated the population at 300 animals. By the mid-1940s the population was estimated at 35 individuals (Carson 1945). The last documented sighting of a native Texas bighorn occurred in October of 1958 on Sierra Diablo Wildlife Management Area (WMA). It is believed that the last native Texas bighorns were gone by the early 1960s (Cook 1994).

Protective measures for bighorn sheep were initiated as early as 1903 with the enactment of a hunting prohibition. Further protective measures occurred in 1945 with the establishment of the Sierra Diablo WMA to serve as a sanctuary for the last remaining Texas bighorns.

Restoration efforts were initiated in 1954

with the development of a cooperative agreement between the Texas Game, Fish and Oyster Commission of Texas, U.S. Fish and Wildlife Service, Boone and Crockett Club, Wildlife Management Institute, and Arizona Game and Fish Department. Initial efforts focused on propagation of desert bighorn sheep in captivity to provide a source of stock for transplanting into suitable habitat. The first propagation facility was constructed on Black Gap WMA and was operational by 1959. Additional facilities were constructed on Sierra Diablo WMA (1970), Chilicote Ranch (1977), and Sierra Diablo WMA (1983). Presently, the population located on the Chilicote Ranch in the Sierra Vieja Mountains is the only captive population within Texas. The facility currently contains 4 rams, 7 ewes, and 2 lambs.

Since 1959, 410 desert bighorn sheep have been transplanted to seven mountain ranges within Texas. Of these, 146 have been transplanted from other states and Mexico including 31 from Arizona, 107 from Nevada, 2 from Utah, and 6 from Mexico. In addition, 264 in-state desert bighorns were transplanted between 1971 and 1997. A transplant from Elephant Mountain WMA to Black Gap WMA is currently planned for 2000.

The Trans Pecos region of Texas currently supports seven free ranging populations of desert bighorn sheep. These occur within the Baylor, Beach, Sierra Diablo, Sierra Vieja,

and the Van Horn Mountains, and the Texas Parks and Wildlife Department's (TPWD) Black Gap and Elephant Mountain WMAs. Helicopter surveys conducted in August 1999 indicated an increasing population with 337 sheep observed during 45.2 hours of flight time (Table 1). Survey results yielded ratios of 73 rams:100 ewes:42 lambs.

RESEARCH

During the past 100 years, TPWD has conducted a variety of desert bighorn research projects. These have included: population distribution, abundance and condition; diseases; use of various drugs in treating disease; food habit studies; guzzler use; home range, movements and mortality studies; and the use of geographic information system (GIS) technology in the evaluation and monitoring of desert bighorn sheep habitat and populations.

Current research projects include: home ranges, movements, and mortalities of desert bighorn sheep at Elephant Mountain WMA; diets and seasonal forage utilization of bighorn sheep at Elephant Mountain WMA; and guzzler use at Black Gap WMA.

HABITAT IMPROVEMENTS

Habitat improvement projects continue to be accomplished through the cooperative efforts of the Texas Bighorn Society (TBS), private landowners, and TPWD. Since the mid-1950s, approximately 48 bighorn water developments have been completed on both public and private land for a total combined storage capacity of 183,000 gallons. Since 1983, the majority of these projects have been funded by the TBS.

In 1999, three water developments including

one conventional style and two slick-rock guzzlers were completed on Black Gap WMA. Six water development projects on private land are planned for 2000.

HARVEST

The hunting of desert bighorn sheep in Texas was reinstated in 1988 following an 83 year prohibition. Since then, 22 desert bighorn hunting permits have been issued including: 5 Foundation for North American Wild Sheep (FNAWS) permits; 3 public hunting permits; 4 Texas Grand Slam public hunting permits; and 10 private landowner permits. Of these, 18 rams were harvested for a hunter success rate of 83%.

The 1999 hunting season proved to be another record year for both numbers of desert bighorn hunting permits issued and the amount of funding generated for desert bighorn management. During the season, a record five permits were issued with hunters harvesting four rams, for an 80% hunter success rate. Among these was the 1999 FNAWS permit that auctioned for \$85,000. A record five permits were issued with hunters harvesting four rams, for an 80% hunter success rate. Among these were the 1999 FNAWS permit that auctioned for \$85,000, an all time high for Texas, and the Texas Grand Slam Hunt permit which generated approximately \$125,000 for the desert bighorn program.

Bighorn sheep management in Texas continues to be funded by hunters through the Federal Aid in Wildlife Restoration Program, FNAWS auction permits, and the Texas Grand Slam Hunt Program. Since 1989, \$344,000 has been generated from five FNAWS auction permits. In addition, approximately \$319,000 has been generated from four permits since the inception of the Texas Grand Slam Hunt Program in 1996.

The Texas Grand Slam is a hunt package consisting of four big game species including one desert bighorn sheep. Unlimited \$10 applications are sold to both resident and non-resident hunters. Funds are generated through the application fee.

Davis, W. B. and W. P. Taylor. 1939. The bighorn sheep of Texas. *Journal of Mammalogy*. 20: 440-445.

PROBLEMS/OPPORTUNITIES

Improved landowner relations have provided increased opportunities for technical guidance. These efforts must be accelerated to ensure proper management of desert bighorns on private land. The private landowner remains the single most important factor in restoring and maintaining viable bighorn populations in Texas.

Aoudad sheep continue to be observed mixing with desert bighorn populations. Efforts to eliminate these problem animals must be accelerated through the cooperative efforts of TPWD and private landowners.

LITERATURE CITED

- Bailey, V. 1905. Biological survey of Texas. USDA Bureau. Biological Survey, North America. Fauna No. 25.222 pp.
- Carson, B. 1945. Final Report - Bighorn Sheep Status. Texas Game, Fish and Oyster Commission. Austin.
- Cook, R. L. 1994. A Historical review of reports, field notes and correspondence on the desert bighorn sheep in Texas. Special report to the desert Bighorn Sheep Advisory Committee. Texas Parks and Wildlife Department. Austin, Texas. 68 pp.

2000 DESERT BIGHORN COUNCIL TRANSACTIONS

Table 1. Desert Bighorn Sheep Observed (1999 Helicopter Survey)

Mountain Range	Sheep Observed	Ratio per 100 ewes Rams/Lambs	Trend
Black Gap WMA	48	65/43	Increasing
Chilicote Ranch	21	31/31	Stable
Elephant Mt. WMA**	59	158/153	Increasing
Metapopulation*	201	66/41	Increasing
Van Horn Mountains	8	20/40	Increasing
Total	337	73/42	Increasing

* Sierra Diablo, Baylor, and Beach Mountains

** Approximately 100 sheep were observed on the ground 2 weeks prior to survey

Table 2. Summary of Desert Bighorn Sheep Numbers and Locations in Texas
(Free Ranging and Captive Populations)

Area	Rams	Ewes	Lambs	Total
Black Gap WMA	15	23	10	48
Chilicote Ranch	4	13	4	21
Elephant Mountain WMA	30	19	10	59
Metapopulation	-	-	-	-
Baylor Mountains	9	22	15	46
Beach Mountains	17	24	9	50
Sierra Diablo Mountains	38	51	16	105
Van Horn Mountains	1	5	2	8
Total	114	157	66	337

BUSINESS MEETING



**PROGRAM FOR THE 44th ANNUAL MEETING
OF THE DESERT BIGHORN COUNCIL**

**Bullhead City, Arizona
APRIL 5-8,2000**

Wednesday (April 5)

4:00 – 6:00 PM Registration

6:00 PM Social

Thursday (April 6)

7:00 - 8:00AM Hosted Breakfast

7:30 – 8:30 AM Registration

8:30 – 8:40 AM Introductions

8:40 – 9:00 AM **"History of the Council – its role in bighorn sheep management"**
Rick Brigham

9:00 – 10:00 AM Technical Session I

**Population dynamics of an increasing desert bighorn sheep
population on the Navajo Nation**

Nike J. Goodson and David R. Stevens – Stevens Wildlife Consulting
Kathleen McCoy and Jeff Cole – Navajo Fish and Wildlife Department

Further cranial morphometric analysis of North American sheep

John D. Wehausen – White Mountain Research Station
Rob R. Ramey II – Denver Museum of Natural History

**Bighorn sheep population in the San Gabriel Mountains: Population
decline or denial**

Steven Torres and Vern Bleich – California Department of Fish and Game
Steve Holl – Jones and Stokes Associates

10:00 – 10:30 AM BREAK

10:30 – 11:30 PM **Technical Session II**

Cause-specific mortality of desert bighorn lambs near an urban interface: a preliminary report

James R. Deforge, Stacy D. Ostermann, Jim W. Bauer, and Sarah D. Hoffman – Bighorn Institute

Desert bighorn on Pusch Ridge

James C. deVos, Jr.
Arizona Game and Fish Department

11:30 – 1:00 PM Hosted Lunch

1:00 – 3:00 PM State Status Reports

Arizona – Raymond Lee
California – Steve Torres
Mexico – Raymond Lee
Nevada – Pat Cummings
New Mexico – Eric Rominger
Texas – Clay Brewer
Utah – Steve Flinders

3:00 – 3:00 PM Break

3:30 PM **Visioning Session on Research** – Jim deVos – What are the most pressing research needs for the management of desert bighorn sheep? Have our present research projects become little more than re-evaluations of someone else's data sets using newer computer driven statistics packages?

6:00 PM Hosted Dinner

Friday (April 7)

7:00 – 8:00 AM Hosted Breakfast

8:00 – 10:30 AM **Visioning Session on Management** – Eric Rominger – What are we willing to support in regards to desert bighorn sheep propagation – **captive** breeding, artificial breeding, super ovulation, cross species embryo transfers?

10:30 – 11:00 AM Break

11:00 – 11:45 PM Technical Session III

Human induced migration and homing behavior of a desert bighorn ram in the Whipple Mountains, California: or Herman, the trailer park ram

Steven Torres, Gerald Mulcahy, Ben Gonzales, Andy Pauli, and Nancy Andrew - California Department of Fish and Game

Public intervention in wildlife research – a case history

Ted McKinney, James C. deVos, Jr., and Robert D. Broscheid – Arizona Game and Fish Department

11:45 – 1:00 PM Hosted Lunch

1:00 – 3:00 **Visioning Session on Administration** – Ray Lee – Who Manages desert bighorn sheep? What are the roles of the various groups – DOD, USFWS, BLM, NGOs, USFS, State Game and Fish Agencies, Universities, Private contractors – in desert bighorn sheep management?

3:00 – 3:30 PM Break

3:30 PM Business Meeting (Tech Staff/ Committee Chair Changes, By-Laws, Next Meeting)

Saturday (April 8)

8:30 AM Field Trips (self-guided)



MINUTES
2000 Desert Bighorn Council Technical Staff Meeting
(Wednesday, April 5th, 2000)

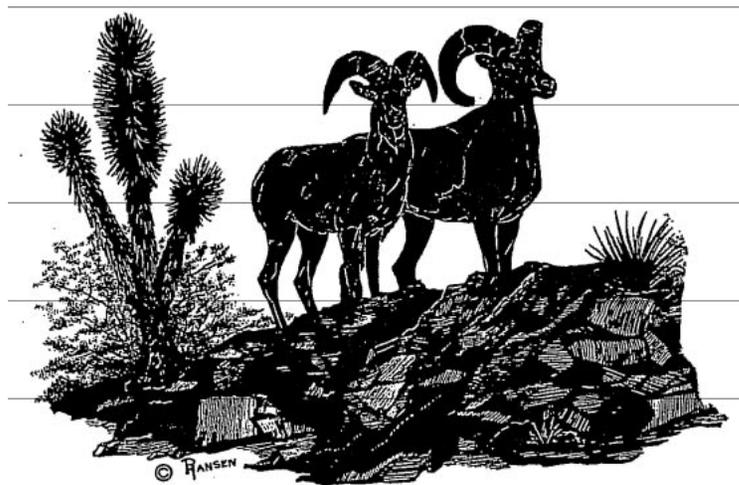
7:30 p.m. - Meeting called to order by Mark Jorgensen

Discussion / Action Items:

1. Minutes of the 1999 Tech Staff were not recorded due to **mis-communication** among members, thus there were no formal minutes to be read.
2. **Darren Divine** presented Secretary / Treasurer's report. A preliminary Treasurer's report had to be given because outstanding bills **from** 1999 joint meeting were not yet accounted for.
3. **Ray Lee** and **Jim deVos** discussed WAFWA and the annual presentation that must be made to the WAFWA Board of Directors. **Jim deVos** will give this year's presentation for DBC.
4. Staff discussed ways to handle upcoming vote for new Tech Staff. It was voted that all names would go forward, **and** that a staggering system will be worked out so we remain in **compliance** with the by-laws:. The Tech Staff must be composed of 5-7 members, with 3 members having served 3+ years. In addition, members shall serve a maximum, of 5 years.
5. **Jim deVos** discussed the alterations made to the by-laws. Sexist language was changed, and language was added **clarifying** con'ducting the Council meeting every other year in one of three core states (CA, NV, AZ). It was decided that a new vote on these changes did not have to be conducted, as all changes (except sexist language) were voted on and passed in prior business meeting, but the alterations were simply never enacted.
6. **Ray Lee** stressed the need to find replacement Transactions Editor, as he was stepping down from the position.
7. A letter was read from **Pat Hansen**, supporting **Darren Divine's** initial suggestion to change the name of the Hansen Welles Memorial Fund - to the Hansen Welles Scholarship Fund. This suggestion was made in an effort to boost the number of annual requests for **funding**. At the moment, the council is making upward of \$2,500 annually, and paying out very little to student research. The proposal will be taken to full council for final approval
8. **John Wehausen** provided an update on Sierra Nevada Bighorn - Predator control results - herd status - Discussion and question period pursued.
9. **John Wehausen** **Don Armentrout**, **Mark Jorgensen** presented an update on the recovery plan for bighorn of **Penninsular** ranges.
10. **Mark Jorgensen** listed yearly requests for Tech Staff plan reviews:
Guzzlers on BLM land
Colorado Desert Plans.

11. 1999 Grants to Rob Ramey and Fernando Colchero were discussed. Both men were provided funding to assist them in attending the Joint meeting, but neither has come through (to date) with a final product - a stipulation of the grant.
12. New Business:
 - A. Rick Brigham provided a list of new items to be published in Transaction every year:
 - Minutes of Annual Council Meeting
 - Minutes of Annual Technical Staff Meeting
 - Instructions to Authors Presenting Papers
 - Hansen-Welles Criteria
 - List of Attendees
 - Awards recipients (Annual or Cumulative)
 - Meeting Program
 - B. Darren Divine brought suggesting renting a table at TWS Reno 2001 Exhibitor's Hall to promote the Council. Taken to full council for vote
 - C. Darren Divine gave a short proposal and timeline to produce a DBC website

9:50 p.m. - Meeting Adjourned - Mark Jorgensen



MINUTES
2000 Desert Bighorn Council Business Meeting
(Friday, April 7th, 2000)



2:45 p.m. - Meeting called to order by Jim deVos

1. 1999 Minutes read by Darren Divine and approved without modification (Lee/Wehausen)
2. Jim deVos reported that the 2001 meeting will either be held in Mexico, or in Utah. Mexican officials have expressed interest in hosting the 2001 meeting, but were unable to attend this meeting at the last minute. Jim asked that the Council give Mexico 30 days to confirm their commitment, and if not, then the venue would move to Utah. - Approved (Wehausen/Jorgensen)
3. Treasurer's Report - Darren Divine reported there would be no report given at the meeting as bills are still outstanding from the 1999 Joint meeting in Reno. There will be a full disclosure and treasurer's report given in late August, after all the bills have been paid, and the final money distributed between the DBC and NWSGC.

Hansen Welles - doing well, \$2,500.00 in interest was added over the past year, bringing the account up to \$51,000.00.

Committee Reports:

1. Tech Staff Voting - (Ray Lee) Asked for votes to be taken for Tech Staff Members, ballots were passed out, collected, and tallied by Nike and Dave Stephens.
2. Arrangements - (Jim deVos) No problems reported, the hotel and accommodations all came together well.
3. Publicity - (Jim deVos) No major problems were reported with meeting publicity. Jim sent letters out to all the major institutions informing them of the meeting dates.
4. Burros - (Ross Haley)

	Estimate	Appropriate Management Level	+/-
AZ	2850	1947	+ 903
CA	1525	845	+ 680
NV	691	794	+ 103
UT	181	120	+ 61
TOTAL:	5247	3706	+ 1541

Burro Captures: AZ - 525 CA - 468 NV - 101 UT - 0 TOTAL: 1094

Specific Burro Removals

Mojave Preserve	612 (1999)	100 (Since 1-1-2000)	1832 (past 3 years)
Death Valley	204 (1999)	185 (Since 1-1-2000)	
Lake Mead	56 (1999)	57 (Since 1-1-2000)	

BLM plans to take 1350 Burros off next year, with an additional 600 from the Mojave Preserve, 20-30 from Death Valley, and 100 from Lake Mead. Current projections show that the overall AML should be achieved by 2004.

5. Ewes - (Darren Divine) Darren gave the final ewes report for Doris Weaver. This is the last year for the Ewes to maintain a formal bank account, and all money was turned over to Darren as the Treasurer (\$979.24 Cashier's check and \$574.00 cash) Darren thanked the Ewes once again for all of their hard work over the years.
6. Hansen Welles - (Dick Weaver) No requests for Hansen Welles money this year.
7. Constitution/ByLaws.- (Jim deVos) Jim announced that he had gone through all of the old available copies of the business meeting minutes, and had made (3) substantive changes to the bylaws: 1.) The language was found to slanted towards males, thus all wording was changed to a gender-neutral format. 2.) At the 1991 meeting in Las Cruces, it was voted that the meeting rotation schedule should be altered so that every other year the meeting would be in either California, Nevada, or Arizona. Accordingly, the meeting rotation schedule has been modified to: CA, NV and AZ in even years, and TX, UT, CO, and Mexico in odd years. 3.) Tech Staff members shall have a maximum term of 5 years. These changes were noted voted upon by the membership, and #1 makes no substantive changes in the Council's workings, and #2 and #3 have been voted on previously.
8. Historian - (Rick Brigham) As of the 2000 meeting, Warren Kelley has retired as historian, and Rick Brigham has agreed to take over.
9. Transactions - (Ray Lee) - The transactions from last year's joint meeting are not yet available, but should be mailed to members by the end of August 2000. In addition, Jon Hanna has agreed to take over as DBC editor.
10. Tech Staff - Results of the Tech Staff voting were tallied and the "new" tech Staff will consist of: Rick Brigham, Mark Jorgensen, Ray Lee, Eric Rominger, John Wehausen, and Mara Weisenberger. This combination brings the Tech Staff membership into line with the by-laws. The by-laws state that three of the 6-7 members must have served at least 3 years, and Brigham, Jorgensen, Lee, and Wehausen have all served at least three years.
11. Old Business - (Jim deVos) - None

12. New Business - (Jim deVos)

Stacey Osterman asked a question about the format of the Transactions, and wanted to clarify that the Transactions should be broken into three sections: Peer-reviewed papers, status reports, and peer-edited notes. She wanted to ensure that the Transactions do not become too difficult for authors to become accepted, nor too easy to diminish its peer-reviewed status. No formal action taken.

Darren Divine brought to the group an idea for the DBC Council to purchase an exhibition booth at the 2001 TWS National Conference in Reno. The cost should be about \$500.00, and the booth would be manned with DBC volunteers and would be dedicated to spreading information about the Council, and obtaining new members from western states. = Motion Passed (Wehausen, Lee).

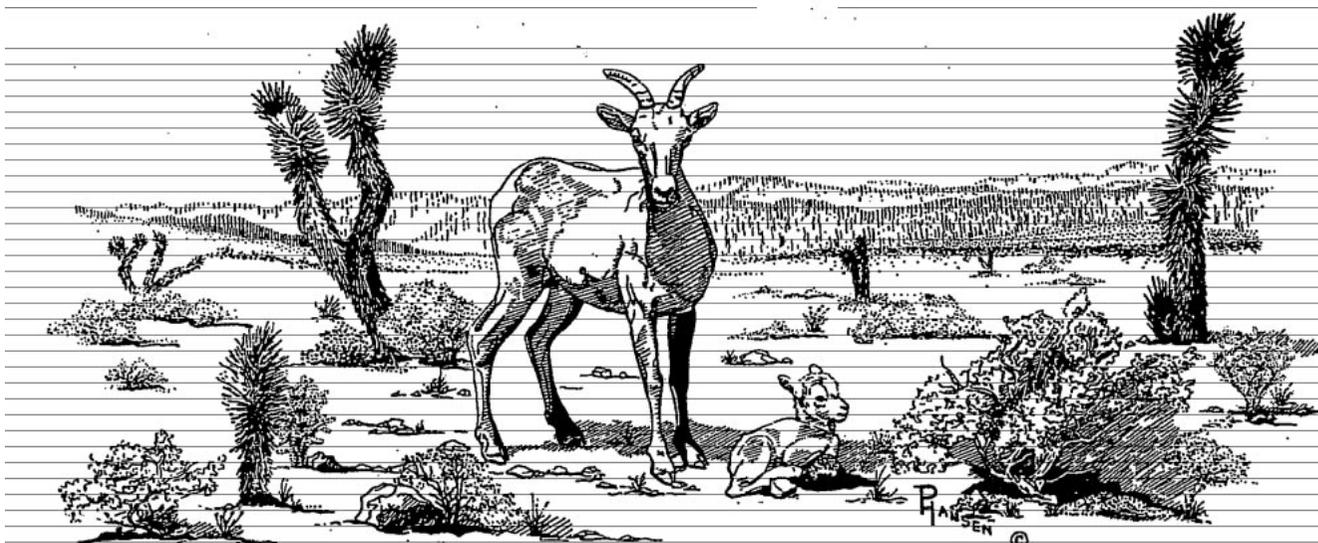
Darren Divine introduced the idea of developing a Council web-page. He will recruit a student at UNLV to provide an estimate of the costs of production and maintenance, and then submit that estimate to Tech Staff. If accepted by Tech Staff, the Web-page will be developed in a trial version, and announced to the membership for viewing and comments. A vote will be taken at the 2001 DBC Business meeting whether to continue the web page. Motion Passed (Unknown / Unknown).

A letter was read from Pat Hansen stating that the Hansen and Welles families support a motion to change the name of the Hansen-Welles Memorial Fund to the Hansen-Welles Scholarship in order to allow wider dissemination of the money availability, and to hopefully increase the number of applicants. Darren Divine will take on the responsibility of getting the scholarship listed and announced in the appropriate places. Motion Passed (Unknown / Unknown).

Nominations:

Darren Divine - Secretary/Treasurer
Chairman - undecided (Mexico or Utah)

4:00 p.m. - Meeting Adjourned



CRITERIA FOR DESERT BIGHORN RESEARCH FUNDING FROM THE HANSEN-WELLES SCHOLARSHIP

Eligibility:

1. Any organization or person submitting a project and / or program proposal shall be an active member of the Desert Bighorn Council, or shall be sponsored in writing by an active current member of the Desert Bighorn Council.
2. Proposed projects and / or programs must be for the benefit of desert bighorn sheep, or desert bighorn sheep habitat.
3. Graduate Students must be accepted as an advanced degree candidate at an accredited college or university and have an advisor in an appropriate department (i.e. Wildlife Management, Science, Zoology, etc.).

Submission Requirements :

1. Must have demonstrated desert bighorn experience or be supervised by an individual with such experience.
2. Must submit:
 - a. An acceptable research project outline, Including:
 - i. in-depth literature review,
 - ii. clearly stated objectives,
 - iii. comprehensive research methods,
 - iv. time frame for all work,
 - v. resume of appropriate experience
 - vi. written approval from appropriate state / federal agency
 - vii. complete budget
 - b. A brief critique of the student and proposed project from the student's major professor.
3. Proposals must be submitted to the Desert Bighorn Council Technical Staff Chairman for consideration prior to December 31 of each year.
4. Proposals will be screened by the Technical Staff of the Desert Bighorn Council and presented to the membership at the annual business meeting for final selection of the recipient(s).
5. Recipients must sign a contractual agreement with the Desert Bighorn Council stating that results of the research project will either be published in a refereed journal and / or presented at the Desert Bighorn Council for inclusion in the Transactions within a 5-year period following receipt of funds from the Hansen-Welles Scholarship. Acceptability of the publication will be determined by the Technical Staff of the Desert Bighorn Council.

6. Upon completion of the project and / or program, a complete accounting of the funds expended will be forwarded to the Technical Staff of the Desert Bighorn Council. None of the funds awarded are to be used for administrative purposes by the sponsoring college, university, or agency, or for travel to meetings.

SUGGESTED RESEARCH PROPOSAL OUTLINE:

1. **TITLE:** A concise, clear, and specific description of the proposed research.
2. **APPLICANT:** Name, address, and telephone number of applicant plus signatures of pertinent people; i.e. advisor, sponsor.
3. **TIME PERIOD:** Proposed initiation and completion dates for the project.
4. **OBJECTIVES:** A clear, concise, and complete presentation of primary research objectives.
5. **INTRODUCTION:** An in-depth presentation of the research, including an extensive review of the pertinent literature.
6. **METHODS AND PROCEDURES:** A statement of working plans, methods to be used, or experimental design.
7. **JUSTIFICATION:** A description or statement as to the importance for the proposed research, and qualifications of the principal investigator(s) to undertake the project. Include what would be lost if the project is not funded.
8. **FACILITIES AND EQUIPMENT:** A list of facilities and / or equipment needed and available.
9. **BUDGET:** Amount requested from Council and amount needed for entire proposal.
10. **PERSONNEL:** A list of qualified persons assisting or supporting the applicant.
11. **PUBLICATION:** Potential journals or other publications in which anticipated results from the proposed research might be published.

In Memoriam



The Desert Bighorn Council lost a valuable member, and friend, on May 31, 2000 when Linda Seibert, a Wildlife Biologist with the BLM and long-time member of the DBC, passed away

Linda received a B.A. Degree in 1969 from San Jose State University and then moved to Las Cruces, New Mexico. After deciding her calling was really the outdoors and natural resources, she returned to school and received a Wildlife Biology Degree from New Mexico State University in 1977.

Linda began her BLM career as a wildlife biologist in Las Cruces, New Mexico in 1977. Early in her career she worked on an inventory crew gathering information for BLM's livestock grazing E. I. S. and land use planning system. While in Las Cruces she also developed strong ties with her BLM co-workers and biologist with the New Mexico Game and Fish Department and became involved with the development and maintenance of several bighorn sheep water catchments.

She transferred to Moab, Utah in 1987, where she served as a Wildlife Biologist and Wildlife Program Leader until illness forced her retirement in December 1999. While in Moab, Linda continued to maintain a high interest in bighorn sheep management, as well as taking on other interests such as initiating a Bald Eagle nest monitoring program, and conducting riparian monitoring and assessments.

Linda served on many partnerships, committees and working groups, including:

Team Leader of the Comb Wash Watershed Plan.

Mill Creek Partnership Project

Utah Division of Wildlife's Southeast Region Advisory Committee

Mexican Spotted Owl Working Group

Peregrine Falcon Working Group

Southwestern Willow Flycatcher

Helped Grand County High School develop an outdoor education program

Bird Club

Member Utah Chapter Wildlife Society,

Desert Bighorn Council

Linda was born on November 21, 1946 and passed away May 31, 2000. She will be truly missed by her family, friends, co-workers and Desert Bighorn Council associates.

DESERT BIGHORN COUNCIL MEETINGS 1957 - 2000

Year	Location	Chairperson	Secretary	Treasurer	Transactions Editor
1957	Las Vegas, NV	M. Clair Albous			
1958	Yuma, AZ	Gale Monson & Warren Kelly			
1959	Death Valley, CA	M. Clair Albous	Fred Jones	Fred Jones	
1960	Las Cruces, NM	Warren Kelly	Fred Jones	Fred Jones	
1961	Hermosillo, MX	Jon Akker	Ralph Welles	Ralph Welles	
1962	Grand Canyon, AZ	James Blaisdell	Charles Hansen	Charles Hansen	Charles Hansen & L. Fountein
1963	Las Vegas, NV	Al Jonez	Charles Hansen	Charles Hansen	Jim Yoakum
1964	Mexicali, MX	Rudulfo Corzo	Charles Hansen	Charles Hansen	Charles Hansen & D. Smith
1965	Redlands, CA	John Goodman	John Russo	John Russo	Jim Yoakum
1966	Silver City, NM	Cecil Kennedy	John Russo	John Russo	Jim Yoakum
1967	Kingman, AZ	Claude Lard	John Russo	John Russo	Jim Yoakum
1968	Las Vegas, NV	Ray Brechbill	John Russo	John Russo	Jim Yoakum
1969	Monticello, UT	R. & B. Welles	W. G. Bradley	W. G. Bradley	Jim Yoakum
1970	Bishop, CA	William Graf	W. G. Bradley	W. G. Bradley	Jim Yoakum
1971	Santa Fe, NM	Richard Weaver	Tillie Barling	Tillie Barling	Jim Yoakum
1972	Tucson, AZ	George Welsh	Doris Weaver	Doris Weaver	Charles Hansen
1973	Ha-athome, NV	Warren Kelly	Doris Weaver	Boris Weaver	Juan Spillet
1974	Moab, UT	Carl Mahon	Lanny Wilson	Lanny Wilson	Juan Spillet
1975	Indio, CA	Bonnar Blong	Lanny Wilson	Lanny Wilson	Charles Hansen
1976	Bahia Kino, MX	Mario Luis Cossio	Peter Sanchez	Peter Sanchez	Charles Hansen
1977	Las Cruces, NM	Jerry Gates	Peter Sanchez	Peter Sanchez	Charles Hansen
1978	Kingman, AZ	Kelly Neal	Peter Sanchez	Peter Sanchez	Charles Hansen
1979	Boulder City, NV	Bob McQuivey	Peter Sanchez	Peter Sanchez	Charles Hansen
1980	St. George, UT	Carl Mahon	Peter Sanchez	Peter Sanchez	Charles Hansen
1981	Kerrville, TX	Jack Kilpatric	Peter Sanchez	Peter Sanchez	Charles Hansen
1982	Borrego Sprs., CA	Mark Jorgensen	Rick Brigham	Rick Brigham	Charles Hansen
1983	Silver City, NM	Andrew Sandoval	Rick Brigham	Rick Brigham	Charles Hansen
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1985	Las Vegas, NV	David Pullman, Jr.	Rick Brigham	Rick Brigham	Charles Hansen
1986	Page, AZ	Jim Guymon	Bill Dunn	Bill Dunn	Paul Krausman
1987	Van Horn, TX	Jack Kilpatric	Bill Dunn	Bill Dunn	Paul Krausman
1988	Needles, CA	Vernon Bleich	Don Armentrout	Don Armentrout	Paul Krausman
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1992	Bullhead City, AZ	Jim deVos, Jr.	Stan Cunningham	Stan Cunningham	Paul Krausman
1993	Mesquite, NV	Kathy Longshore	Charles Douglas	Charles Douglas	Walter Boyce
1994	Moab, UT	Jim Guymon	Charles Douglas	Charles Douglas	Walter Boyce
1995	Alpine, TX	Doug Humphries	Charles Douglas	Charles Douglas	Ray Boyd
1996	Holtville, CA	Andy Pauli	Charles Douglas	Charles Douglas	Ray Boyd
1997	Grand Junction, CO	Dale Reed & Van Graham	Steve Torres	Charles Douglas	Raymond Lee
1998	Las Cruces, NM	Eric Rominger & Dave Holdermann	Darren Divine	Charles Douglas	Raymond Lee
1999	Reno, NV	Rick Brigham & Kevin Hurley	Darren Divine	Charles Douglas	Allen and Harriet Thomas
2000	Bullhead City, AZ	Ray Lee & Jim deVos	Darren Divine	Charles Douglas	Jon Hanna

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