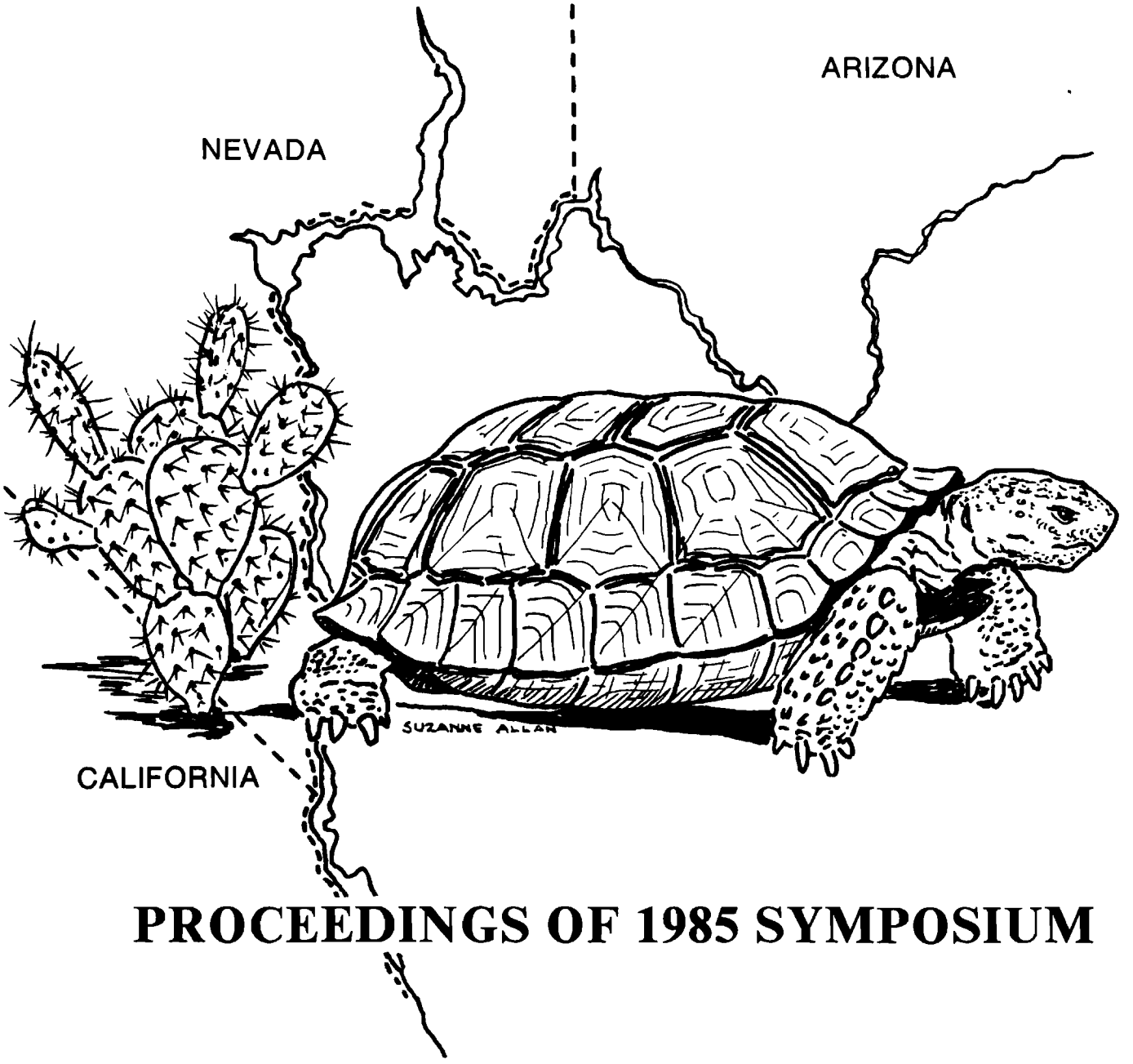
THE DESERT TORTOISE COUNCIL



PROCEEDINGS OF 1985 SYMPOSIUM

DESERT TORTOISE COUNCIL

PROCEEDINGS OF 1985 SYMPOSIUM

A compilation of reports and papers presented
at the 10th annual symposium of the
Desert Tortoise Council,
March 30 - April 1, 1985,
in Laughlin, Nevada

Publications of the Desert Tortoise Council, Inc.

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These proceedings record the papers presented at the annual symposium of the Desert Tortoise Council. The Council, however, does not necessarily endorse the conclusions reached in the papers, nor can it attest to the validity or accuracy of the data.

DESERT TORTOISE COUNCIL

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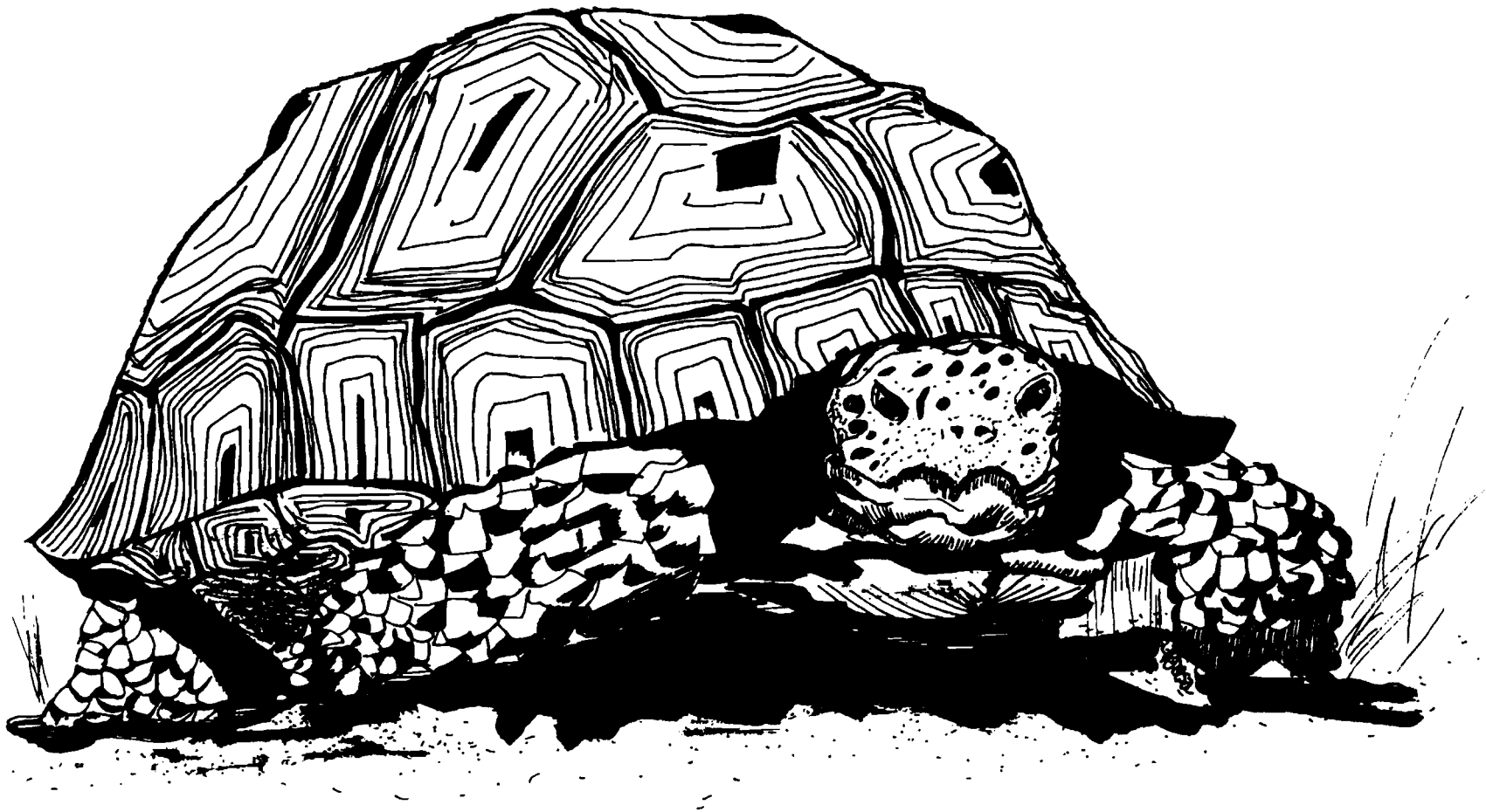

Desert Tortoise Council Symp. Proc. 1985:1-3

DESERT TORTOISE COUNCIL — THE FIRST 10 YEARS

JAMES A. ST. AMANT
California Department of Fish and Game
245 W. Broadway
Long Beach, California 90802

In 1976 Carter was elected President, Mao-Tse-Tung died, the U.S. landed Vikings I and II on Mars, the Cincinnati Reds beat the Yankees to take the World Series, and the Pittsburgh Steelers edged out the Dallas Cowboys 21-17 to take the Super Bowl. Not in the headlines this bicentennial year was the most important event of the century (second only to my courtship of Evelyn) — the First Annual Desert Tortoise Council Symposium. The first-ever symposium of the Desert Tortoise Council took place on 23-24 March 1976 at the Showboat Hotel in Las Vegas.

Formation of the Council began in 1974 when the Prohibited and Protected Fish, Amphibians and Reptiles Committee of the Colorado River Wildlife Council formed an *ad hoc* Desert Tortoise Recovery Team. On 21 April 1975, members of this Recovery Team met at the San Bernardino County Natural History Museum and officially formed the Council as we know it today. Kristin Berry and I were elected Co-chairmen, and the goal and objectives of the Council were set.

The goal of the Council 10 years ago and today is, "To assure the continued survival of viable populations of the desert tortoise, *Gopherus agassizi*, throughout its existing range."

To reach this goal, the Council's objectives include:

1. To serve in a professional advisory manner, where appropriate, on matters involving management, conservation and protection of desert tortoises.
2. To support such measures as shall work to insure the continued survival of desert tortoises and the maintenance of their habitat in a natural state.
3. To stimulate and encourage studies on the status and on all phases of life history, biology, physiology, management and protection of desert tortoise populations.
4. To provide a clearinghouse of information among all agencies, organizations and individuals engaged in work on desert tortoises.
5. To disseminate current information by publishing proceedings of meetings and other papers as deemed useful.
6. To maintain an active public information and conservation education program.
7. To commend outstanding action and dedication by individuals and organizations fostering the objectives of the Council.

For any volunteer organization to be effective requires a core of dedicated officers willing to work long and hard hours. The Council is fortunate in having a number of these people who have served and some who continue to serve. People who have served as Co-chairmen include: Kristin Berry, Glenn Stewart, Don Seibert, Bill Ratdkey, Dave Stevens, Phil Medica, Dave Stevens, Bob Turner, Frank Hoover, George Sheppard, Ted Cordery, Dan Pearson, and myself. Others who have served as officers — some of whom continue to serve — include: Mary Trotter, Lori Nicholson, Norm Edmonston, Mike Coffeen, Martha Young, Judy Hohman, and Evelyn St. Amant.

And, of course, a major segment of the Council is the membership, which includes members from 19 states. The membership is made up of government agency personnel, turtle and tortoise societies, herpetological societies, students, teachers, professors, zoo and museum curators, fish and game commissioners, environmental groups, consultants, veterinarians, and people who are just interested in helping the desert tortoise.

Starting in 1976, we have annual symposia. A major byproduct of the symposia is the proceedings. Proceedings have been published from 1976 through 1982, with 1983 and 1984 being completed for publication soon. The proceedings are found in the major libraries across the nation, the Library of Congress, and in 12 other countries — Mexico, Canada, Israel, South Africa, England, Puerto Rico, Australia, France, New South Wales, Netherlands, Brazil, and Germany. As valuable references, they have been and are used as baseline data for additional research for documentation for regulations, mitigation, and management of desert areas.

The Council has also published "An Annotated Bibliography of the Desert Tortoise," and is responsible for a number of studies completed under contracts, including "The status of the desert tortoise (*Gopherus agassizii*) in the United States," and "The distribution and abundance of the desert tortoise on the Chocolate Mountains Aerial Gunnery Range." The latter study required working in areas where only fools and Desert Tortoise Council members would go.

The Council provides assistance in helping to design and review numerous studies conducted by universities, consultants, and state and federal agencies. Our Research Advisory Committee also reviews studies conducted on the Desert Tortoise Natural Area.

Although the limelight is on the annual symposium, the Council is active on a daily basis throughout the year. The Council's Board of Directors meets at least four times a year, carrying on the routine Council business. Recommendations on environmental documents such as the California Desert Conservation Area Plan amendments, numerous energy developments, off-road vehicle races, grazing allotment reviews, proposed regulations, and other correspondence consume a great deal of time. Responding to daily correspondence, including requests for information and Council publications, takes a great deal of our Secretary's time each day.

The Council has participated in numerous meetings and workshope in California, Arizona, Nevada, and Utah, and provided technical assistance in

developing management plans for the various agencies involved. Recently, members of the Council participated in a workshop sponsored by the Southern California Edison Company. This past year the Council participated in the Mojave Desert Range Project's Desert Tortoise Workshop. The Mojave Desert Range Project considers the desert tortoise as its number one priority for investigation and studies.

Council members were partially responsible for the Beaver Dam Slope desert tortoise population being federally listed — an unpopular decision in Utah, but a necessary one to protect this population. The Council has reviewed and made recommendations on the Recovery Plan, and only received the final draft last Monday. In 1979 Council members assisted in the listing of the bolson tortoise (*Gopherus flavomarginatus*) as endangered.

The Council played a major role in passage of regulations banning the commercial sale of native reptiles and amphibians in California. Assistance has been given to state agencies in preparing desert tortoise information leaflets and to the California Department of Fish and Game in the development of the "Hands Off Pardner" poster. The Council also worked with the California Department of Fish and Game in the captive tortoise rehabilitation program.

The Desert Tortoise Council recognizes and supports other groups that are helping the desert tortoise. The Council awarded its First Annual Award to the Desert Tortoise Preserve Committee. This Committee, made up of dedicated citizens, is responsible for the creation of the Desert Tortoise Natural Area and continues its relentless pursuit of acquiring the needed lands to complete the world's only area dedicated to the desert tortoise and its associated ecosystem. Another group received the Council award in 1979 — The Nature Conservancy — for its support of the Desert Tortoise Natural Area and preservation of other natural areas. And in 1983 the California Turtle and Tortoise Club received the award for its adoption and educational program and assistance to the Council.

Among the many projects the Council is currently involved in is working with the California Department of Fish and Game to list the desert tortoise as rare in California. Support of the federal listing will be a high priority for 1985.

To help keep the general membership better informed of the Council's activities, a newsletter was initiated last year. The Council is presently working on a methods manual that will provide standardized procedures for desert tortoise data collection. The Council is also preparing a manual on desert tortoise management guidelines. This manual will be invaluable in preparation of recovery plans and day-to-day reference for mitigation on proposed development projects.

We have come a long way in the past 10 years but, as I said in 1978 at the annual symposium, "We still have a long way to go, but through your efforts the desert tortoise now has a chance."

We must save a place on this planet for the tortoise to continue to exist.

Desert Tortoise Council Symp. Proc. 1985:4-11

Keynote Address

A MEASURE OF PROGRESS: THE DESERT TORTOISE AND MULTIPLE-USE

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Bureau of Land Management
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Thank you for inviting me to speak to you today, on the occasion of the Desert Tortoise Council's 10th anniversary meeting. I am pleased to represent the Bureau of Land Management (BLM), at what I feel is a major turning point in our agency's challenge in managing public land resources. I will speak to that challenge in a few minutes.

State Director Ed Hastey sends his greetings today, and wishes the Council continued success in your goal of assuring the survival of viable populations of the desert tortoise throughout its existing range.

The challenge you have as an organization, and the Bureau has as a federal agency, is to pursue our mandates in meeting our goals. The Bureau's mandate is multiple-use of the natural resources on public lands for which we are entrusted. The Council's mandate, as I understand it, is one of single-use in perpetuation of the desert tortoise. Therein lies the dichotomy, and therein rests our challenge. Can we achieve both mandates to the full satisfaction of each other? Probably not! Nor should we expect to achieve full compatibility.

What, therefore, should we expect? Let this question roll over in our minds for a few minutes, while I remind you where the Bureau has been, and where we are heading.

The BLM manages more than 17 million acres of California's 101 million acres (17%). Twelve and a half million of those 17 million acres are in the California desert. This awesome responsibility was recognized most clearly in the Federal Land Policy and Management Act of 1976. Perhaps the key thing the Act did was to recognize the Bureau as a permanent land management agency. The concept of "ultimate disposal," found in the Taylor Grazing Act of 1934, was dropped. The BLM was finally given authority to "retain and manage" the public lands. Under the Act, land use planning is a key to directing that management. Under Section 102 of the Act, Congress told us to provide for the "protection and administration" of the public lands in the context of multiple-use, sustained yield, and maintenance of environmental quality. The desert environment is recognized as an ecosystem. That ecosystem includes man. Man is part of the multiple-use mix with which the Bureau is charged to manage. In the Act, the many values in the desert were recognized — historical, scenic, archaeological, biological, cultural, scientific, educational, recreational, and economic. The fact that large populations impinge upon the desert resource values was also noted.

Uses of the desert are extensive and varied. Mineral development ranges from facilities run by mining corporations to the claim filed by a modern-day sourdough. Several thousand cattle and sheep graze the desert at one time or another during the year. Recreation uses of many types occur throughout the desert, with over 19 million visitor-use days occurring annually. Off-road vehicle users both tour and race in competitive events. Visitors also camp, hike, rockhound, and ride horses. You are likely to see weekenders landsailing and flying autogyros. The desert also serves as a source and transmission avenue for energy being delivered to the coastal cities. Transmission lines link population centers with power generation sources out of state. Coal and oil generation plants exist, or are under consideration, while the desert's greatest resources — the sun and the wind — offer other sources of energy.

Managing these uses is further complicated by the desert's land pattern. For example, a 40-mile wide belt of land in a checkerboard ownership pattern crosses the desert along the route of the Santa Fe Railroad. Nineteenth-century grants of land to the railroads are responsible for this pattern of alternating one-mile-square sections. State school lands offer a second example. Sections 16 and 36 of each township were granted to the state in the last century. The result was isolated parcels of state-owned land, many of them of little use to state government, but complicating the ownership patterns for both the BLM and the state. Other management problems arise from the scattered distribution of public lands near urban areas. Small isolated tracts of federal land are dispersed among rural and suburban housing. This combination — the natural attractions of the desert and the development and recreation needs of the coastal population centers — has resulted in a very unique situation not found elsewhere in the West.

How was the Bureau to assess these human and resource needs and values? The Federal Land Policy and Management Act directed us to prepare a comprehensive, long-range plan for the desert. And this we did. In 1980, the Plan was completed. It recognizes the special fragility of desert lands, and the kinds of stress human impacts place on arid ecosystems. The Plan recognizes that the California desert lands and resources are to be used by people — but that sometimes this use must take place in special ways.

And each year since 1980, the *Desert Plan* has been amended. Changes required by generating new information, or because things have changed, are discussed in an open public forum. Our Desert Advisory Council has played a key role in assuring all viewpoints are expressed and analyzed.

The desert has an ever-changing face, but perhaps not so much as has happened in the five years since the Plan was completed. Before I get to the tortoise specifically, let me relate a few of the more important transformations.

Energy Development.—Five years ago wind whistled uninhibited through San Gorgonio Pass near Palm Springs. Today, over 1,000 wind-generating machines are on BLM-managed land, producing 150 million kilowatt hours of electricity — enough electricity for a community of 22,000 people. The U.S. Treasury is receiving over $1 million per year for the use of this resource. More is coming, not only in the Palm Springs area, but at Tehachapi near Mojave.

There we have permitted 325 wind machines to date. The BLM is excited about being able to play a part in using the public lands' potential to help meet current and future energy needs.

Experiments on the public lands at Danby Dry Lake are also underway to see if energy can be generated from diluting and pumping salt brine, and using low-temperature turbines.

Mineral Development.—Five years ago, there was little indication the desert offered potential for gold mining. The prospector and his burro have since given way to larger operations, using recently developed techniques. These new procedures let microscopic gold particles be recovered, unthought of just a few years ago. We currently have three such operations pending BLM and local government approvals — Goldfield's operations just east of the Imperial Sand Dunes; Hydromet north of Soda Springs; and Amselco, in eastern San Bernardino County. Each of these projects has its unique environmental problems — loss of grazing land, visual contrasts that could be obtrusive, alterations of topography, sporadic dust emissions, hazardous materials, and tolerance of sensitive plants and animals. Yet, carefully planned and carried out mining operations, with mitigations tuned to heading off these sorts of problems, can allow multiple-uses to work.

Wild Burros.—Combining round-ups in the field with a highly successful Adopt-A-Burro Program, the Bureau has almost brought the burro populations on public lands in the desert to management levels. Since 1981 we have removed some 14,000 burros from federal lands in the California desert. Five thousand burros have been gathered from BLM public lands, 5,000 have been removed from the China Lake Naval Weapons Center, and 4,000 have been rounded up from Park Service lands in Death Valley. Nearly all of the burros gathered from BLM lands have been placed in foster homes throughout the United States.

We are striving to manage these animals to maintain a balance in their food-cover-water-living space needs, while reducing conflicts with other resource values. At times, for example, the burro and the tortoise were not compatible. Our management efforts are trying to reduce these conflicts.

Choachella Valley Preserve.—In the last forty years, the area around Palm Springs has grown from about 12,000 people to over 200,000 today. If growth continues at its current pace, we estimate the entire Coachella Valley floor would be developed by residential, commercial, and agricultural uses by the year 2000 — just 15 short years from now. With this development threatening preservation of the Coachella Valley fringe-toed lizard, an adversarial relationship between developers, cities in the valley, and state and federal agencies was about to erupt.

The challenge to the BLM, and to others, was to figure out some way to preserve the lizard and yet allow development to continue. The idea of a "preserve" was born. To acquire the preserve, private and public parties agreed to pool their resources and talents, and establish 13,500 acres of habitat to assure continuation of the species. By establishing the preserve, private development of other lizard habitat in the valley could continue without the uncertainty of delays and constraints.

Wilderness.—If you think "desert tortoise" evokes emotionalism, try "wilderness"! Across California, sides are taken — positions established. But on BLM lands in the California desert, the opportunity is still there to influence the final decision.

After going through the wilderness inventory step in our process, 122 Wilderness Study Areas, 5.5 million acres, were identified on Bureau lands. Of these study areas, 42, totalling 1.8 million acres, were shown to have wilderness values and are preliminarily recommended as suitable. We are now waiting for geological survey and Bureau of Mines minerals reports to be completed on them. These reports will be available for public review and comment over the next year and a half.

As the Secretary prepares his recommendations to the President — probably sometime in 1988 — the final Environmental Impact Statements, for both the nonsuitable and the suitable recommended areas, will be available for public review and comment. Following this, his recommendations will go to the President, and then to Congress.

During this time, we are doing everything we can to assure our interim management of all 122 Wilderness Study Areas (both those preliminarily recommended as suitable, as well as those recommended nonsuitable) protects the potential wilderness values until Congress decides. Our desert ranger patrols in these areas have increased; we are routinely flying and making aerial observations of all Wilderness Study Areas; and we are making a concerted effort to advise and alert public land users of their responsibilities in not damaging wilderness values.

Livestock Grazing.—The Bureau understands the extreme significance and critical nature of livestock use and forage production in the desert environment. That use is one of the multiple-uses with which the BLM is charged, and that production is a key to survival of many animal species, as well as to soil stability and other values. Because different management techniques are needed when dealing with ephemeral range as compared to perennial range, we take certain precautions. We know ephemeral forage production varies from year to year, requiring management flexibility in setting livestock stocking rates and seasons of use. Based on professional judgment of our range conservationists and wildlife biologists, we set certain restrictions on livestock grazing, for the benefit of the desert tortoise, in highly crucial tortoise habitat:

- We assure 350 pounds of ephemeral forage (dry weight) per acre is available before allowing livestock turnout.
- We restrict sheep to only one grazing pass-through.
- We select sheep watering and bedding areas.

In crucial tortoise habitat we assure 200 pounds of ephemeral forage per acre is available before turnout.

Interchange.—I should also mention the current Land Interchange Program. The Bureau and the Forest Service are actively involved in a program to interchange management of some 2.7 million acres of land in California. This is a Bureauwide—Forest Service wide effort, affecting public lands and resources management across the country. The interchange will enhance public service and improve our administrative efficiency. Teams of BLM and Forest Service people are now preparing plans to implement the program, and public meetings have been held across the state. Until legislation is introduced — later this year — and ultimately passed, both BLM public lands and national forest lands will continue to be managed under existing laws and rules.

In the California desert, only one small change is proposed. The Southern Inyo Mountains, south of Highway 168, would transfer from Forest Service to BLM management.

With this as a setting, what then, is the Bureau's relationship to the desert tortoise?

The Bureau is the major landholder of tortoise habitat in California. We are the leader in conducting and promoting research for the desert tortoise. We are the leader in managing tortoise habitat in the California desert. Let me account to the Desert Tortoise Council, the Bureau's efforts to protect, manage, and increase our knowledge toward management of tortoise habitat.

- The Desert Tortoise Natural Area — nearly 24,000 acres of land, of which about 16,500 acres are managed by the Bureau — was established in the *Desert Plan*. Fencing, interpretive displays, and exclusion of sheep grazing are some of our efforts to protect the habitat of the tortoise in this 38-square-mile area.

We have over the past three to four years worked hard to effect some sort of land adjustment within the Desert Tortoise Natural Area to block up public land ownership and relieve private landowners of the concern they have of owning property within the Natural Area. The Bureau still favors blocking up certain areas, and we have set priorities on areas we do want to acquire. We have worked with various groups, including The Nature Conservancy, to see if we can extract some resolution of the land ownership situation. From a cost-effective standpoint, the BLM cannot afford to pursue small tract land exchanges. We have been interested in larger scale exchanges if smaller, privately owned parcels could be blocked up. We are currently developing a desert-wide land exchange priority list that will be looked at in total for all desert lands. However, we do feel the integrity and the management of the Desert Tortoise Natural Area can be maintained with the current land ownership status.

- Other special areas for tortoise protection include the Chuckwalla Bench Area of Critical Environmental Concern (ACEC) and the Shadow Valley, Ivanpah Valley, and Fenner/Chemehuevi Valley special areas. These were highlighted in the *Desert Plan* for special attention.

- The Bureau has an active program of cooperative management with a variety of public land and resource users. One such agreement is with the Desert Tortoise Preserve Committee, to help us in the Desert Tortoise Natural Area. They conduct tours of the area, publicize the tortoise's place in the desert ecosystem, and help the Bureau maintain that special area. In fact, last fall the Committee was instrumental in helping the Bureau patch and mend the Desert Tortoise Natural Area fence. Thanks to them, the Natural Area's integrity continues to be maintained.

- For over 10 years, the BLM has been in the mainstream of studies, research, and monitoring. Over 1,000 transects have been run to determine population densities, and maps have been made. We have contracted for a population study and biology of the tortoise, have funded research into effects of cattle grazing on desert tortoise growth and reproduction, and are monitoring a 640-acre sheep exclosure plot — again to help determine effects of grazing.

Kristin Berry of the Bureau's California Desert District has been most active in advocating continued work toward expanding our knowledge of the tortoise. For example, we have a monitoring program to check population size and trend, including over 25 transect and permanent plots. Other studies conducted include analysis of mortality causes, the relationship between shell wear and aging, and development of a population model.

Most recently, the Bureau awarded a contract on March 15, 1985, for obtaining quantitative data on the density, structure, and sex ratios of populations of desert tortoises on four permanent trend plots, three of which are at the Desert Tortoise Natural Area. The contract will run through June 1, 1985.

One final item I should mention is the potential for the Fish and Wildlife Service to list the desert tortoise, at least in parts of its range, as an endangered or threatened species. As you know, I am sure, the Defenders of Wildlife, the Natural Resources Defense Council, and the Environmental Defense Fund recently petitioned the Fish and Wildlife Service to list the tortoise as threatened or endangered. The petition is for the tortoise in its entire range. Reasons for the petition include vandalism, collection, careless recreation use, urbanization, livestock overgrazing, and agricultural development. It is my understanding they are currently evaluating the data, and no decision has yet been made about that listing. We in the BLM are also reviewing the available information and reports on the status of the species, to understand the implications listing may have on our total multiple-use responsibilities. We presently feel listing of the tortoise may be necessary in certain specific geographic areas, areas where the scientific evidence clearly shows populations are particularly vulnerable. We cannot, at this time, with our present knowledge of the situation, support listing the desert tortoise across its entire range.

Now the challenge!

Where does tortoise management fit into the Bureau of Land Management's multiple-use mandate? And where does the Desert Tortoise Council fit into the Bureau's management picture?

The desert tortoise is a part of the California desert ecosystem the Bureau of Land Management is charged with managing. But so, too, are our other responsibilities: careful mineral and energy development; measures to ensure the health of the livestock industry and the communities that depend on the industry, while restoring and increasing rangeland productivity; providing growing space for urban communities; protecting water resources and ensuring their availability; and finding places for recreation activities of many kinds — hunters, fishermen, wilderness hikers, and off-highway vehicle users. We need to protect and enhance wildlife habitat and protect the best of our natural, historical, and cultural heritage.

Our multiple-use responsibility includes an open, cooperative approach in managing desert resources. We are committed to assuring consultation with the public (public participation in our decision-making); acquiring the information managers need to make decisions; and expediting decisions so the American public is not left undecided about their use of their lands. We place heavy emphasis on our employees for a high standard of public service.

And what of your responsibilities? Re-read your organizational objectives and see how well you are fulfilling them. Ask yourself:

- How do I serve in a professional advisory manner on matters of management, conservation, and protection of the desert tortoise? Do you know the BLM District Manager, Gerry Hillier, and his resource Area Managers? Do you call them, personally, to discuss your views on tortoise management? Do you know how the Desert District Multiple-use Advisory Council works? Who are its members? Which members can be expected to support positions you want?

Also ask yourself:

- How do I disseminate information? And how do I maintain an active public information and education program? How do I maintain an active public of information? Do your members go on field trips with BLM field people to see what multiple-use means to them? Do you know what our range conservationists are looking for when they inspect allotments, and work with operators to achieve better plant and animal management? When was the last time you rode with one of our rangers on patrol? On a day when he drives hundreds of miles through the desert — helping, looking, observing, discovering — serving as the eyes and ears of our management team. When was the last time (or the first time) you presented a slide show or gave a talk to a four-wheel-drive group to let them know where you are coming from with this thing called a desert tortoise? When have you, as a conservationist or biologist concerned about the desert tortoise, strengthened your position by inviting a livestock operator or wild horse and burro representative to your meeting to listen to their side of the multiple-use coin?

The questions I have asked you here today are taken from the objectives statement of your organization bylaws. If you are, as an organization and as individuals, doing many of these things — if you can answer in the affirmetive — then I guess you are doing all you can. But, if you are not, then

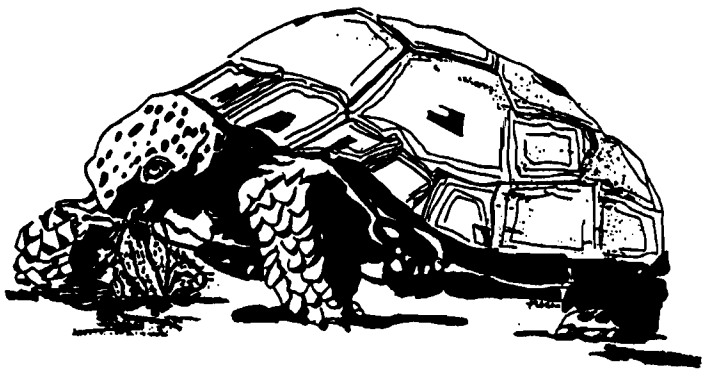
consider what really is your role. Are you really succeeding as an advocate for the desert tortoise?

Don't draw back into your shell of only research and studies! Don't burrow into the sands of professionalism to the exclusion of all else!

I believe that for you to be truly effective and successful in meeting the Council's goal and objectives, you must work with the Bureau in the context in which we work. And for us to be successful in managing a portion of the nation's natural heritage, we, too, must work with you and understand from where you are coming.

Through the *Desert Plan*, the Bureau recognizes its responsibilities for wise management of the desert's resources must be shared by all citizens. The federal dollars expended in management are investments needed to protect our capital in public-land resources and to insure that these resources are available and productive for those who come after us. The money spent and the service provided by dedicated public employees must be matched by commitment from the people. Your commitment as individuals and as an organization, is essential.

I thank you very much for allowing me to speak to you this morning. I wish you every success in this, your 10th anniversary meeting.



Desert Tortoise Council Symp. Proc. 1985:12

MAJOR ACTIVITIES OF THE DESERT TORTOISE COUNCIL 1984-1985

TED CORDERY
Senior Co-chairperson

During 1984 the Council continued efforts along many fronts toward its primary goal: To ensure that viable populations of the desert tortoise are maintained throughout its range. Some of the highlights of a busy year follow.

The Council maintained an active role in reviewing and providing comments on environmental and planning documents for actions proposed by management agencies in the four-state range of the tortoise. Such issues as livestock grazing, wilderness, amendments to the California Desert Plan, off-road vehicle use, land disposal, powerlines, pipelines, and others have been addressed. The commenting process is necessary to ensure that agencies use the best environmental data available and are kept aware that the public is concerned about wild tortoise populations.

"The status of the desert tortoise (*Gopherus agassizii*) in the United States," a report completed by the Council through Kristin Berry and others, was sent to the U.S. Fish and Wildlife Service in March of 1984. This exhaustive document is a major accomplishment and represents a summary of present knowledge on the status of the tortoise north of Mexico. Copies of the document were distributed to state fish and game departments and land management agencies. After the status report was completed, three organizations — the Defenders of Wildlife, the Environmental Defense Fund, and the Natural Resources Defense Council — petitioned the U.S. Fish and Wildlife Service to list the desert tortoise as endangered throughout the geographic range in the U.S. The Council continued to work on State listing of the desert tortoise in California.

A more formalized newsletter was begun to bring ongoing events and important items concerning the tortoise to the members in a timely manner. The newsletter is to be published three or four times each year.

We struggled as an organization through attainment of the Council's status as a nonprofit corporation. Changes in the bylaws and organizational structure were necessary to reach this goal.

We acquired a MacIntosh computer which should help us keep better records of Council activities, maintain a better mailing list, update membership records, and keep track of finances.

Many members participated in a workshop on the desert tortoise sponsored by the Mojave Desert Range Project, an Extension Service special program. The project was designed to bring environmental issues affecting Mojave Desert users into focus and to resolve problems through research and education.

Much has been accomplished this year, but, as always, much remains to be done in our efforts to save the remaining tortoise populations.

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1985 ANNUAL AWARD: PROFILE OF RECIPIENT, C. KENNETH DODD, JR.

Although Ken was born in California, his family moved to the East when he was only six months old. He was raised in Virginia and spent his youth there. In 1971 he obtained a B.S. in Zoology from the University of Kentucky. Graduate degrees quickly followed: an M.S. in Zoology from Arizona State University in 1972, and a Ph.D., also in Zoology, from Clemson University in 1974.

Ken Dodd

After a year as a Visiting Assistant Professor at Mississippi State University, Ken joined the Office of Endangered Species of the U.S. Fish and Wildlife Service in Washington, D.C., as a Staff Herpetologist. His eight years there form the basis of the Desert Tortoise Council's 1985 Annual Award. Ken Dodd was responsible for more than 60 *Federal Register* documents dealing with threatened and endangered amphibians and reptiles, including the Red Hills salamander, Atlantic Salt Marsh snake, eastern indigo snake, Houston toad, hawksbill sea turtle, leatherback sea turtle, American alligator, desert tortoise in Utah, and the Coachella Valley fringe-toed lizard. One document was on 17 species of foreign reptiles. No other federal employee has initiated so many listings or accomplished so much in such a short time span, and Ken is to be commended for his initiative, diligence, and persistence in conserving herpetofauna nationally and internationally.

Ken is or has been a member of several Committees: the Committee on Environmental Quality for the American Society of Ichthyologists and Herpetologists, Conservation of Herpetological Resources for the Society for Study of Amphibians and Reptiles, the Scientific Committee of the World Conference on Sea Turtle Conservation, the Technical Advisory Committee to the Western Atlantic Sea Turtle Group, a Consultant for the Wider Carribean Sea Turtle Recovery and Conservation Network, the Tortoise Specialist Group for the International Union for Conservation of Nature (IUCN), and the Crocodile Specialist Group for the IUCN. He also is a Research Associate with the

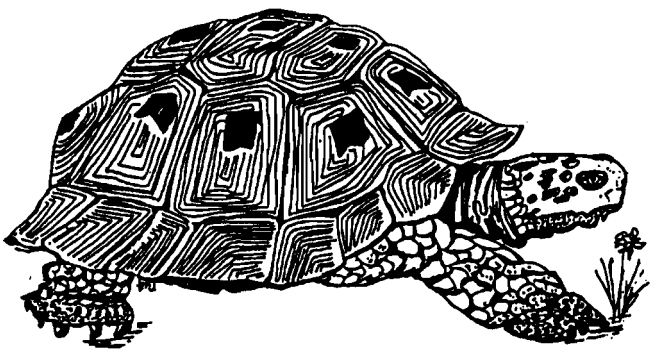
Smithsonian Institution, an adjunct curator of herpetology with the Florida State Museum, a member of several major herpetological societies, the Gopher Tortoise Council, Sigma Xi, and the American Society of Zoologists.

Ken has 49 published articles and papers dealing with reptiles and amphibians. Most focus on some aspect of conservation. He is now at work on a chapter for a book on a world-wide review of conservation and management of snakes.

Ken Dodd has made significant contributions to conservation and management of the desert tortoise, among them preparation of the listing package for the population of tortoises on the Beaver Dam Slope, Utah. His careful and articulate summary of data and viewpoints was instrumental in the final ruling. He also has reviewed papers submitted for publication in the Desert Tortoise Council Proceedings, and continues to be a font of information and ideas for Council members engaged in field studies and research.

In October of 1984, Ken became a Research Zoologist for the Fish and Wildlife Service, and is now stationed in Gainesville, Florida. He recently began field work on the flattened musk turtle, a threatened species. In Gainesville Ken will continue to pursue his research interests on such topics as the influence of life history characteristics on population dynamics, conservation and management of the world's herpetofauna, and the evolution and community ecology of many amphibian and reptile species. We salute you, Ken, for superb work on behalf of the desert tortoise and many other reptiles and amphibians!

— *Kristin H. Berry*



Desert Tortoise Council Symp. Proc. 1985:15-17

1985 Annual Award Acceptance

SOME THOUGHTS ON CONSERVATION

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I would like to thank the members of the Desert Tortoise Council for presenting me with the Annual Award for 1985. Unfortunately, circumstances prevented me from attending the meeting, but I assure Council members that my absence was not a reflection of a lack of appreciation at receiving the award. These days, government biologists have a difficult enough time justifying their field studies to an often unsympathetic bureaucracy much less travel to scientific meetings, especially one whose members have taken an activist approach to conserving an important constituent of a fragile and threatened ecosystem.

This past summer (1985), I studied a far distant relative of the desert tortoise called the flattened musk turtle, *Sternotherus depressus*, in northern Alabama. This little aquatic turtle faces a variety of complex threats that are likely to increase in the near future. Like the tortoise, valuable time that could have been used to plan conservation progress has been lost while those who should have known better argued about specific details of determining status. As Dr. Robert Mount once told me during one of many discussions of his concern for Southeastern reptiles and amphibians, you don't need a physiograph to measure nerve conduction on a dog hit by a coal truck to prove that he's dead. Unfortunately in conservation, we often are put in the position of trying to prove threats and declines beyond a legalistic doubt, something that biologists know can be done in far too few cases.

As much as I may dislike saying it, I cannot fault lawyers entirely for thinking that the natural world operates on a human-imposed adversarial legal system. For many, that is their training, view of the world, and ethical background, though I do see it as a failure of our educational system. Never mind; we are not going to reform lawyers and Chambers of Commerce to the complexities of the world and our often difficult to understand and nonmaterialistic reasons for wanting some of it and its inhabitants saved from immediate human whims.

What bothers me more is the seeming lack of commitment among so many established biologists, ones whose names ring bells of recognition in fields of genetics, ecology, and physiology, yet who are so busy with molecular clocks, cladistics, DNA, community ecology theories, and whatever else is the current fad in their specialty, that they have little active interest in preserving the subjects of their research and the ecosystems on which they depend. These people always have their excuses, the chief of which seems to be the lack of time to devote to conservation. Think of it! Lack of time. Time to determine molecular phylogenies or methods of quantifying species' interactions, but lack of time to devote their considerable expertise to

preserving Southern rivers and the deserts of the Southwest.

It seems to me that lack of time is not the real reason for not becoming involved in conservation matters. Perhaps it is simply lack of interest cloaked with the "taint" of being termed a conservationist, or — God forbid — a "preservationist." Even after the so-called environmental enlightenment of the last decade, many of our colleagues still equate conservation with radicals or little old lady bird-watchers (no offense, we still need them, too!), or at least with a form of soft science not up to their talents. In eight years with the Office of Endangered Species, my guess is that fewer than 25 herpetologists showed sustained interest in the program, not only to try to effect a positive and scientifically based approach to species protection, but perhaps more importantly to learn the laws and guidelines under which government agencies must operate to bring about effective conservation efforts.

Conservation approaches today have two major groups of constraints. One group is the biological constraints that are set by the species, those constraints that lawyers and bureaucrats have the most difficulty in understanding. We biologists recognize these constraints, or at least we understand that the constraints are there even when we don't know what they are.

The second group, the one biologists often tend to ignore, is the legal constraints under which biologists and others must act to obtain both money and the power of the law to prevent species loss or protect ecosystems. When I worked in the Office of Endangered Species, many times I was told, "You should not protect this species for [whatever] reasons, but you should protect its ecosystem." When I would explain this was not possible under the provisions of the Endangered Species Act, some biologists seemed perplexed or somehow annoyed with me. Instead of trying to formulate a conservation program within admittedly artificial legal constraints, they walked away, though I sensed that they felt that they had tried to do something.

The point is, of course, that to be effective at conservation, one must delve beyond one's own specialty (or interest) and learn how the political and government regulatory system works. Perhaps this is the real reason why some claim they have no time to become more involved. Given the realities of the system we must work within, however, I often find myself questioning the priorities and the commitment to the natural world of one invoking this excuse. Those who should be in the vanguard of conservation often, alas, do not take the time to become involved and be effective.

The fear of being associated too closely with conservation, or perhaps more correctly the fear of taking a stand on vital and often controversial issues when so little is known about the causes and solutions to environmental problems, is very strong in academic circles. There is a pervasive myth present among certain scientists, no matter where they may be employed, that one should never go beyond "objective" science. This type of person believes that one should not take a stand on an issue unless the data are so overwhelming that no doubt exists as to their meaning.

I think most Council members would agree that shooting one's mouth off

with inadequate or faulty data will hinder conservation. But what should we do in the case of the desert tortoise, a species whose present status and, more importantly, future prospects have been more than adequately documented? Yet we still hear scientists, even some who are sincere and reasonably unbiased, state that the tortoise does not need additional protection. In this role, they may be acting as statistically trained professionals viewing biological data from an ideal world point of view. The tortoise is widespread and there are viable remaining populations. Yes, it is difficult to prove in a legalistic sense that declines have occurred and that unless the species receives federal protection it will likely become endangered or extinct within the foreseeable future.

In spite of such concerns, I still find it difficult to believe that these same biologists would state that the tortoise has a secure future in an evolutionary sense. To do so would ignore too much available information on projections for human population growth and land use in the arid Southwest, and the biological attributes of K-selected species.

Differences about the adequacy of databases brings other problems into play that objective scientists appear to have much trouble confronting, i.e., the choices that must be made given available data. My feelings are well known about what I think should be done concerning the listing of the tortoise. There will never be enough information for some people, and if the desert tortoise, and the gopher tortoise, and my little flat friends in northern Alabama, are to be preserved in an evolutionary sense, hard decisions must be made using the data at hand rather than the data we might like to have. I would like to suggest to some of my colleagues that they are not being really "objective" by cloaking their opposition to available conservation approaches in the biological language of science.

In the real world in which conservation actions must be undertaken, failure to make a hard decision in favor of a species is in reality making a decision that could lead to irreversible decline. To use the thoughts of Bob Mount once again, conservation and conservative both have the same roots, politics aside. The truly conservative approach is to preserve and protect the environment and the species it contains using the best means available; the radical approach is to be objective and watch the decline of a species while insisting on more and conclusive data.

At least where the natural world is involved, I'm proud to be a conservative, and I hope that other members of the Council feel likewise. I hope that you will continue to advocate what you feel is right, and not be misled by the concerns of those preaching objective science rather than scientifically based conservation undertaken in an imperfect and legalistic world.

Desert Tortoise Council Symp. Proc. 1985:18-19

WINNERS OF THE DESERT TORTOISE COUNCIL'S FIFTH DESERT PHOTOGRAPHY CONTEST 1985

COLOR SLIDES

CAPTIVE:

Desert Tortoise

1st Joe Ross

Other Desert Reptiles

1st Betty Burge (Banded Gecko)

WILD:

Desert Tortoise

1st Betty Burge
2nd Jan Roberson
3rd Betty Burge

Other Desert Reptiles

1st Jan Roberson (Sidewinder)
2nd Jan Roberson (Horned Lizard)
3rd Wolfgang Oesterreich (Rosy Boa)

Desert Mammals

1st Jan Roberson (Kit Fox at den)
2nd Jan Roberson (Kit Fox)

Desert Scenics

1st Wolfgang Oesterreich (Soda Dry Lake)
2nd Wolfgang Oesterreich (New York Mountains)
3rd Joe Ross (Lone Juniper)

Wild Flowers

1st Betty Burge (Bear Claw Poppy)

People at Work with Wild Desert Tortoise

1st Betty Burge (Changing battery pack)
2nd Betty Burge (Going after tortoise)

BLACK and WHITE PRINTS

CAPTIVE:

Other Desert Reptiles

1st Joe Ross (Chuckwalla)

2nd Joe Ross (Collared Lizard)

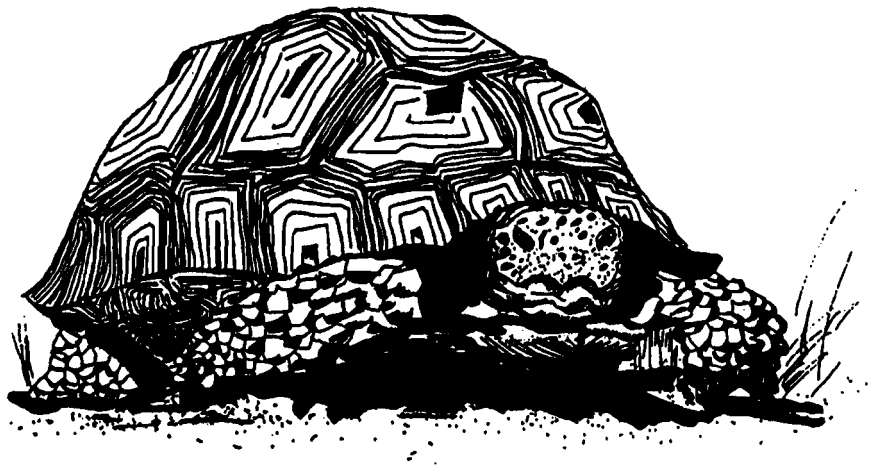
Desert Scenics

1st Joe Ross (Mountain Range near Tonapah, Nevada)

BEST OF SHOW

Jan Roberson's "Kit Fox at Den"

— *Beverly F. Steveson*



Desert Tortoise Council Symp. Proc. 1985:20

1985 ANNUAL BUSINESS MEETING OF THE DESERT TORTOISE COUNCIL

The following resolution was passed on the 31st day of March at the 1985 Annual Business Meeting of the Desert Tortoise Council:

RESOLUTION IN SUPPORT OF THE FEDERAL LISTING OF THE DESERT TORTOISE

WHEREAS, the desert tortoise, as a long-lived herbivore, stands as an indicator species for the health of the desert ecosystem; and

WHEREAS, its ability to maintain its populations on a long-term basis is irrevocably linked to the sustainability of the desert ecosystem(s) on which it depends; and

WHEREAS, in the professional opinions of many Desert Tortoise Council members, the species is declining in numbers and in geographic range and continuity; and

WHEREAS, the majority of desert tortoise populations reside on federally administered, public lands, the decline must be expected to continue under existing land management practices; and

WHEREAS, several Desert Tortoise Council members have reviewed the Status Report or parts thereof; and

WHEREAS, many Desert Tortoise Council members have contributed to the data base contained therein; and

WHEREAS, the Desert Tortoise Council has committed itself to advancing conservation efforts on behalf of the desert tortoise;

BE IT RESOLVED, that the Desert Tortoise Council supports the petition submitted by Defenders of Wildlife, the Natural Resources Defense Council, and the Environmental Defense Fund to the U.S. Fish and Wildlife Service to list the desert tortoise, *Gopherus agassizii*, under the Endangered Species Act of 1973, as amended.

Desert Tortoise Council Symp. Proc. 1985:21-22

1985 FIELD TRIP TO PIUTE VALLEY, NEVADA

At least 33 people participated in the field trip to Piute Valley. After assembling at Cal-Nev-Ari, the group proceeded to the desert tortoise permanent study plot west of Highway 95 (the Piute Valley Plot) where Paul Schneider had discovered a catastrophic die-off in 1983. The group actually stopped approximately 0.5 mile south of the study plot when one of the vehicles became stuck in a sandy wash. The wash was a convenient place to stop anyway, because it was about 200 yards from the southeast corner of a quarter-square-mile study plot established by the Nevada Department of Wildlife after the die-off was discovered. This small plot was one of 11 such sites which were subsequently surveyed to determine the extent of the die-off in the valley.

After a brief discussion of the history of the area, the group dispersed to examine what may be the highest density tortoise habitat in Nevada. At least six tortoises were located by the group, and the informal exchange of observations and ideas which ensued — regarding habitat conditions, tortoise behavior, food habits, morphology, and research techniques — was certainly beneficial to everyone involved. Biologists from Arizona were particularly impressed to see first hand just how different tortoise habitat looks in Nevada compared with Arizona.

The next stop was just north of Cal-Nev-Ari and across the highway from the first stop (i.e., east of Highway 95). Here we explained that habitat on the east side of the highway was in a different grazing allotment than the area we had just visited. We also noted that during examination of the quarter-square-mile plots in 1983, no apparent die-off was detected on this allotment. We suggested that, as the group examined the area, they should keep this in mind, so that they might be able to detect habitat differences which could result in such drastic differences in population trends between the two areas. Perhaps the presence of a greater amount of perennial grass on the east side of the highway provided enough food to prevent a die-off in spite of very low forb production during the drought. During the field trip, more forbs appeared to be present on the west side of the road than on the east. However, during the first week of March when the Bureau of Land Management conducted clipping and weighing transects, more dry ephemeral forage was present on the east side than on the west side. We also noted that neither allotment had sufficient forage production to meet the minimum requirements for livestock turnout in late winter recommended by the Coordinated Resource Management and Planning Group (i.e., a minimum of 500 pounds of dry ephemeral forage/acre in the area where the die-off occurred and 300 pounds/acre where no die-off was detected).

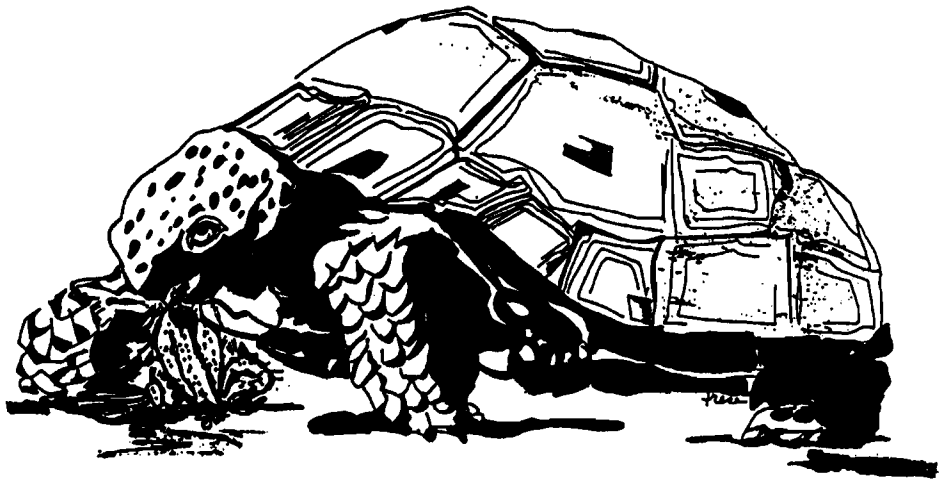
Only two or three tortoises were located by the group east of the highway, but this may have been simply because of the time of day. Temperatures were in the mid-eighties, so most tortoises probably had returned to the cool recesses of their burrows by the time we began searching.

At this point, since we had not stopped for lunch and it was after two o'clock, most of the group returned to Cal-Nev-Ari. However, about ten field

trip participants proceeded north to Searchlight and then turned west toward Nipton. Here we examined an impressive fenceline contrast which clearly illustrated the effects of cattle grazing on the delicate Mohave Desert ecosystem.

In summary, the excellent weather, a relatively large number of tortoise sightings, and a tremendously interested and knowledgeable group of participants made for a very successful and informative trip.

— *Ross Haley*



Desert Tortoise Council Symp. Proc. 1985:23-27

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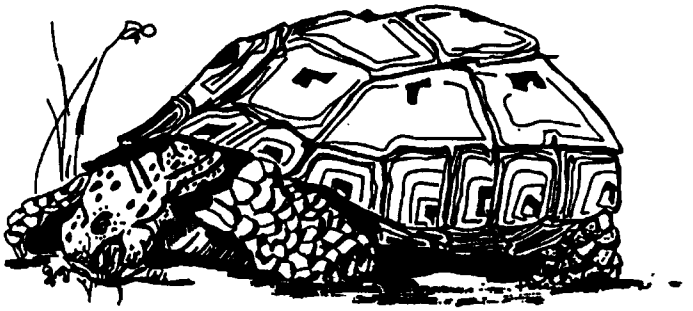

Desert Tortoise Council Symp. Proc. 1985:28-31

STATE REPORT - CALIFORNIA

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On the occasion of this 10th Annual Symposium, I will review the studies conducted by the Bureau of Land Management (BLM) in California over the past 10 years. In 1975, public lands in the California desert were administered by two Bureau districts — Bakersfield and Riverside. Inventory and planning efforts were conducted on a regional basis. With passage of the Federal Land Policy and Management Act in 1976, the California Desert Conservation Area was designated, and planning began on a desert-wide basis.

In order to prepare this *Desert Plan*, wildlife inventories were required to determine the status of species, the range of less common species, and an estimate of absolute abundance for a few species. This information would then indicate management needs for wildlife. Inventories were conducted on selected groups of invertebrates such as dune beetles, ants, bee flies, robber flies, butterflies, and playa invertebrates. Bird censuses were conducted for raptors and for birds of specialized habitats. In addition, for a broad coverage of the desert, standard breeding and wintering bird surveys were conducted at dozens of sites. Mammal censuses for kit foxes, Mohave ground squirrels, and other rodents were conducted. Herpetofaunal surveys were conducted at selected locations throughout the desert.

Very little was known about the density of the desert tortoise throughout its general range. As the desert tortoise was obviously an issue species and also an indicator of annual plant productivity, our office decided that it warranted more treatment than most others. To provide the needed information, Dr. Kristin Berry, who was lead biologist for the Desert Plan Staff, developed two complementary procedures.

One procedure involved transects which could be assessed relatively quickly. The observer walked a 1.5-mile course (generally triangular) and recorded tortoise sign — tortoises, tortoise shell or skeletal remains, burrows, scats, and tracks. Since one transect can be conducted in a couple of hours, this procedure could be performed in large numbers around the suspected tortoise range. At this time, the Bureau has contracted or conducted over 1000 of these transects in the California Desert. The Department of Fish and Game has funded about 300, and other agencies and companies have added another 500, giving a total of over 1800. By themselves, these transects are only indirect measures of the population and only indicate relative densities, not absolute densities.

A second procedure was needed to measure absolute density. The technique developed was an intensive survey method in which a square-mile plot is searched for 60 days. Some early test plots were larger, and some survey times shorter. These plot surveys yielded estimates of absolute densities

TABLE 1. — List of 16 permanent tortoise trend plots to be resurveyed in ongoing trend studies.

Plot name	Crucial habitat	Resource area	Latest year[1]
Chemehuevi Valley	Fenner-Chemehuevi	Needles	1982
Chuckwalla Bench	Chuckwalla	Indio	1982
Chuckwalla Valley	Chuckwalla	Indio	1980
DTNA Interp. Ctr. (3 plots)	West Mojave	Ridgecrest	1979
DTNA Section 11	West Mojave	Ridgecrest	1982
Fremont Peak	West Mojave	Barstow	1980
Fremont Valley	West Mojave	Ridgecrest	1981
Goffs	Fenner-Chemehuevi	Needles	1980
Ivanpah Valley	Ivanpah	Needles	1979
Johnson Valley	Johnson	Barstow	1980
Kramer Hills	West Mojave	Barstow	1982
Lucerne Valley	Lucerne	Barstow	1980
Stoddard Valley	West Mojave	Barstow	1981
Ward Valley	Fenner-Chemehuevi	Needles	1980

[1] Prior to 1985.

which could then be used to calibrate the transects. When applied to the large number of transects, a general density map was developed. Twenty-seven such plots have been surveyed using this procedure. Some of the plots have been surveyed several times to give an indication of population trend. Sixteen of these 27 plots have been selected for continued replication to determine population trends in good habitat (Table 1).

This procedure, called permanent trend plot studies, was also highly productive in providing data on population factors other than density. Measurements taken on tortoises revealed tortoise size structure and, indirectly, age structure of the population. Sex ratios were determined. Seasonal and daily activity periods were better understood. Direct observations increased our knowledge of behavior.

The opportunity to perform these field surveys has led to the development of a large cadre of biologists with experience with tortoises. Many of those involved in tortoise research today began their work by conducting permanent trend plot surveys.

In 1980, the *Desert Plan* was completed, and the BLM combined management of the desert into one district — the California Desert District. Keep in mind, or course, that these public lands are interspersed with private lands,

military bases, and National Monuments.

The tortoise permanent trend plot studies resulted in a large amount of data available for analysis. These data included measurements of body size, photographs of individual tortoises, shell remains, and behavioral notes. Paul Schneider, under contract to the Bureau, analyzed tortoise variation using the measurement data from California as well as Arizona and Nevada. Problems with the data base have compromised the results, but there are substantial indications that geographic variation in size and shape exists.

Using the photographs, Peter Woodman and Kristin Berry have analyzed shell wear characteristics. They related shell wear to size, growth, and age. Kristin Berry has recently analyzed shell/skeletal remains to determine the significance of gunshot mortality. These results are being presented later in these meetings. Kristin has gathered information on predation on tortoises by raptors, especially golden eagles and common ravens. These results will also be presented later in these meetings.

To determine mortality rates using carcasses, it was desirable to know how long ago a tortoise died. To aid in determining this, Peter Woodman and Kristin Berry conducted experiments by placing shells in various places in the desert and by examining shell/skeletal remains from permanent trend plot studies. They described carcass deterioration and gave preliminary disintegration rates. Field experiments are continuing.

A variety of studies have been conducted on the impacts of potentially conflicting activities. An analysis of population levels along roads was conducted for the Bureau by Lori Nicholson. She found increasing tortoise sign with increasing distance from the roads of various ages and types. Lori Nicholson and Ken Humphreys gathered data on the effects of sheep grazing on soil and vegetation on the Kramer Hills permanent trend plot. They quantified soil disturbance, damage to tortoise burrows, and changes in annual plant cover due to sheep activities.

In 1980, the Bureau constructed a 1600-acre exclosure in Ivanpah Valley to monitor cattle-grazing effects. In 1980 and 1981, Fred Turner, Phil Medica, and Craig Lyons used the exclosure area and an adjacent grazed area to study the effects of grazing on tortoise growth and reproduction. The study was inconclusive due to the short time the exclosure had been up and the low grazing level during these two years. However, the study results will provide a basis for comparison after a few years.

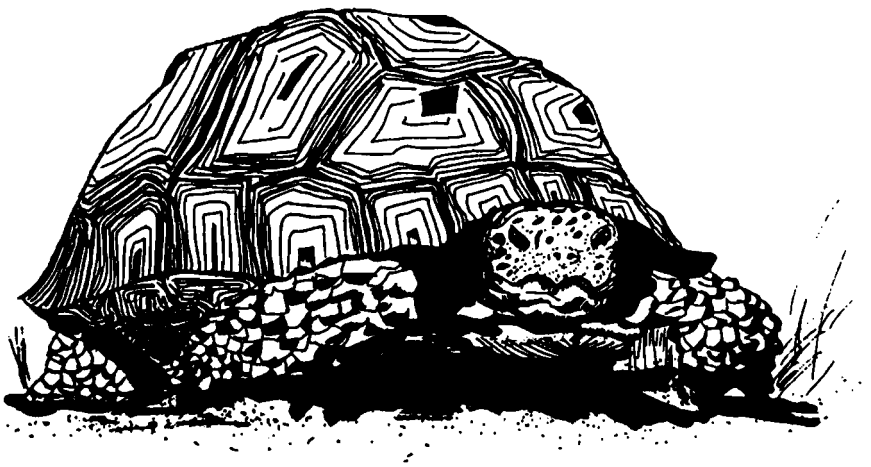
Southern California Edison is funding a variety of studies in the eastern Mojave Desert. We are pleased that Kristin Berry of the Bureau is able to participate in these studies. Major goals are to produce a population model and a habitat model. These efforts will be described later in these meetings. Southern California Edison has also provided funding for the preparation of some of the reports that Kristin has recently prepared.

In 1985, the Bureau is undertaking several other tasks. We have issued a contract to conduct surveys of four permanent trend plots. One is near Fremont Peak, and three others are adjacent plots around the interpretive

center at the Desert Tortoise Natural Area. These are replications of previous surveys and will provide information on trends at these plots. The survey workers are Peter Woodman, Karen Bohuski, Tim Shields, and Steve Juarez, all of whom have performed these surveys before.

Last year the Bureau constructed a square-mile exclosure north of Kramer Junction in a sheep-grazing area. This large exclosure will be useful in determining the effects of sheep-grazing on vegetation as well as wildlife. This spring, the Bureau is conducting vegetation baseline surveys in the exclosure and on an adjacent area for future comparison.

We are pleased that the Bureau has been able to contribute to desert tortoise research over the past ten years. We are pleased that one of our employees is able to participate on the team conducting research for Southern California Edison. This research into basic life history and management questions is especially timely. Because of our management responsibilities, the Bureau will continue to emphasize population trend studies and analyses of impacting activities. With our limited funding, even these tasks will be difficult.



Desert Tortoise Council Symp. Proc. 1985:32-39

EXCAVATION OF WINTER BURROWS AND RELOCATION OF DESERT TORTOISES (*GOPHERUS AGASSIZII*) AT THE TWENTYNINE PALMS MARINE CORPS AIR GROUND COMBAT CENTER

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Abstract.—Approximately 300 burrows, including many dug by rodents, were fully or partly excavated in December 1984 on a 90 ha site destined to become an aircraft facility. Eleven hibernating tortoises (5 adult males, 3 adult females, and 3 juveniles) were found. One burrow contained two adult males. Another burrow was occupied by a juvenile tortoise and a juvenile Mojave rattlesnake. The lengths and depths of occupied burrows ranged from 50 to 290 cm, and from 20 to 90 cm, respectively. There was no apparent correlation between either set of measurements and tortoise size. All tortoises and the rattlesnake were relocated to artificial burrows in an area about 450 m from the site. Six tortoises are known to have moved from their new burrows within a few days. The status of the relocated tortoises will be evaluated during continuing studies.

INTRODUCTION

The Marine Corps Air Ground Combat Center (MCAGCC) near Twentynine Palms, California, encompasses over 6600 km^2 of the southern Mojave Desert. Most types of desert terrain are represented, including steep, rocky hills, bajadas, washes, and gently rolling plains. Recent studies commissioned by the Center's Natural Resources Office (Fromer et al. 1983, Kirtland 1984) have provided preliminary data on the habitat and occurrence of the desert tortoise (*Gopherus agassizii*) at the MCAGCC. Most of the suitable tortoise habitat that remains is located on an area of about 200 km^2 in the Sand Hill and West Training Areas at the southwest corner of the Center. This area ranges in elevation from 550 to 915 m. Slopes range from 0 to 30%, and the soils generally are sandy. The plant community is creosote bush (*Larrea tridentata*) scrub, with burrobush (*Ambrosia dumosa*) as the principal associated shrub species. Other common plants, mixed with the dominants to varying degrees, are galleta grass (*Hilaria rigida*), desert trumpet (*Eriogonum inflatum*), and ratany (*Krameria parvifolia*). Kirtland (1984) estimated tortoise population densities to range from low (0 to 50/mi^2) to moderate (51 to 100/mi^2).

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[1] Send all correspondence to second author at address given.

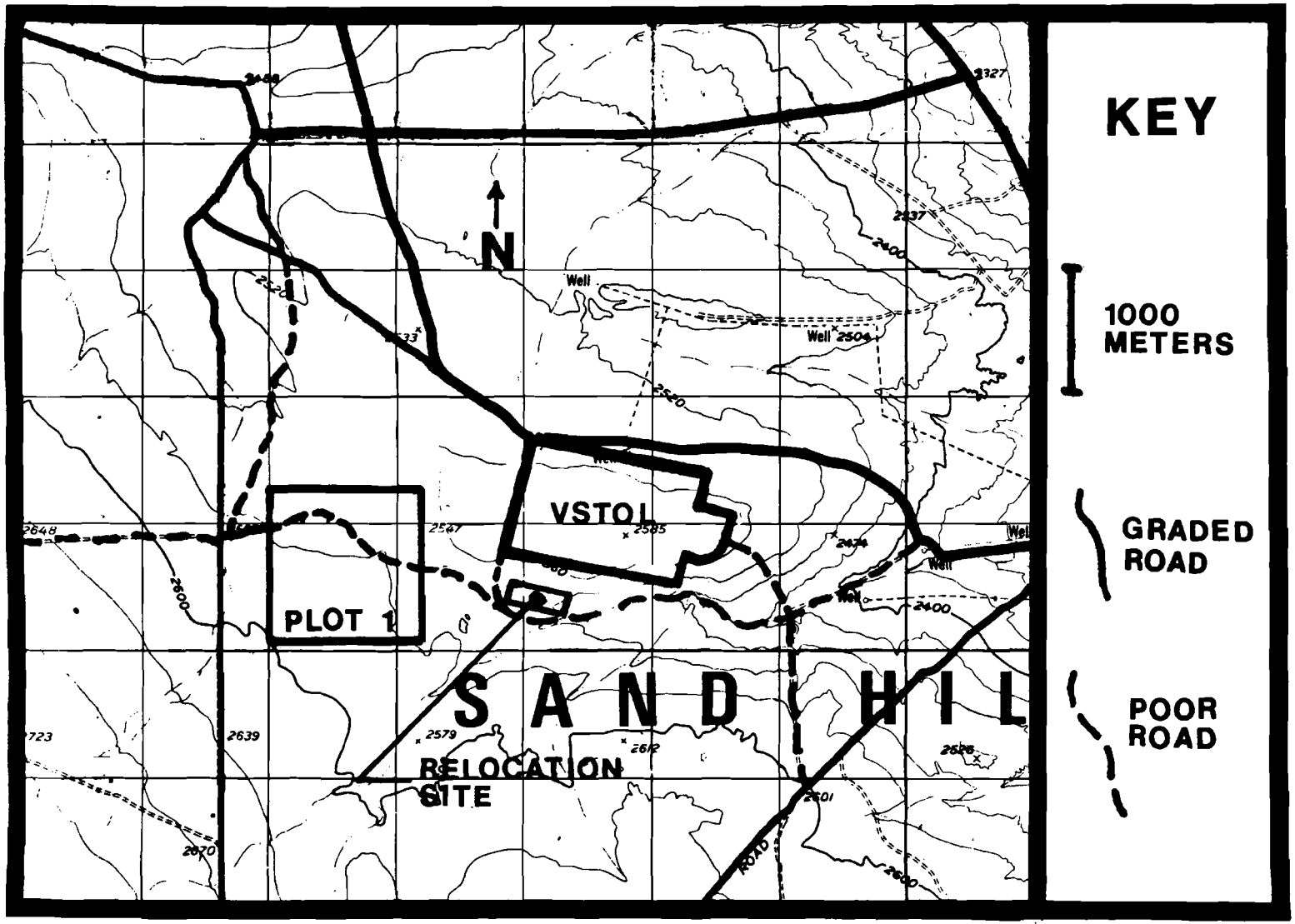

FIG. 1. — Map of a portion of the Sand Hill Training Area, showing locations of the VSTOL site, relocation site, and permanent study plot no. 1. Elevations in feet. Contour interval 40 feet.

The MCAGCC is used for training combat personnel. Portions of the Sand Hill and West Training areas were shelled in the past and current operations involve extensive off-road travel by tanks, personnel carriers, jeeps, and other vehicles. Virtually all tortoise habitat suffers from vehicle impacts, though these impacts may be reduced significantly on about 3000 ha which recently have been designated as a Tortoise Preserve (Fig. 1). However, construction of a 90 ha facility for Vertical Short Takeoff and Landing (VSTOL) aircraft commenced within the preserve in January 1985. The VSTOL site (Fig. 1) is an essentially rectangular area measuring about 1250 X 750 m. It is located on a relatively flat area known to have resident tortoises. Immediately southwest of the VSTOL site is a southwest-facing slope of about 5% grade. This slope descends to a small wash over a horizontal distance of roughly 900 m and also shows signs of tortoise use.

Kirtland (1984) recommended that mitigation for the VSTOL project include relocation of resident tortoises and construction of a fence to keep tortoises out of the project site. As the first phase of a larger study of tortoises on the southwestern corner of the MCAGCC, excavation and relocation of tortoises living on the VSTOL site was accomplished in December 1984. This paper describes the procedures and observations of this work.

METHODS AND MATERIALS

In preparation for the excavation of tortoises on the VSTOL site, a grid was established such that the site was subdivided into 39 squares, each 152.4 m on a side. Grid points were marked by 2.4 m stakes. A map of the grid was prepared and the grid sections were numbered. From 11 through 14 December, the site was systematically searched by one or two teams of biologists, each accompanied by one to four Marines. Members of each team made parallel traverses about 10 m apart, working one grid section at a time. All obvious tortoise burrows were initially checked by a biologist using a flashlight or mirror and probe. Many small burrows showing rodent use also were checked, as were kit fox (*Vulpes macrotis*) dens, which tortoises are known to use. Burrows harboring tortoises were flagged with one color of tape; those not definitely empty were flagged with another color. Each flagged burrow was numbered and plotted on the grid map.

Because of the availability of suitable habitat on the slope immediately southwest of the VSTOL site and the proximity of the slope to a proposed ½ mi^2 permanent study plot, the relocation site was established at the mid-level of the slope about 450 m from the VSTOL site (Fig. 1). The relocation site measures 400 X 150 m (6 ha). From 12 through 15 December, biologists supervised two teams of Marines in construction of artificial burrows on the relocation site. Fourteen burrows for adult tortoises were placed in three rows at intervals of 30 - 50 m in the eastern three-fourths of the relocation site. Three burrows for large juveniles and three for small ones were arranged in a row at approximately 15 m intervals in the western one-fourth of the site.

The design of the artificial burrows for adult tortoises was a modification of one developed for captives by Burge (1985). Burrows for adults were

2.4 m long and sloped to a maximum depth of 65 cm. The initial excavation was made with a small, motorized trenchdigger creating a trench about 15 cm wide. This trench was enlarged by hand to about 30 cm, with a slightly wider chamber at the end to accommodate two tortoises side by side. A ledge was carefully carved about 15 cm above and parallel to the floor. This ledge supported a piece of plywood 60 X 240 X 2 cm which formed the ceiling. The plywood was covered with enough earth to bring the burrow roof just above the natural surface. This mound over the entire excavation was graded to facilitate drainage. Burrows for juveniles were dug entirely by hand. Their length X width dimensions were roughly 120 X 11 cm for large juveniles and 80 X 7 cm for small ones. Maximum depths were 50 and 30 cm, respectively. Entrances to all artificial burrows faced downhill and were marked by numbered stakes.

From 15 through 18 December, flagged burrows on the VSTOL site were excavated by hand sufficiently to determine whether or not they were occupied by

TABLE 1.—Size, sex, and burrow dimensions of tortoises excavated on the VSTOL site, with information on pairings and movements after relocation.

Identification number	MCL (mm)	Sex	Burrow length (cm)	Roof thickness (cm)
R-25$^{=}$	306	M	135	50
R-60$^{=}$	274	F	50	20
R-65$^{*\bullet}$	272	M	260	60
R-64$^{*\bullet}$	270	M	260	60
R-164	268	M	210	52
R-24$^{=}$	253	M	120	38
R-26$^{\sim=}$	248	F	84	26
R-62$^{+=}$	209	F	60	20
R-61^{+C}	169	J	220	50
R-66$^{=}$	163	J	290	90
R-63$^{\sim}$	163	J	90	30

*found paired in natural burrow

$\bullet$, $\sim$, $^{+}3$ pairs, paired in relocation burrows

$^{=}$emerged after relocation

^{C}hibernating with *Crotalus scutulatus*

tortoises. The length and thickness of the roof at the end of each occupied burrow were measured. Each tortoise found was measured and marked according to the standard procedures described by Berry (1984*a*). In addition, each tortoise was file-marked on the left side of the supracaudal scute. After processing, each tortoise was placed in a closed cardboard box and set in a shaded spot. Most tortoises were carried on foot to the relocation site within 2 hr, some almost immediately. A few were taken by vehicle. At the artificial burrows, tortoises were introduced by hand, head first, and pushed to the far ends with a long, wooden stake.

RESULTS

Approximately 300 burrows of various sizes were fully or partly excavated. In these were found 11 hibernating tortoises (5 adult males, 3 adult females, and 3 juveniles) (Table 1). Midcarapace lengths (MCL) were as follows: adult males 253 - 306 mm, adult females 209 - 274 mm, and juveniles 163 - 169 mm. Occupied burrows ranged in length from 50 to 290 cm and had roof thicknesses (depths) of 20 - 90 cm. There was no apparent correlation between these burrow dimensions and tortoise size, but burrow length showed a positive correlation with depth ($r = .99$, Spearman's rank correlation coefficient). One burrow contained two adult males of nearly equal size (R-64 and R-65). Another burrow contained a juvenile tortoise (R-61) with a juvenile Mojave rattlesnake (*Crotalus scutulatus*).

Nearly all tortoises were awakened by the handling procedures. They opened their eyes and extended their limbs. Some became restless in their boxes and a few voided small amounts of urine. Most, however, remained quiet. The few ambient temperatures recorded ranged from 5 to 10°C at 1 m above the ground.

Between 15 and 19 December, 11 tortoises were relocated to 8 artificial burrows; 6 tortoises were paired (Table 1). Six adult and 6 juvenile burrows were left unoccupied and available for additional tortoises that might be found on the VSTOL site during construction.

The status of the relocated tortoises was checked on 19 and 20 December, and a few observations were made on the 21st. Six tortoises had moved (Table 1). Female R-60 and male R-25 were found on the 19th in shallow depressions at the bases of shrubs 3 m and 30 m, respectively, from their relocation burrows. The female had been relocated from the VSTOL site on the 15th and the male on the 17th. Both were replaced in their burrows on the 19th and remained there during the 20th.

Female R-26, relocated on the 18th, and juvenile (R-66), relocated on the 19th, were found active outside of their burrows. At 1105 h on the 19th, the female was found on the apron of her burrow and replaced in the burrow. At 1400 h she was found resting 10 m from the burrow entrance. She was replaced again and was inside the burrow on the 20th. On the 21st, R-26 was gone from the burrow. Tracks led to a natural burrow 10 m south, but the end of this burrow was not visible. Juvenile R-63, with which this female shared her relocation burrow, remained in place. Juvenile R-66, which had its own

burrow, was found basking 15 m west of its burrow at 1100 h on the 20th. The air temperature was 9.4°C at 1 m. The tortoise was replaced in its burrow. At 1300 h, it was found walking 40 m west of the burrow and again replaced. It was still in the burrow when checked at 1340 h.

Two tortoises (R-24 and R-62) moved from their relocation burrows but were not positively identified thereafter. The occupants with which R-62 shared her relocation burrow — juvenile R-61 and the Mojave rattlesnake — remained in place on 19 and 20 December.

DISCUSSION

The number of tortoises found is small relative to the number of burrows excavated. Although many were rodent burrows suitable only for juvenile tortoises, one would expect juveniles to be found. Berry (1984*b*) reported that tortoises <180 mm MCL composed about 50% of those observed in systematic searches (without excavation) of 26 study sites in California. The absolute number of tortoises found on the 90 ha site is equivalent to a density of only 31/mi^2. This agrees with Kirtland's (1984) estimate of a low density on the VSTOL site.

The lengths of excavated burrows fell within the range reported for tortoises in California (Berry 1972, 1974; Luckenbach 1982) and Nevada (Burge 1978). Burrow roof thicknesses (depths) also were similar to those reported by Berry (1972, 1974) and Burge (1978). The wide range of burrow lengths and depths, and the lack of correlation between these burrow characteristics and tortoise size, follows the pattern found in soil burrows used by hibernating tortoises in Nevada (Burge 1978).

While there was only one instance of shared burrow occupancy among the tortoises in our study, Woodbury and Hardy (1948) and Burge (1978) found many hibernation burrows harboring two or more tortoises. However, these authors were referring to the use of caliche cavities which often branch into multiple chambers. In burrows dug in soil, such as those at the MCAGCC, Burge (1978) found that tortoises hibernated singly.

Woodbury and Hardy (1948) and Burge (1978) also reported a number of commensal species in tortoise burrows. Luckenbach (1982) summarized these data along with his own. Reported commensal reptiles include several species known or likely to occur on the VSTOL site: zebra-tailed lizard (*Callisaurus draconoides*), desert iguana (*Dipsosaurus dorsalis*), side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), banded gecko (*Coleonyx variegatus*), coachwhip (*Masticophis flagellum*), gopher snake (*Pituophis melanoleucus*), night snake (*Hypsiglena torquata*), sidewinder (*Crotalus cerastes*), and Mojave rattlesnake (*C. scutulatus*). Considering the large number of burrows excavated, it is puzzling that the only snake or lizard found was a single Mojave rattlesnake.

The movement of over half of the tortoises after their placement in relocation burrows indicates that either the tortoises were severely disturbed by the process of excavation and relocation, or the artificial burrows were

not suitable in some way (perhaps too wide and drafty, especially at the bottom). That suitability of the relocation burrows may have been less of a factor than disturbance is suggested by several considerations. First, we already noted that most tortoises were awakened by handling. Second, Woodbury and Hardy (1948) observed that, although tortoises may occasionally move from one den to another during the winter, the excavation and handling of tortoises in their study was largely responsible for these winter movements. Third, most tortoises that moved in our study had been placed in burrows appropriate to their size. Finally, two of the tortoises that did not move (juveniles R-61 and R-63) had been placed in relocation burrows with substantially larger companions that did move (Table 1). If unusual spaciousness of the burrows was a serious problem for the tortoises, one would expect the smaller of the paired tortoises to have moved instead of, or as well as, the larger ones. In this respect, it is interesting that the juvenile Mojave rattlesnake also remained in place with its original companion, tortoise R-61.

Berry (1972, 1974) observed movement of several wild tortoises in a homeward direction after relocation over 100 km away. Since tortoises in the present study were transported only a few hundred meters (some probably remaining within a portion of their original home ranges), we expect that some of them will return to the fenced VSTOL site. The status of the relocated tortoises will be evaluated during the course of work on permanent study plot no. 1 (Fig. 1) in the springs of 1985 and 1986.

ACKNOWLEDGMENTS

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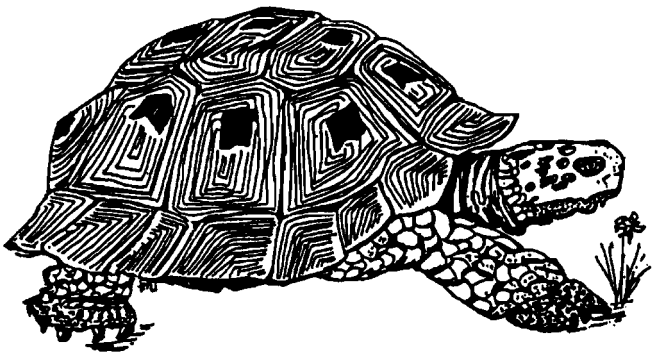

Desert Tortoise Council Symp. Proc. 1985:40-41

STATE REPORT - UTAH

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General Description

The desert tortoise (*Gopherus agassizii*) is limited in Utah to the southwestern portion of Washington County. This area, known as the Beaver Dam Slope, contains a sparsely scattered population of desert tortoises that encompasses 91 mi^2 (235 km^2) of Lower Sonoran vegetation that extends into the neighboring states of Arizona and Nevada.

Desert tortoises in Utah were listed as a federally protected Threatened species on 20 August 1980 with a 31 mi^2 (90 km^2) area of designated Critical Habitat. All tortoises found within the 91 mi^2 of habitat on the Beaver Dam Slope in Utah are protected by the *Federal Register* notice.

Present Management of the Desert Tortoise in Utah

Monitoring Population Dynamics of the Native Desert Tortoises and Captive Releases.—During all trips to the Beaver Dam Slope, observations are made of all live tortoises and shells. In 1984 nine live tortoises were encountered on the Beaver Dam Slope, four of which were natives captured for the first time, one of which was a native recapture, and four of which were captive released tortoises (Table 1). All were found on the Slope west of the highway.

TABLE 1.—Tortoises encountered on Beaver Dam Slope in 1984.

BD#	Date	Origin	Rate Classification	MCL	Sex	Collector
796	Sep 09	N	SA	197	F	Coffeen
817	Jan 07	C	SA	194	F	Coffeen
821	Feb 01	C	AI	201	F	Coffeen
869	May 12	C	AII	247	M	Coffeen
871	Feb 19	C	AII	274	M	Beck
873	Jan 07	N	AI	214	F	Coffeen
874	Apr 08	N	JII	64	J	Coffeen
886	May 12	N	AII	256	M	Coffeen
887	Sep 09	N	AII	254	M	Coffeen

Monitoring of Livestock Grazing Seasons of Use and Vegetative Conditions on the Beaver Dam Slope.—Range conditions and grazing pressure in relation to season of use and approved Animal Unit Months are documented during all trips to the Beaver Dam Slope.

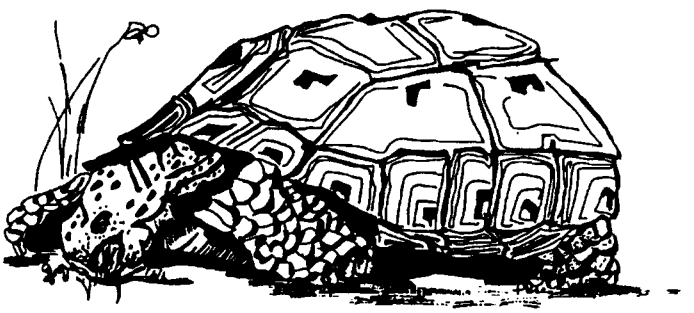
Maintaining and Updating a Computer File for All Numbered Tortoises Released on the Slope from 1973 to the Present.—During the winter of 1984, the format of the computer file was expanded to cover 49 data items which now include partial data on up to three recaptures per tortoise. The computer file is being maintained on an Apple IIe using commercial software. In 1985 we plan for this file to be transferred to the Department of Wildlife Resources Wang computer system, as soon as software has been generated for the project.

Paradise Canyon.—In summer of 1985, a resort development will start construction in Paradise Canyon near St. George. Paradise Canyon had one of the densest remaining populations of tortoises in southwestern Utah. The population of tortoises could number 200, and plans are being made to handle up to 100 of these during the two-year construction phase. Most of these displaced animals will be transplanted to the Beaver Dam Slope.

1985 Federally Funded Research Program.—In 1985 a federally funded research program will be conducted within the designated Critical Habitat. The objectives are: (1) to monitor desert tortoise populations and densities within a 2-mi^2 study plot on the Beaver Dam Slope; (2) to monitor reproduction of female desert tortoises using radio telemetry; (3) to record general habitat use of tortoises and general habitat condition within the Critical Habitat; (4) to monitor dispersal of captive-released tortoises using a remote camera; and (5) to monitor projects and activities on the Beaver Dam Slope that may affect conservation of the desert tortoise.

Beaver Dam Slope Desert Tortoise Recovery Plan

On 27 March 1985, the Utah Department of Wildlife Resources received the draft of the Recovery Plan for the Utah desert tortoise population from the U.S. Fish and Wildlife Service. This document will be extensively reviewed, and our comments will be coordinated with the Desert Tortoise Council.



Desert Tortoise Council Symp. Proc. 1985:42-43

STATE REPORT - UTAH

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The Beaver Dam Slope population of desert tortoise (*Gopherus agassizii*) is located in the southwest corner of the state. This area is approximately 70 square miles in size. The vegetative aspect for the area is Joshua tree-creosote bush type with a variety of annual and perennial forbs and grasses.

The listing of the Beaver Dam Slope population of desert tortoise as a Threatened species was finalized in the August 20, 1980, *Federal Register* (CFR Part 17). Along with this listing, a designation of 35 square miles of Critical Habitat was established.

Multiple use management will continue in the designated Critical Habitat with some restrictions (Robison 1982). The Critical Habitat area will continue to be open for oil, gas, and mining exploration with special stipulations required for the protection of the desert tortoise and its habitat (Rowley 1984).

The off-road vehicle (ORV) designations for Washington County were finalized in the September 25, 1980, *Federal Register*. Vehicular travel in the desert tortoise Critical Habitat area is designated as limited to existing roads and trails.

The Allotment Management Plans (Beaver Dam Slope and Castle Cliffs) on the Beaver Dam Slope have been implemented. Both of the Allotment Management Plans (AMPs) have a modified, deferred rotation plan. The Castle Cliffs AMP provides for yearlong rest in the Critical Habitat area two out of every four years. Spring rest would occur the remaining two years with cattle being removed after February 28 one year and April 15 the other. Critical Habitat area within the Beaver Dam Slope AMP will be rested in the spring after February 28, two out of every three years, and after April 15 the third year. A 60 percent utilization rate has been established so a good cover of annuals remains.

A reduction of cattle numbers has been made in these two allotments. A reduction of grazing preference was made in Castle Cliffs AMP, while in the Beaver Dam Slope AMP the grazing permittees have taken a voluntary nonuse reduction for three years so the grazing capacity can be determined. The BLM is pleased with the cooperation received from the livestock permittees in the protection efforts of the desert tortoise and its habitat.

During 1983 a number of mining claims was located in the Critical Habitat area (T. 43 S., R. 18 W., Sections 21, 22, and 28) (Rowley 1984). In 1984 the Bureau of Land Management (BLM) received a plan of operation for mining exploration in this area. An environmental analysis was started by the BLM that year. However, due to the claimants withdrawal of their Plan of Operations, this environmental analysis was not completed. The BLM will keep the Desert

Tortoise Council informed of future development.

The 500 kV Intermountain-Adelanto Line is being constructed through a portion of the Beaver Dam Slope tortoise habitat (T. 42 S., R. 19 W., and T. 42 S., R. 20 W.). This line will not cross through the Critical Habitat area but will pass to the north and west. A tortoise inventory of this corridor was completed with tortoise densities ranging between 0 and 50 tortoises per square mile.

The anticipated impacts occurring during construction should be negligible in a regional sense. Long-term impacts due to access and spur road construction should be minor due to the presence of good existing access.

Impacts from construction of this line will be reduced through the recommended mitigation activities including having a tortoise biologist present during periods of heavy construction.

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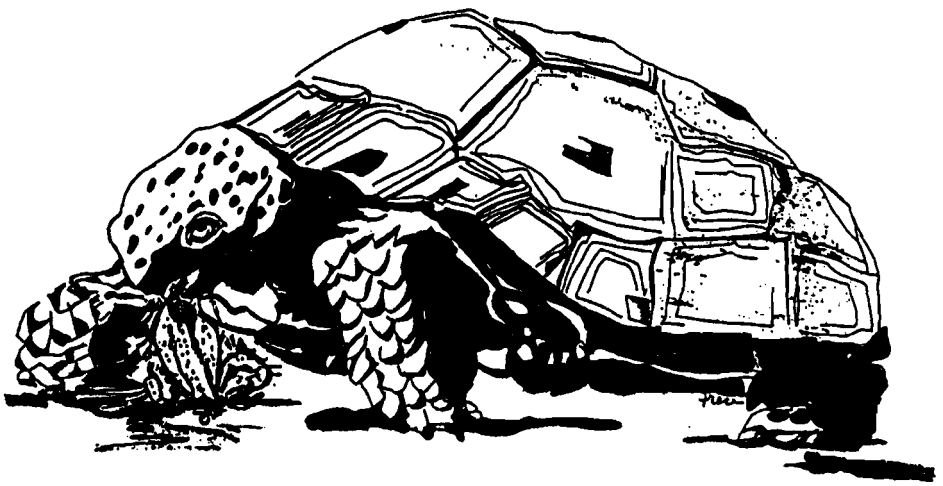

Desert Tortoise Council Symp. Proc. 1985:44-46

STATE REPORT - NEVADA

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Although the Nevada Department of Wildlife (formerly Nevada Department of Fish and Game) is charged by statute with the preservation, protection, management and restoration of all wildlife, nongame species were largely ignored for many years due to the agency's funding base (i.e., funding has been provided by sales of hunting and fishing licenses and federal matching funds derived from excise taxes on guns, ammunition, and fishing equipment). However, a nongame program was initiated in July of 1973 with money provided by the State's general fund. Although the tortoise was not initially identified as a priority species, this reorganization paved the way for the Department to manage species which were not pursued by hunters, trappers, or fishermen.

The tortoise was identified as a priority species in the nongame program in 1975, but no fieldwork was accomplished until the following year. Beginning in 1976, Department of Wildlife biologists conducted cursory "ground surveys" to determine desert tortoise distribution and preferred habitat characteristics at several sites in Nevada. From these early surveys (conducted from 1976-1980), it was determined that the northernmost distribution of the desert tortoise in Nevada was at Cherokee Mine, Garden and Snow Washes in the eastern part of the state, upper Pahranaget Valley in the central part of the state, and near the town of Beatty in the West (Lucas 1978, 1979). The Department first became involved in population density estimates in 1980 when two of our biologists surveyed two 1-mi^2 plots in Eldorado Valley and Valley of Fire State Park (Turner 1981). Densities were estimated at 50/mi^2 in Eldorado Valley and 21 tortoises/mi^2 in Valley of Fire State Park. In 1981 the Department of Wildlife and the U.S. Fish and Wildlife Service jointly supported 150 transects on Bureau of Land Management, Fish and Wildlife Service, State Park, and National Park Service lands to gain further knowledge on tortoise distribution, densities, and habitat preferences (Schneider et al. 1982).

The desert tortoise was afforded some legal protection with the 1947 passage of Assembly Bill No. 64 which made it unlawful to catch or kill a desert tortoise in the State of Nevada. Further protection came in 1969, when the tortoise was classified as a protected species in Nevada, thereby making its mere possession illegal. In spite of this legislation, a very large population of captive tortoises still developed, particularly in the Las Vegas area. A population estimated at between 30,000 and 40,000 animals was believed to exist in 1982.

A temporary program was initiated in 1980 to deal with captive tortoises which were turned in to the Department or confiscated for illegal possession. Since releasing domesticated tortoises to the wild is seldom successful and is generally opposed by the scientific community for a variety of reasons, we began releasing them on Las Vegas golf courses (Turner 1981). A total of 80

tortoises were released on two Las Vegas golf courses during 1980 and 1981.

During 1982 most of the Nevada Department of Wildlife's management efforts concerning the desert tortoise were directed toward developing a management strategy for dealing with this growing problem. An informational bulletin was published and after a considerable effort, NRS 503.080 was passed which maintained the protected and rare classification for the tortoise while legalizing possession of captive tortoises within urban areas of Clark County. This made it possible to initiate a management program which recognized that two distinct populations of tortoises exist within the state: a captive, domesticated population and a wild population. With the help of the TORT Group (a volunteer organization) we can now provide interested persons with tortoises for adoption from a considerable pool of domesticated tortoises, thereby diminishing the collection pressure placed on wild populations by people desiring tortoises for pets. The new legislation and the TORT Group also provided our Department with an alternative to attempting to return captive tortoises to the wild, or releasing tortoises on Las Vegas golf courses.

Once we finally had laws which we felt were adequate to protect the tortoise and which recognized the captive tortoise situation, the Department was once again ready to become more actively involved in research on wild populations. In 1983 the Department funded a 60-day study of the Piute Valley Permanent Study Plot (PSP) which was first established by Alice Karl under contract for the Bureau of Land Management (BLM) in 1979 (Mortimore 1984). When our contractors discovered that a serious die-off of tortoises had occurred on the study plot (the remains of 109 tortoises which were primarily adults were collected on the plot during the course of the study and a crude adult annual death rate of 23.8% was estimated), eleven 0.25-mi^2 plots were established in the vicinity of the permanent plot to help determine the extent of the die-off. Surveys of the small plots indicated that the die-off was apparently restricted to one, or possibly two, pastures on the Crescent Peak Allotment. We believe that long-term habitat degradation from livestock grazing, compounded by the effects of a drought, caused the die-off. The information gathered in this study was instrumental in obtaining tentative agreement with the livestock operator through the Coordinated Resource Management and Planning (CRMP) process to turn his cows out in these pastures only during years when at least 500 lbs. (dry weight) of ephemeral forage/acre was available by March 1st. Through the CRMP process we have also been successful in obtaining agreements from several other livestock operators to graze cattle in crucial tortoise areas only after at least 200 lbs. (dry weight) of ephemeral forage have been produced per acre. On one allotment near Gold Butte an operator agreed to manipulate water distribution to keep cattle out of an important tortoise area during the spring. Other gains accomplished through the CRMP process include: agreements to limit off-road vehicle (ORV) races in crucial tortoise habitats to existing roads, trails, and washes; and limits on seasons of use for ORV races to periods when tortoises are likely to be in hibernation.

During 1984 the Department supported a 60-day survey of the Sheep Mountain PSP which was also established by Alice Karl under contract with the BLM in 1979. The results of this study will be covered in some detail in a paper to be presented at this conference by Todd Esque and Russell Duncan. A three-year

study of the Mojave biome was also initiated in 1984. This study should provide some additional information on tortoise distribution, and more importantly, should provide us with better information on the effects of various land use practices throughout the Mojave Desert.

Time was also spent during 1983 and 1984 reviewing work which has been accomplished to date by various individuals and agencies. Color-coded maps were prepared which show where tortoise transects have been walked, who walked them, the date, and what was found (Mortimore 1983). These maps will be updated periodically to help us identify areas which might need more research and areas which should be considered to be important tortoise habitat. They should also provide an easy method for illustrating population trends in various areas.

This spring we issued a contract for a 60-day survey of a new PSP on the Christmas Tree Pass Allotment east of Highway 95 and east of the Piute Valley PSP. Although this area is in close proximity to the area which experienced the catastrophic die-off between 1979 and 1983, no apparent die-off was detected on this grazing allotment.

We also plan to issue a contract for 150 transects to be conducted in selected areas later this summer, as part of our habitat delineation and monitoring effort.

The Nevada Department of Wildlife has exhibited an accelerating involvement in the management of the desert tortoise over the past ten years. Gains have been made through research, legislation, and negotiation with land management agencies and private interest groups. The State of Nevada has laws which adequately protect the tortoise, and, through cooperation with federal land management agencies, we can also protect the habitat which is needed to insure that the desert tortoise will thrive in southern Nevada. The Nevada Department of Wildlife is firmly committed to this goal.

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A POPULATION STUDY OF THE DESERT TORTOISE (*GOPHERUS AGASSIZII*) AT THE SHEEP MOUNTAIN STUDY PLOT IN NEVADA

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Abstract.—Sixty-three person days were spent studying the desert tortoise (*Gopherus agassizii*) from 4 April to 16 May 1984 on the permanent study plot at Sheep Mountain in Clark County, Nevada. Fifty-nine tortoises were registered. A population estimate for all size classes inclusive was 74 (50 to 98). An estimate for those tortoises ⩾180 mm maximum carapace length (MCL) was 47 (33 to 61). Sixteen tortoises captured in 1984 represent 73% of those which were registered as ⩾180 mm MCL in 1979. Thirty adults (51%), 2 subadults (3%), 14 immatures (23%), and 13 juveniles (22%) represented the size distributions. The sex ratio was 16:16, male to female.

Fifty-seven skeletal remains were found, 22 of which probably died within the last two years. These 22 remains were all ⩽180 MCL. Nineteen of these 22 were scavenged or directly preyed upon by Common Ravens (*Corvus corax*). All adult size class remains probably died four or more years ago.

Five caliche caves were found to be actively used by tortoises during the time of the census. Annual vegetation production was zero for five permanent vegetation transects. Available forage on perennial species was poor throughout the study period.

INTRODUCTION

There has been mounting concern for the population status of the desert tortoise (*Gopherus agassizii*) throughout its range. Population trend plots have been utilized as a means to monitor the health of tortoise populations throughout their range (Berry 1984*a*). The Sheep Mountain Permanent Study Plot (PSP) was established by Karl (1979) for the United States Department of the Interior, Bureau of Land Management (BLM). The Nongame Program of the Nevada Department of Wildlife (NDOW) shares responsibility for observing trends in desert tortoise populations at Sheep Mountain and throughout its range in the state of Nevada.

This report describes the second census of the Sheep Mountain study site. Field work for this report was performed during April and May 1984 for

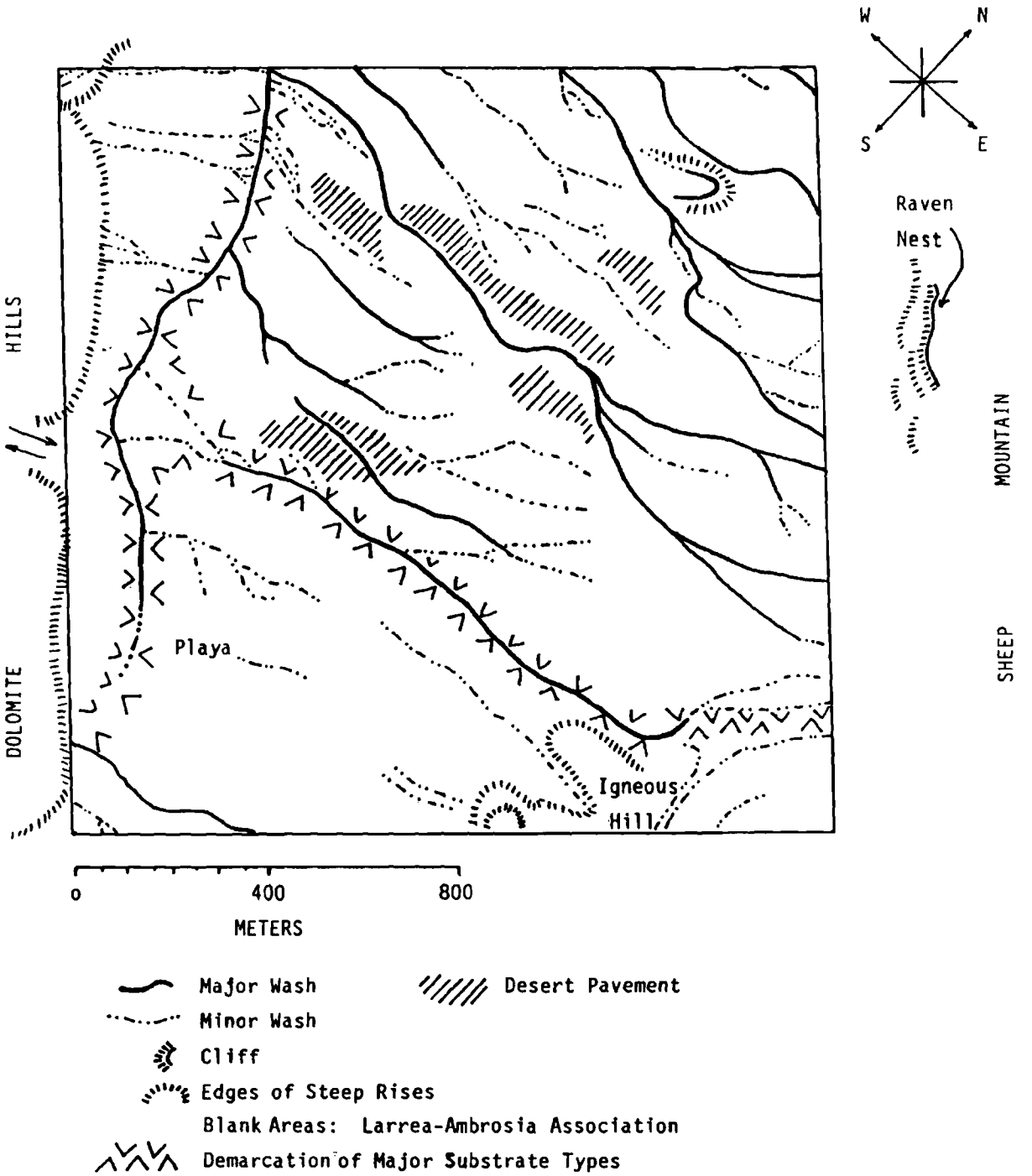

FIG. 1.—Map of Sheep Mountain Permanent Study Plot, Clark County, Nevada, including physiography and other landmarks in 1984.

NDOW. The field period was extended from the initial 30 person days in 1979 to 60 days in 1984 to provide a more reliable sample of the population (Berry 1984*b*). Observations were made on densities, age structures, sex ratios, mortality factors, distribution, and behaviors.

SITE DESCRIPTION

The Sheep Mountain Permanent Study Plot is located in Clark County of southern Nevada, about 30 miles south of Las Vegas and east of Interstate Highway 15. The site is just south of the community of Jean, Nevada. The legal location for the PSP is: Townships 25/26 South, Range 60 East, in portions of Sections 5, 6, 31, and 32.

HABITAT DESCRIPTION

The site encompassed a narrow fault valley between Sheep Mountain and a low ridge to the southwest, named the Dolomite Hills by the authors. Average elevation for the site was 3200 feet (3120 - 3280). The overall vegetation composition was a creosotebush—bursage (*Larrea tridentata—Ambrosia dumosa*) association. Mojave yucca (*Yucca schidigera*) contributed to the visual character of the site but was sparse. Other associative species varied in prominence according to local soil conditions, slope exposure, and moisture availability.

The Sheep Mountain Bajada (59% plot coverage, 3% average slope [Karl 1979]) extended along a rift at the base of Sheep Mountain. The rift was characterized by low hills which were separated by deep washes of various sizes. The hills were interspersed with outcrops of sedimentary, igneous, and metamorphic rock (U.S. Geologic Survey Map, 1958). Caliche caves were well developed in some of these washes. Approaching the center of the plot, the bajada surface consisted of crustal limestone. Across the hills and into the flats the vegetation created a mosaic of *Ambrosia dumosa*, *Ephedra nevadensis*, and *Larrea tridentata*. *Yucca schidigecra* occurred primarily in this habitat type.

The Igneous Hills Bajada (27% plot coverage, 3% slope) only covered a small portion of the study plot (2%), but their effect spread across about 20% of the plot due to weathering and dispersion of the parent material. The slopes of the hills had sparse vegetative cover due to a large amount of exposed Pre-Cambrian bedrock (U.S. Geologic Survey Map, 1958). The hills supported *Dalea fremontii*, *Echinocereus englemanii*, *Eerocactus acanthodes*, and *Mortonia utahensis*. The bajada was characterized by loose sand, littered with gravel and rocks which were igneous in origin. The vegetation here was a homogeneous association of *Ambrosia dumosa* and *Larrea tridentata*. Minor dendritic washes laced parts of this low lying habitat. Figure 1 illustrates a distinct demarcation of substrate types which existed along the major wash which separated the Igneous Hills and Sheep Mountain habitats.

The Playa Habitat (1% plot coverage, 3% slope) was a region of well developed vessicular soil which showed evidence of standing water. The vege-

tation association here was *Atriplex* sp. and *Lycium* sp.

The Dolomite Hills Slope and Bajada (13% plot coverage, 12% slope [Karl 1979]) had a steep, east-facing slope which extended to the major drainage of the plot where it met the other two major habitat types. The western corner of the plot was near a ridgetop where there was an excellent view of the surrounding area. The entire east-facing slope was very rocky with large slabs of dolomite exposed on the surface. Boulders were strewn across the slope and bajada. This area had shallow washes except for one deep wash on the northwestern boundary which contained caliche caves. *Eurotia lanata* and perennial grasses such as *Tridens muticus, Sporobilis* sp., *Aristita* sp., and *Orozopsis* sp. were important secondary associative vegetation species.

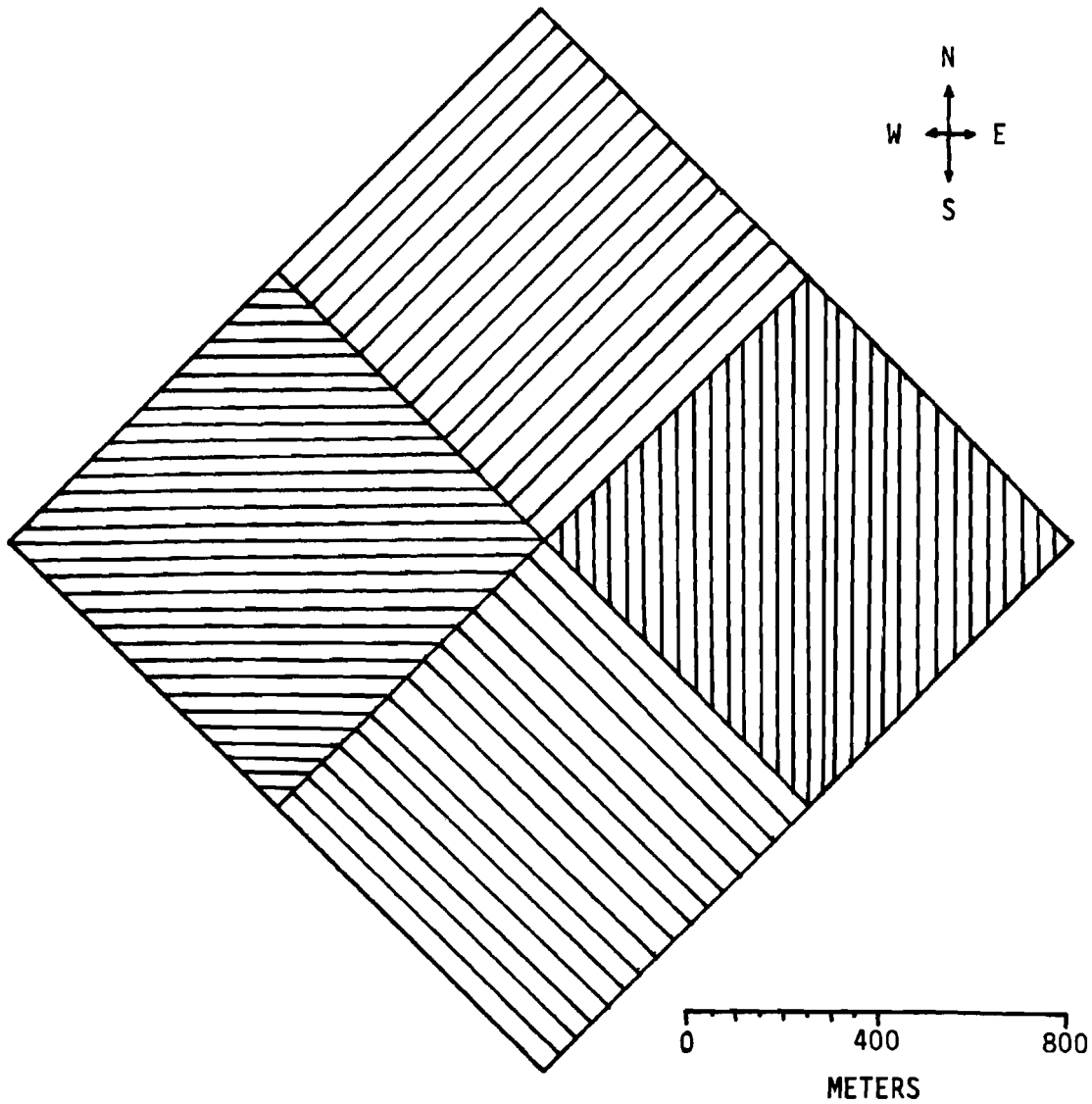

FIG. 2. — Map indicating transect axes and intervals during tortoise censuses at Sheep Mountain Permanent Study Plot, Clark County, Nevada, in 1984.

METHODS AND MATERIALS

Establishing a Grid

A 1.6-km^2 ($\approx$1-mi^2) study site was established in 1979 as Sheep Mountain PSP. Work was continued on this original site with reestablished boundaries as close to the original boundaries as possible. A grid was placed at 100-m intervals across the entire plot using 6-ft laths. The laths were color-coded using plastic surveyor's tape and assigned a numerical identification for plotting tortoise positions and other locations of importance.

Flagging of Burrows

A system for flagging burrows was initiated for a number of reasons: (1) burrows with flags were easier to relocate thereby increasing the capture rate, especially for those tortoises <180 mm maximum carapace length (MCL); (2) flagging made it possible to check on known tortoise locations in order to observe behaviors and learn more about tortoise movements; (3) it was necessary to flag locations of tortoises registered before the grid was completed so mapping could be completed at a later date; and (4) flagged burrows prevented redundancy in mapping and measuring. Flags were removed upon departure.

Transecting for Tortoises

Sixty-three person days were spent transecting for tortoises from 4 April through 16 May 1984. Several of these were combined half-days. A day lasted approximately eight hours, between the time of sun-up to sun-down depending on temperature extremes.

Figure 2 describes transect axes and intervals. The plot was transected a total of three times on each of the axes. Transecting was completed on a rotational basis to ensure that tortoises had the most possible advantage to mix between censuses.

Hatchlings were searched for upon encountering: tortoise nests; tortoises in the smallest size classes; or likely looking burrows.

A special survey was conducted surrounding an active raven nest, but outside the plot boundary, to determine the role of raven predation.

Data Collection on Tortoises

All equipment, handling, marking techniques, and data cards have been described by Berry (1984*b*). All live tortoises were photographed using 35-mm slide film. Tortoises were assigned shell wear classes (Berry and Woodman 1984) by reviewing 35-mm slides. Locations of tortoise captures were mapped. Recaptured tortoises were measured for changes in mass.

Data Collection on Tortoise Remains

All tortoise remains were photographed in situ and collected for analysis. Data were collected on standard data cards (Berry 1984*b*). Remains were assigned an estimated time since death (Woodman and Berry 1984).

Estimation of Tortoise Abundance and Statistical Treatment

Density estimates for Sheep Mountain PSP were made using Bailey's binomial model (Bailey 1951, 1952) Bailey's model is a single mark-recapture method:

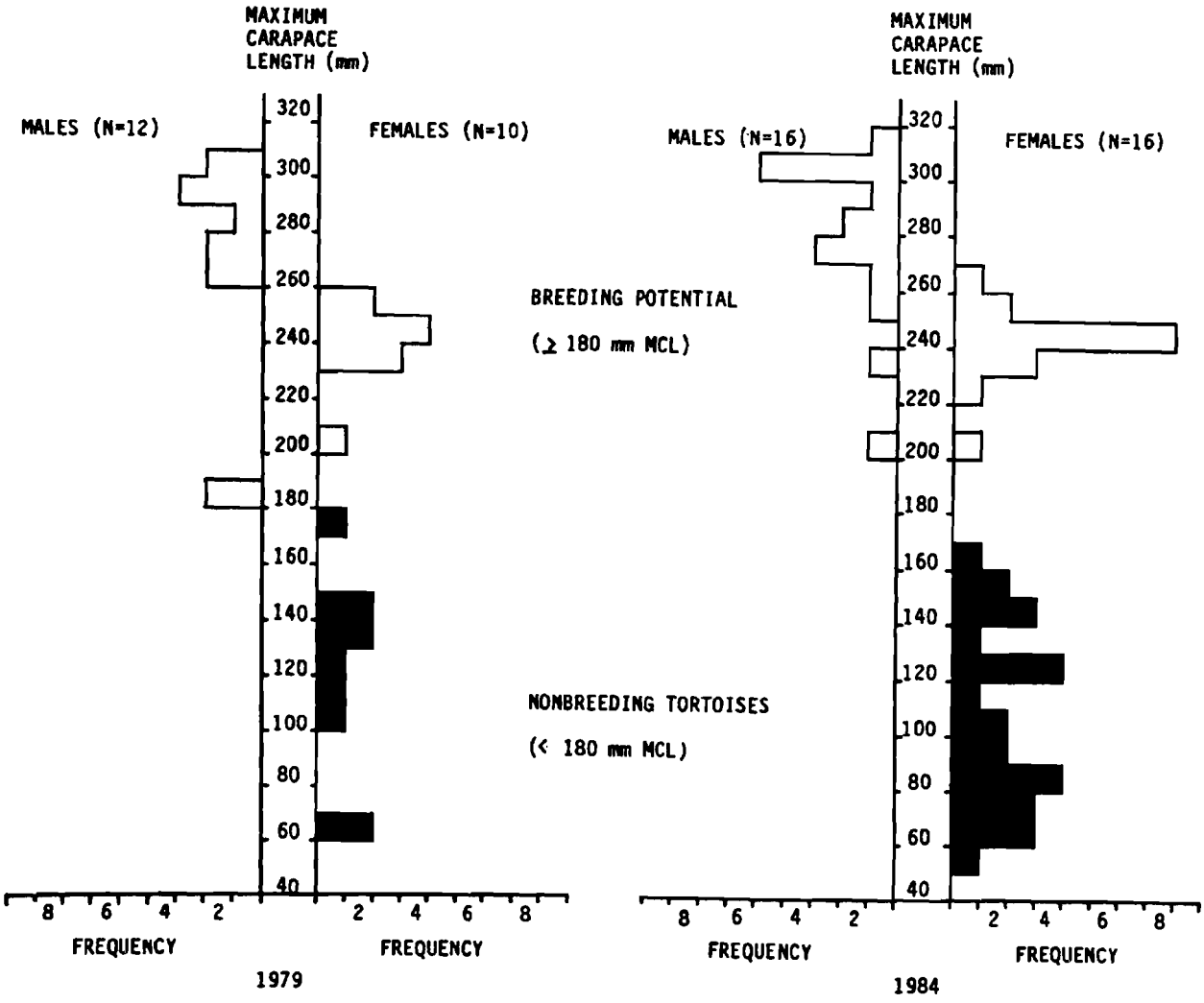

FIG. 3.—Comparison of size structures and sex ratios for tortoises registered at Sheep Mountain Permanent Study Plot, Clark County, Nevada, in 1979 (Karl 1979) and 1984.

$$\hat{N} = a(n+1)/(r+1),$$

where *a* was the number of marked tortoises after the initial period of marking, *n* was the total number of tortoises seen during the second period, and *r* was the number of marked tortoises recaptured during the second census period. We then calculated the 95% confidence interval of the population estimate according to Bailey's derivation (Bailey 1952).

This method for estimating population was used to rework Karl's data (1979) in an effort to compare and contrast data found in 1984.

A Chi-squared (x^2) test for association was used to determine whether or not there was a significant association between the size class distributions in 1984 and in 1979 (Karl 1979). This test was also used to compare the 60-day vs. 30-day spring censuses for the same study.

Collecting and Analyzing Vegetation Data

Perennial vegetation was sampled as described by Rowlands (1978) with a minimum sampling area of 200 m^2 for each habitat type. Ephemeral vegetation was sampled as described by Cain and Castro (1959).

Two permanent vegetation transects were reestablished in 1984 and three new transects were added to the study plot.

RESULTS

Population Structures

The size-frequency distributions for 1979 and 1984 are shown in Figure 3. These censuses had similar size distributions, but in 1984 there were considerably more juvenile tortoises registered than in 1979. This observation has partially been attributed to census periods of 30 versus 60 days, but the authors do not believe this fully explains an observed increase of 300+% for live tortoises (N = 3 in 1979 vs. N = 10 in 1984, Adding juvenile tortoise remains would result in an increase of about 500%). Studies in California indicate that, "The production of eggs [in tortoises] is obviously related to the acquisition of energy. One would expect conditions increasing energy resources [rainfall] to promote greater egg production . . ." (Turner et al. 1986). Turner et al. (1986) also pointed out that exactly how egg production relates to precipitation fluctuations "is not wholly clear." We suggest that in a year like 1978 when rainfall was 12+ inches above the norm (National Oceanographic and Atmospheric Administration 1978) that tortoise reproductivity could also be above average in that time period. Thus, some six years down the road we observe an abundance of tortoises in the juvenile size class. We would not have expected Karl to have observed the results of this "banner year" as early as 1979.

The lack of tortoises in the subadult size classes common to both cen-

TABLE 1.—Comparison of ranges of size classes to ranges of shell wear classes for desert tortoises.

Size classes	Shell wear classes*							Not known	Total
	1	2	3	4	5	6	7		
Juvenile 1	1	---	---	---	---	---	---	---	1
Juvenile 2	---	12	---	---	---	---	---	---	12
Immature 1	---	1	7	---	---	---	---	---	8
Immature 2	---	1	3	2	---	---	---	---	6
Subadult	---	---	1	1	---	---	---	---	2
Adult 1	---	---	---	---	---	4	1	---	5
Adult 2	---	---	1	3	7	12	1	1	25
Total	1	14	12	6	7	16	2	1	59

* Early, middle, and advanced stages of each shell wear class were combined for ease of reading table.

suses is perhaps the most alarming feature of the population structure. It would appear that little recruitment has occurred from the lower size classes since 1979. However, healthy populations of tortoises such as at Goffs, California, also observe low relative numbers of subadults (Turner and Berry 1984).

Table 1 compares tortoise size classes (Berry 1984*a*) to shell wear classes (Berry and Woodman 1984). All of our adult 1 and adult 2 tortoises fell into shell wear classes 6 or 7. The significance of these shell wear classes occurring in the advanced stages is that the scute and bone material of tortoises in those classes goes beyond mere "wear." The bone structure may actually deteriorate to some degree. Exactly how this relates to reproductivity is not completely understood, but it is known that these tortoises are in the oldest age classes and would expect reproductivity to diminish with advanced ages.

Sex Ratio

The 1:1 (16 males:16 females) sex ratio from the sample in 1984 does not differ significantly from that of 1979 (12 males:10 females). Size dimorphism where males are larger than females is normal for desert tortoises.

Population Density

Karl (1979) estimated the density of tortoises at the Sheep Mountain PSP using a multiple marking Schnabel census for closed populations (Schnabel 1938). The estimate in 1979 was 65 tortoises/mi^2. This estimate included all size classes and both sexes. Karl judged this estimate to be too high because of her low capture-recapture ratio, and intuitively estimated that the population was about 50/mi^2.

The 1979 data (Karl 1979) has been reanalyzed using the Bailey method (1951, 1952). These figures represent only those tortoises $\geq$180 mm MCL, because of the low capture-recapture ratio of smaller tortoises in the 1979 sample. Using this method the population estimate is 36 (N) where: $a = 18$, $n = 13$, and $r = 6$. The 95% confidence interval of $\pm 1.96s$ is 17, where s is 8.672 ($N = 19$ to 53).

In 1984, we made population estimates for tortoises $\geq$180 mm MCL and an estimate of all size classes inclusive. We did not estimate for the subgroup $<$180 mm MCL because of the low capture-recapture ratio. According to Schneider (1980, 1981), an estimate of the adult and subadult subgroup within the population will give a more accurate picture in regard to the reproductive potential of the population. The estimate for the entire population was 74 (N), where $a = 30$, $n = 48$, and $r = 19$. We recaptured 19 tortoises which had been registered in 1979. The 95% confidence interval of $\pm 1.96s$ is 24.42 where s is 12.464. The estimate for tortoises $\geq$180 mm MCL was 47 (N), where: $a = 25$, $n = 32$, and $r = 17$. The 95% confidence interval at $\pm 1.96s$ is 13.89, where s is 7.098.

Reproduction

The adult 1 and adult 2 tortoise sex ratio of 16 males to 16 females is the 1:1 sex ratio found in healthy reproducing populations (Berry 1976). Four previous nest sites were identified by eggshell remnants. One copulation occurred on 17 April. That was the only evidence of mating observed this year. No hatchling tortoises were located.

Growth

No measurable growth was recorded for any tortoise during the 1984 study period. The lack of new growth is probably due to poor primary production this year. No shrinkage was observed. Seventeen tortoises which were registered in 1979 were recaptured in 1984. Fifteen of these adult tortoises grew larger (2:$\leq$1 mm, 10:2-10 mm, 1:30 mm, and 1:88 mm). Three of four tortoises registered in 1979 in the adult 1 size class joined the ranks of adult 2 in 1984. One immature 2 jumped two size classes and entered the adult 2 size class. More data are needed to discern whether or not this growth pattern is typical of immature tortoises at this site. There was no recapture data for immature 1 and juvenile size classes since none were recaptured between 1979 and 1984.

TABLE 2.—Size distributions of remains of desert tortoises found on the Sheep Mountain Permanent Study Plot, Clark County, Nevada, in 1979 and 1984.

	1979			1984			
Size classes	Sex not known	Male	Female	Sex not known	Male	Female	Total
Juvenile 1 & 2*	1	--	--	9	--	--	10
Immature 1 & 2	3	--	--	4	--	--	7
Subadult	--	--	--	--	--	--	0
Adult 1 & 2	--	2	--	--	--	--	2
Not known	--	--	--	22	--	--	22
Total	4	2	0	35	0	0	41

* Sex for those tortoises ≤180 mm MCL cannot be reliably determined. This includes all juvenile and immature tortoises.

In 1984 a larger number of tortoises showed a loss in mass than a gain. This was attributed to poor forage this year.

Mortalities

The carcasses of 35 tortoises were collected on the study site. Seventeen carcasses were collected off of the plot to assist in determining the role of predation at Sheep Mountain. Six carcasses were collected prior to establishing the grid so that exact locations are not available. Table 2 indicates size structure for mortalities found on the plot in 1979 (Karl 1979) and 1984. Mortalities for immature tortoises are relatively well represented in both census samples.

Carcasses were assigned a shell deterioration class to estimate time since death (Woodman and Berry 1984). All juvenile carcasses were estimated to have died within the last 2 years. The immature carcasses were estimated to have died more than 4 years ago. All fragmentary remains were estimated to have died in excess of 4 years. In fact 11 of 21 were located within packrat middens (*Neotoma* sp.) and were probably on the plot before the 1979 census.

Predation

Twenty-three of 57 (40.3%) remains were attributed to predation. Nineteen of these were caused by Common Ravens (*Corvus corax*), and only four

showed sign of mammalian predation.

A raven nest was located on a cliff within 300 m of the study plot. According to Karl (1979), "Ravens . . . were continuously present" during the 1979 study. The pair successfully reared one fledgling in 1984. Ravens were observed flying over the plot every day. The location of the nest provides ravens with an excellent vantage for surveying the study site area. On several occasions ravens were observed coursing the study site (within 15 feet of ground level). By searching cliffs near the raven nest (off the plot), the remains of 14 juvenile tortoises which had been eaten by ravens were discovered. The nest was so close to the study site that even though all of these mortalities cannot be attributed solely to the study site, the effect of the ravens on the site cannot be ignored either. Five of nine juvenile tortoise remains were located at raptor perches on the plot.

Four remains were attributed to predation by mammals. These were all located off the site. No live predatory mammals were observed on the plot. Burrows of predators correlate directly with locations of predators' burrows in 1979 (Karl 1979). Of 16 burrows, none were determined to have been used this season. This is in contrast to the active kit foxes (*Vulpes macrotis*) that Karl observed.

Parasites and Fungal Growth on Tortoises

Those parasites encountered were soft-bodied ticks (*Ornithodoros parkeri*) (Gerald E. Greene, *pers. comm.*) and a true bug nymph of the family Reduviidae. Ticks were found on five adult tortoises. All ticks were removed on initial capture and none were found on subsequent encounters.

A nymph of an insect in the Reduviidae family was found on one tortoise. Bugs in this family are known to parasitize other vertebrates. There was not enough evidence to positively determine whether or not the nymph was involved in any relationship with the tortoise other than catching a ride. Woodbury and Hardy (1948) mentioned finding a similar parasite of the genus *Triatoma*, family Reduviidae, in caliche caves associated with tortoises. This was attributed to the presence of packrats and other small mammals on which these insects are known to live.

Fungus was found on three tortoises. The fungus forms a thin, white layer on the plastron. It was also observed on a number of tortoises at the Piute Valley PSP in Nevada during 1983 (Mortimore and Schneider 1984) and speculated that this was the result of unusually moist conditions on the study site. Whence the low incidence of occurrence in 1984. An immediate effect of this fungal growth is a general softening of the plastron's surface layer. Long-term effects are unknown.

Sickness and Weakness in Tortoises

Five of 13 (38.5%) live juvenile tortoises showed signs of "sinking" along the vertebral column. Berry and Burge (1984) used the word, "sinking,"

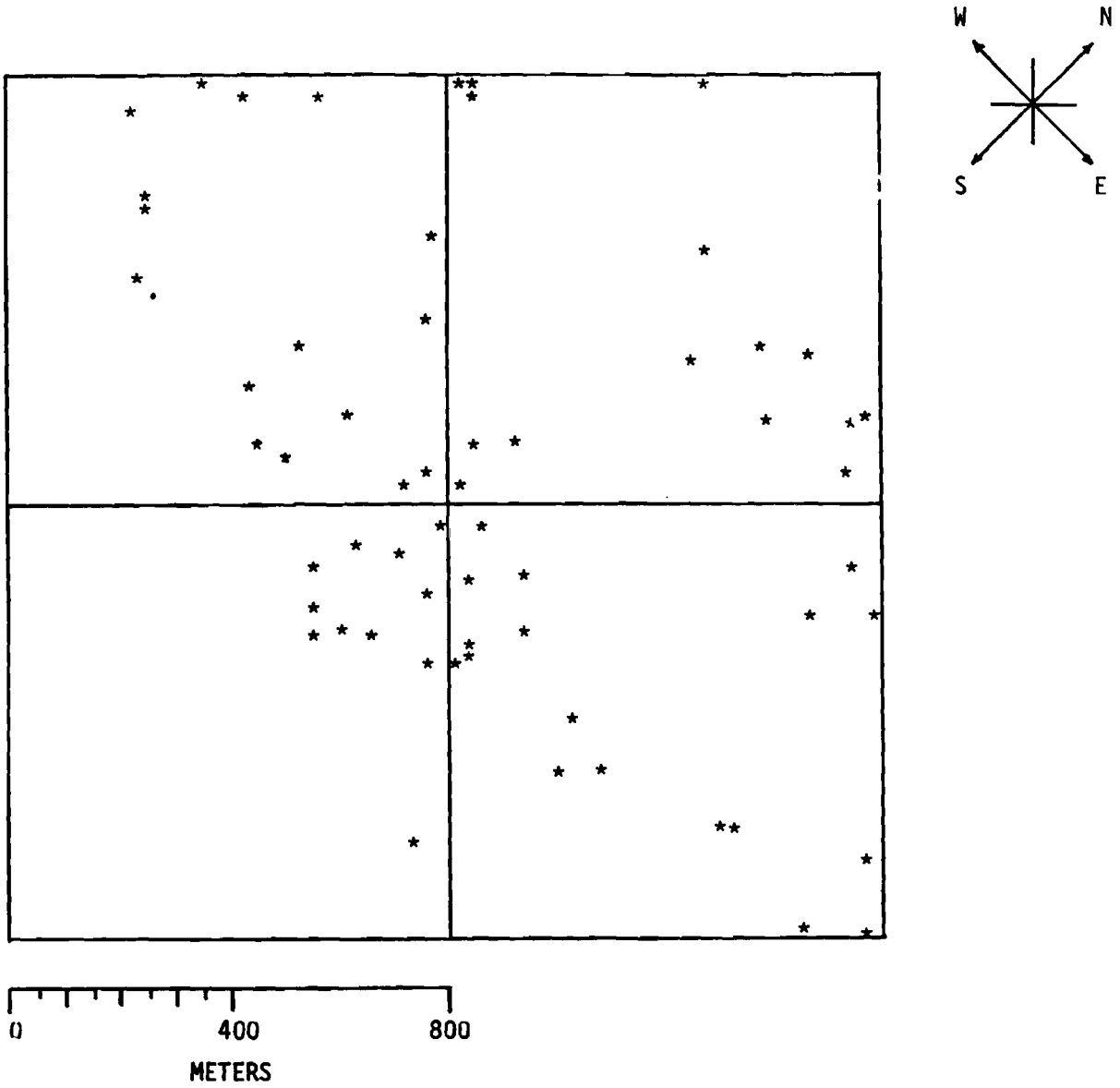

FIG. 4. — Distributions of tortoises at initial capture sites for Sheep Mountain Permanent Study Plot, Clark County, Nevada, in 1984.

to describe a condition of the scutes of tortoises in advanced shell wear classes (classes 6 and 7). We use the word to describe a similar phenomenon which was only observed in juvenile size classes and the lowest shell wear classes (classes 1 and 2). Those juvenile tortoises which were already deceased before being located could not be reliably sampled for "sinking" since this "symptom" is normal as the carcass is desiccated with deterioration. Their lack of complete bone structure promotes this result. Karl (1979) observed one immature tortoise with sunken vertebral scutes. Woodman (1979) made note of this in nearby Ivanpah Valley, and assumed that it was related to poor health.

Distribution of Tortoises on the Study Plot

Figure 4 illustrates tortoise distribution during the study period. Karl (1979) observed the same distribution pattern. Areas in proximity to the east and west corners produced a small percentage of the captures, while the southern corner, an area of about 11,000 m^2, produced no tortoises. The locations of mortalities, active burrows, and inactive burrows all reflect the same pattern of distribution. When the uninhabited portion of the study plot was taken into account, the population estimate was in effect more dense than the number/mi^2. Karl (1979) conducted strip censuses which were used to determine relative densities (Karl 1980). Karl's transect no. 197 was located at the northern end of the study plot where the density tapers off. Karl (1980) estimated the population here to be 45 to 90 tortoises. Transect no. 203 was located in the southern corner, near the region we have labeled as uninhabited, and the estimate for the relative density was 10 to 45 tortoises/mi^2.

Juvenile tortoise encounters were within the distribution pattern described above. Within this area, 14 of 15 encounters occurred in relation to dendritric washes.

Denning Behaviors

Thirty-eight tortoises were found in burrows. Twelve were in pallets, two were found in abandoned predator burrows, and nine were associated with rock cover sites. We identified 48 burrows which were active and 102 which were inactive before 17 May. Seventeen active pallets and 32 scrapes were identified.

Tortoises were encountered at caliche caves 17 times during transects. All of the caliche caves were within areas of moderate to high tortoise densities for this plot. These caves had entrances large enough to accommodate even the largest males. They often extended underground much further than we were able to measure accurately. One particular cave measured a length of 6 m and then branched into several other channels at that point. These caves were all situated in relation to major drainages on the plot. The number of tortoises located at specific caliche caves varied from one individual to as many as seven. Certain males were observed at more than one cave during the course of the study. In contrast, some females remained sedentary at a cave throughout the study period.

Eight juvenile tortoises were captured in burrows. Two juveniles were found in the open. Six of the 15 juvenile encounters were beneath rock slabs associated with washes.

Woodbury and Hardy (1948) excavated burrows of large tortoises but made no mention of juvenile tortoise burrows. Three juvenile 2 tortoises were excavated from their burrows. They were found to have been using modified rodent burrows which offered a variety of paths to follow. While the length at which tortoises were found was not great, the depth was sometimes surprising. The slopes within the burrow systems were steep. The three tortoises were found to be at depths of 10, 23, and 45 cm. There seems to be no

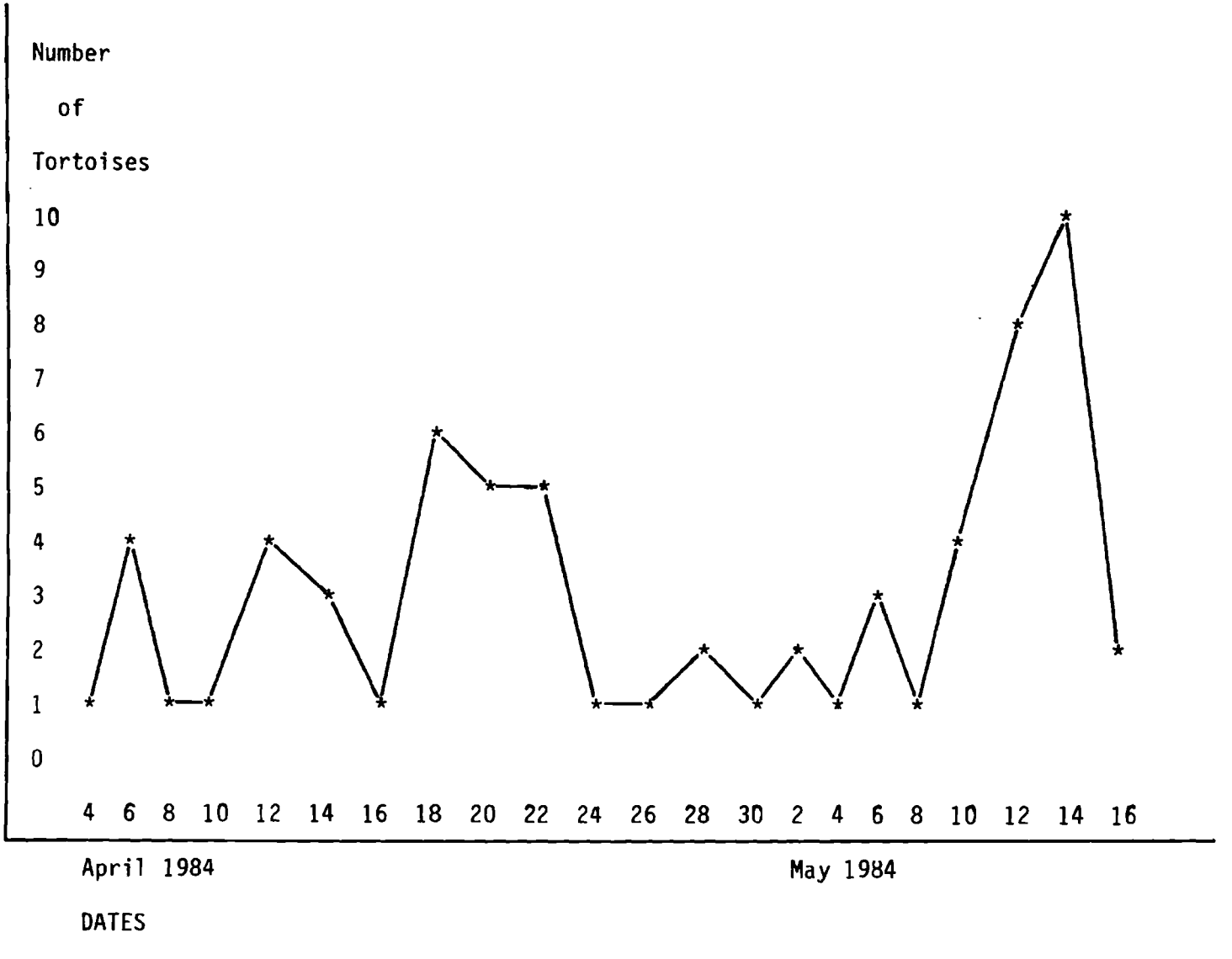

FIG. 5. — Frequency of tortoise captures in relation to study period dates at Sheep Mountain Permanent Study Plot, Clark County, Nevada, in 1984.

TABLE 3. — Comparison of weather conditions and numbers of tortoises from 4 April through 16 May 1984 on Sheep Mountain Permanent Study Plot, Clark County, Nevada.

Date	Mean ambient air temperature[a]	Range of temperature	Precipitation	TNT[b]	NAT[c]
4-11 April	20.5	16.1-24.1	trace	13	10
12-19 April	27.5	15.7-31.8	--	19	14
20-27 April	23.2[d]	19.1-28.2	trace	16	7
28 April - 5 May	26.0	22.4-28.2	--	24	11
6-13 May	29.3	22.9-36.0	--	37	22
14-16 May	22.8	N/A[e]	--	9	2

[a]Air temperature taken in shaded location, 1 m above ground surface, in degrees centigrade.

[b]Total Number of Tortoises located in time period.

[c]Number of Active Tortoises located in same time period.

[d]Freezing temperatures occurred on 26 and 27 April.

[e]Not Applicable. Data was only available for one tortoise.

reason that they could not go deeper if necessary for the burrows continued deeper. One tortoise was almost missed because it was in a side pocket near the entrance and was only found by sifting through previously excavated material. The pocket was within 10 cm of the entrance. This should be taken into consideration when surveying for small tortoises in the future. All three tortoises were released within 15 m of the sites from which they were excavated in what appeared to be unoccupied rodent burrows. Checking these locations at repeated intervals was a good way to observe small tortoises. When repeated visits were necessary, care was used not to disturb the vegetation and soils in the immediate area of the burrows.

Activity Patterns and Weather

From 4 April through 16 May 1984, sixty-five observations were made on active tortoises. We compared weekly temperature averages and rainfall patterns with tortoise activity (Table 3).

A rate of capture curve (Fig. 5) shows that numbers of new captures had not begun to decline. The rapid decline in captures occurring 14 and 16 May are attributed to incomplete workdays. This indicates tortoises were still active when the study period ceased.

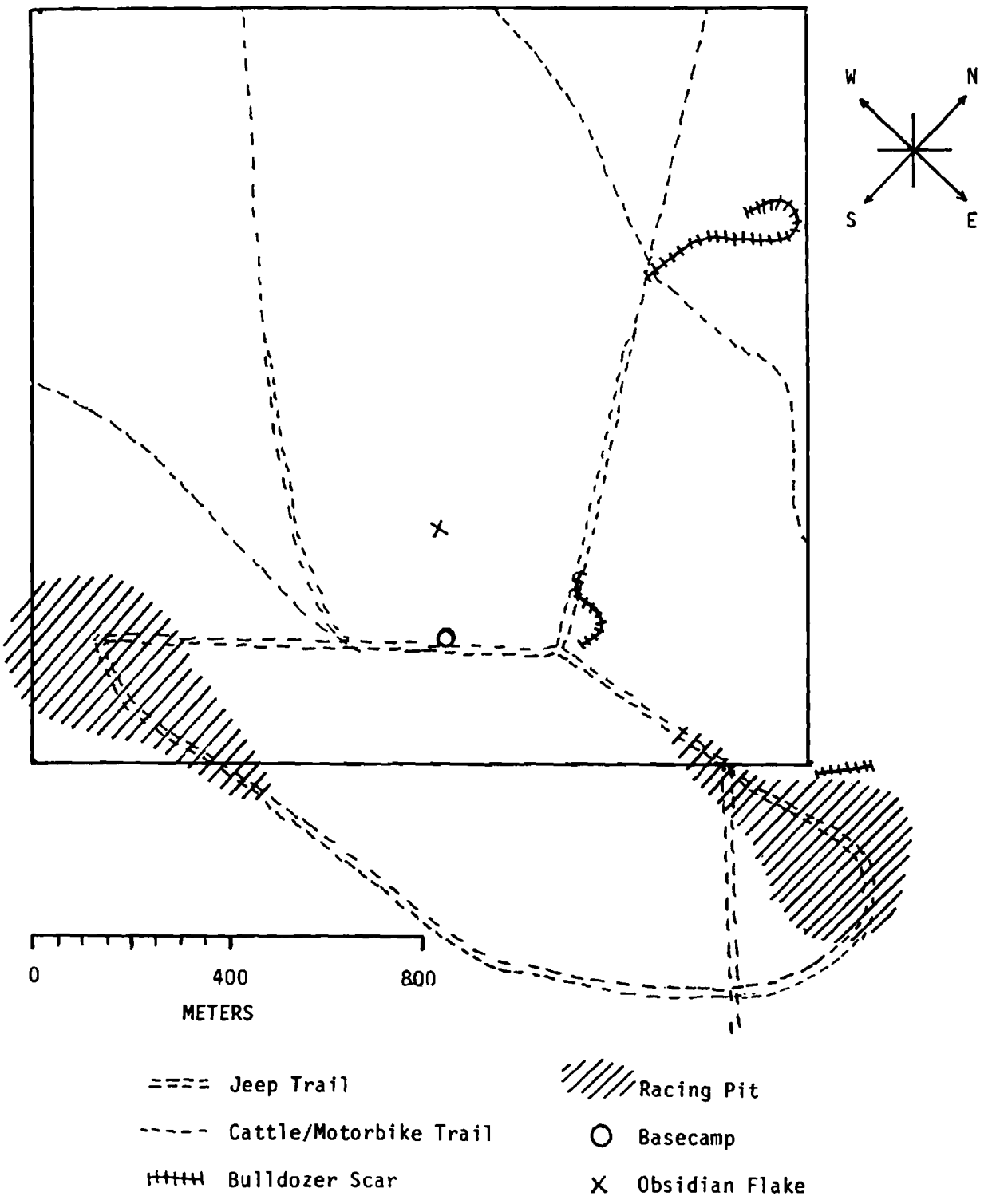

FIG. 6. — Map indicating human use of Sheep Mountain Permanent Study Plot, Clark County, Nevada, as of 1984.

TABLE 4.—Results of perennial vegetation transects during the spring of 1984 on Sheep Mountain Permanent Study Plot, Clark County, Nevada.

Transect No.	Number of species	Absolute density/200 m^2	Absolute volume $cm^3/200\ m^2$	Absolute frequency
I	5	146	5.1916161507^7	64
II	18	317	1.1646811^7	106
III	13	233	1.546550751^7	123
IV	19	300	3.0119934^7	159
V	11	413	2.964241215^7	116

The greatest rainfall occurs during the winter according to Bostick (1973). Sheep Mountain and vicinity experience a rainshadow a effect all year-round as they are surrounded by higher elevations.

Rainfall for January through June 1984 was slightly under the norm <-0.06 below the norm, Searchlight, Nevada (National Oceanographic and Atmospheric Administration 1984).

Vegetation

Primary production was poor for all plant species during the spring of 1984 (Table 4). Perennials were mostly dormant during the study period. Total number of perennial species identified on the plot was fifty-four.

Only 13 ephemeral species were identified. Zero ephemeral vegetation production was observed for all transects.

Areas with the greatest tortoise densities were correlated with the vegetation type observed on Transect II. This transect had the greatest densities of *Erioneuron pulchellum*. Transect I is a *Larrea—Ambrosia* association but has the lowest tortoise density. Transect IV indicated the greatest species diversity but offered little in the way of cover sites.

Human Usage of the Study Site

Figure 6 shows the extent of human use on and around the study site. The earliest sign of human use was a flake of black obsidian apparently the work of some Amerindian.

Mineral exploration has occurred since 1918 as evidenced by a claim

marker. Recent bulldozer scars indicate that this has been an ongoing process. Cattle grazing is licensed in the area; however, no cattle were observed on the site this year. Cattle sign was common across the entire plot.

Perhaps the most noticeable habitat destruction is the result of off-road vehicles (ORVs). Motorbikes were observed following cattle trails across the site on three separate occasions. A motorbike race was held on Easter Sunday. Part of the race course was within 300 m of the study site boundary. In fact, there was an area where spectators congregated on the plot for a previous race. This "racing-pit" was severely torn up. An area of no less than 11,000 m^2 was absolutely laid to waste. Perennial vegetation was flattened and uprooted. The soil was disturbed or entirely gouged out to a depth in excess of 50 cm.

DISCUSSION

Karl (1979) estimated there were 50 tortoises/mi^2 which was in contrast to our estimate. It was inferred that the Sheep Mountain tortoise population was on a decline and that a die-off of adult tortoises was to be expected. This was concluded due to the observed age structure which weighed heavily toward older tortoises and observed lack of tortoises in the smaller size classes

We observed a small population of large, apparently older tortoises that were breeding. Recruitment to larger size classes was low. This was similar to what Karl inferred.

Our estimate of 74 tortoises/mi^2 was a slight underestimate because of low capture—recapture rates of tortoises <180 mm MCL. Our estimate of 46 tortoises ≥ 180 mm MCL per square mile is higher than the result extracted from the 1979 data, yet it was still conservative. Our rate of capture curve (Fig. 6) indicates that at the time that the census period ended, we had not yet begun to observe a decline in the number of unregistered tortoises.

Proof of reproductive activity since 1979 was indicated by nests which were located in addition to the number of juvenile tortoises registered in 1984 combined with the number of juvenile carcasses we recorded (combined total = 33). Thus in 1984 the total number of tortoises present has not declined. Evidence at Sheep Mountain does indicate that recruitment from juvenile and immature size classes to adults was low. However, this has not been proven as a means of identifying a lack of recruitment sufficient to sustain the population to date. This effect is partially due to the fact that the subadult size classes span the least number of points in mm of any size class. We cannot neglect evidence such as sunken vertebral columns and large numbers of immature mortalities in such a small population. Berry and Nicholson (1979) have suggested that a population of less than 50 tortoises/mi^2 will not be viable, but lower limits of reproductive equilibrium for populations of moderate density are not known. That is why observing these populations as well as the high density populations is important. These are the populations which may be in trouble now and have limited reserve.

Our concerns are: (1) is recruitment actually occurring; (2) what are the causes of lack of recruitment (this is difficult to determine because of small sample size of the population — in 1984 -2 recaptures of tortoises registered as ≤180 mm MCL in 1979 — yet important since this study plot may reflect trends for other similar moderate density population); and (3) without recruitment, how long can this population remain reproductively stable?

ACKNOWLEDGMENTS

We wish to thank Craig Mortimore of the Nevada Department of Wildlife, and Roy Price of the Bureau of Land Management, Las Vegas, Nevada, for support during this study.

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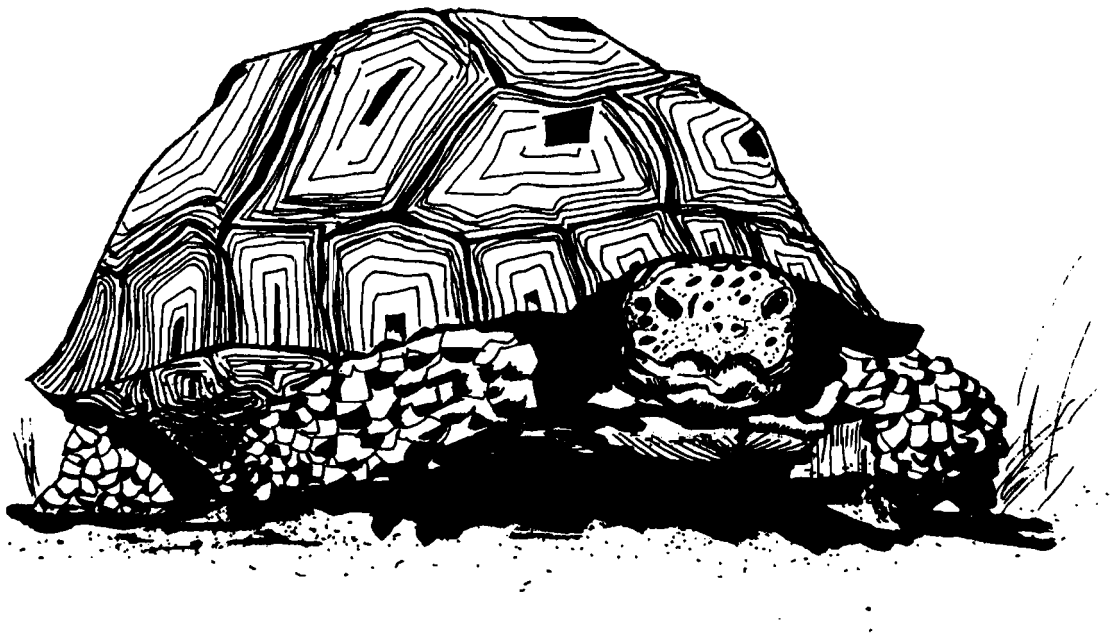

Desert Tortoise Council Symp. Proc. 1985:68-70

STATE REPORT - ARIZONA

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On the national level, two milestones were the completion of the desert tortoise status report and the petition to list the desert tortoise as endangered range wide. Both events sharpened focus on the desert tortoise in Arizona.

Status Report.—The draft "Status of the desert tortoise (*Gopherus agassizii*) in the United States" (Berry 1984) brought together all of the work that has been done to date. It provides a very useful summary of available data, techniques used on tortoise research and an updated bibliography of desert tortoise publications. The report also discusses further work needed on aspects of desert tortoise biology and land uses in order to manage the tortoise and its habitat more effectively. The Arizona section points out the almost total lack of population data available on the desert tortoise here, especially in Arizona Upland Desert habitats.

Interagency Desert Tortoise Team for Arizona.—About two years ago the Department, the U.S. Fish and Wildlife Service, and other interested organizations discussed the possibility of establishing an interagency team to develop management and research guidelines for the desert tortoise in Arizona. Following the formation of the Nongame Branch within the Arizona Game and Fish Department, continued discussions with other Federal and State agencies indicated a clear consensus that this would be the best way to address the desert tortoise situation here.

The Department has requested that the following agencies name one (or two, at most) technically appropriate representatives to participate with it on such a team: Arizona State Land Department; U.S. Department of Agriculture (USDA) Forest Service, Region 3; U.S. Department of Interior (USDI) Bureau of Land Management, Arizona; USDI Bureau of Reclamation, Lower Colorado Region; USDI Fish and Wildlife Service, Region 2; and Utah Division of Wildlife Resources (Utah Division of Wildlife Resources and the Department agreed upon a cooperative effort to share information pursuant to better understanding and management of the desert tortoise in the two states).

This team will be charged with developing (1) a draft research program (including identification of problems, methods, objectives, and funding required) to gather, analyze, and disseminate biological information on the desert tortoise to determine long-term strategies for its management and conservation, and (2) draft interim management policies, if any, to be adopted by each agency during the period in which the research is being conducted.

The first meeting is scheduled for the week of 22-26 April 1985, in Phoenix, to discuss methods and a time frame for development of strategies.

Review of Regulations.—Comments on Arizona amphibian and reptile regulations were solicited from approximately 150 agencies, organizations, and individuals. Of the 30 responses received, 13 pertained to the desert tortoise. Eleven of those requested that no collecting be allowed, and two requested that collecting continue to be permitted. However, we do not know from this type of survey how many of the nonrespondents actually support the current regulations, but just failed to state so. Our regulations presently allow a take and possession limit of one live desert tortoise under the authority of a hunting license. None may be killed or exported from Arizona.

Fourteen people (plus seven Department personnel) attended a public meeting in Phoenix in August to discuss our reptile and amphibian regulations. Most of those attending expressed support for closing the season on the desert tortoise. They were given the impression that regulations regarding the desert tortoise might be changed at the October Commission meeting. That could not occur because Department review on such a proposed change had not been completed. Our regulations are currently being reviewed within the Department. No changes regarding the desert tortoise are anticipated pending formation of the interagency team and response of the Fish and Wildlife Service to the listing petition.

Desert Tortoise Workshop.—Terry Johnson, Nongame Branch Supervisor, and Cecil Schwalbe, Herpetologist, participated with other members of the Desert Tortoise Council in a Desert Tortoise Workshop sponsored by the Mojave Desert Range Project in the Las Vegas, Nevada, 26-27 October 1984. According to Dr. James Bowns, Range Extension Specialist for Southern Utah State College, the ultimate goal of the workshop was to develop a regional research project on the desert tortoise through the regional extension/university system. A report on the workshop appears elsewhere in these proceedings.

Field Studies.—Departmental personnel and others surveyed localities in southern Arizona for potential long-term desert tortoise study sites. Areas evaluated included the Harquahala, McDowell, Picacho, Silverbell, Tortilla, and Tortolita mountains.

Adoption Programs.—Two adoption programs have been established in Arizona to find suitable homes for urban-salvage and captive-bred desert tortoises. In Tucson, the Arizona-Sonora Desert Museum placed 72 desert tortoises into homes in 1984. In Phoenix, the Department placed 59 desert tortoises in appropriate homes or educational and research institutions.

History of Desert Tortoise Management in Arizona.—The following summarizes regulations and policies affecting the desert tortoise in Arizona. It does not attempt to address fully all of the field studies and other activities involving the desert tortoise in recent years, most of which are summarized in past Proceedings of the Desert Tortoise Council Symposia.

Prior to 1967 there was no bag or possession limit or closed season on desert tortoises in Arizona. From 1967 until the present there has been a bag and possession limit of one live desert tortoise per person. None may be killed, purchased, sold, offered for sale, bartered, imported into or exported from the State unless authorized by the Arizona Game and Fish Commission.

They can be given to people as gifts (within Arizona). Initially, no license was required to take a desert tortoise. Since 1973, a hunting license (or scientific collecting permit) has been required for taking all reptiles, including desert tortoises, from the wild.

In 1974 all four species in the genus *Gopherus* were classified as "prohibited wildlife" in Arizona. As such, none of them can be imported, exported, possessed, transported, propagated, purchased, bartered, sold, leased, or offered for sale. However, a desert tortoise (*Gopherus agassizii*) legally taken or held in Arizona specifically can be possessed, transported and given or received as gifts, as mentioned in the preceding paragraph. Desert tortoises not legally held in Arizona are considered "prohibited wildlife" and are subject to the constraints given above. The intent was to stop or at least slow the interstate pet trade and movement of North American tortoises, but to allow residents of Arizona reasonable access to native desert tortoises.

The first list of Threatened Wildlife in Arizona was adopted in 1976 and revised in 1978 and 1982. The desert tortoise was classified in Group 3 (species or subspecies whose status in Arizona may be in jeopardy in the foreseeable future) on all three lists. The group definitions were slightly modified and expended on the current list (Arizona Game and Fish Commission 1982). The desert tortoise is listed therein under:

> Group 3. Species or subspecies whose continued presence in Arizona could be in jeopardy in the foreseeable future. Serious threats exist to the habitats they occupy and their populations (a) have declined or (b) are limited to few individuals in few locations.

In 1983, the Arizona Natural Heritage Program of The Nature Conservancy was absorbed into the Department, and the Nongame Branch was formed with Terry Johnson as Supervisor. Cecil Schwalbe was hired as Nongame Herpetologist in 1984, with responsibility for managing reptiles and amphibians in Arizona. Activities affecting the desert tortoise in Arizona in 1984 are reported above.

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Desert Tortoise Council Symp. Proc. 1985:71-74

STATE REPORT - ARIZONA

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The Bureau of Land Management (BLM) in Arizona is concerned about management of desert tortoise habitat. The management of habitat for the desert tortoise, as well as other species on public lands in Arizona, is first assessed in large-scale Resource Management Plans (RMPs). Resource Management Planning is used by BLM managers to allocate resources and select appropriate uses for the public lands. These plans set up systems to monitor and evaluate the status of resources and the effectiveness of management practices over time. The RMP is often supplemented by more detailed, site-specific management plans for a particular land-use activity, such as livestock grazing, wildlife habitat management, and wilderness management.

In Arizona the BLM has an estimated 2.5 million acres of potential desert tortoise habitat within its jurisdiction. The Bureau presently provides a specific management prescription of one form or another for approximately 1.06 million acres of tortoise habitat. This management emphasis is located principally in areas of high tortoise population density or high value habitat.

Arizona's primary management tool for tortoise habitat is the Habitat Management Plan (HMP) program. This program was initiated in Arizona during the late 1970s. Through this program, specific habitat management plans are cooperatively prepared by the BLM and the Arizona Game and Fish Department to establish management objectives for wildlife and its habitat within a specified geographic or ecological region. Objectives established in these plans provide management with guidelines for maintaining, improving, and monitoring known wildlife values. They also identify opportunities for further analysis of habitat areas where existing data indicates a potential opportunity for species expansion or a need to gather more data concerning the distribution of wildlife species and their use of these areas.

Arizona Strip

Implementation of the Virgin River-Pakoon Basin HMP, which encompasses approximately 180,000 acres of high-value tortoise habitat, was initiated this year. A planned action in the HMP calls for the development of fifteen 20-acre exclosures to monitor vegetative condition within known tortoise habitat. Monitoring studies were initiated on the three known populations — namely, the Pakoon Basin, the Beaver Dam Slope, and the Virgin Mountains — to assess soil conditions and forage availability in high, moderate, and low density areas.

Livestock management objectives are also discussed in the HMP. In 1984, three Allotment Management Plans (AMPs) were revised. The Beaver Dam AMP was

revised to a combination three-pasture rest-rotation system. This will allow each of the two pastures containing desert tortoise habitat complete rest one year out of three. It will also provide spring rest for each pasture one year out of the remaining two years. The Pakoon AMP was revised to control water availability at well sites. This will provide for alternate-year grazing deferment on half the allotment. The highway AMP was implemented in 1984. Pipelines and tanks for livestock were placed in areas outside of high-density tortoise habitat.

Within the Shivwits Resource Area, the Arizona Strip District has implemented an off-road vehicle policy which makes it unlawful to drive vehicles cross-country or off existing roads, specifically in tortoise habitat. The Arizona Game and Fish Department is supporting the BLM in the enforcement of this policy.

A Fire Suppression Plan that provides for full suppression action on desert tortoise habitat is in effect in the Arizona Strip. This effort should further guarantee forage availability for tortoises.

Last year, 12 Environmental Analyses were written for land-use actions proposed to occur on or impact tortoise habitat in the Arizona Strip. A field analysis was conducted in each case to ensure impacts to tortoise and their habitat would be negligible. A proposed 120-acre gypsum mining operation in low-density tortoise habitat was evaluated and modified to remove the mine operation from tortoise habitat to a nearby site. The proposed Wayne's Well Pipeline, which would have increased livestock distribution in high-density tortoise habitat, was dropped because of its negative impact on tortoise habitat. An 80-mile motorcycle race across Arizona and Utah during late February was modified to divert the race from high-density tortoise habitat to areas showing only scattered or minimal use by tortoise.

The Arizona Strip District has been involved in development of the draft Desert Tortoise Recovery Plan for the Beaver Dam Slope population in Utah. The draft Plan was prepared by Region 6 of the U.S. Fish and Wildlife Service. This week we have once again been requested to review the document to ensure that tortoise populations immediately to the north are given the utmost in management efforts. We are especially interested in this Plan inasmuch as we believe that management efforts on the Beaver Dam Slope in Utah may have application to adjacent tortoise populations in Arizona.

We are currently making an effort to compile data collected in past years on tortoise distribution on the Arizona Strip. A 500-acre study area is also being monitored this year. This area is considered one of the highest density areas on the Beaver Dam Slope in Arizona.

Phoenix and Safford Districts

The Phoenix District is completing the final Draft of the Lower Gila South RMP. Within the RMP area there are approximately 45,000 acres of desert tortoise habitat. The RMP will provide general guidelines for management actions associated with tortoise habitat. A major action will be to

acquire, through exchange, parcels of State land which have high-value tortoise habitat. The plan also establishes objectives for monitoring livestock use in areas of high tortoise density. Comments concerning the Lower Gila South RMP are due in the Phoenix District Office by 2 May 1985. We welcome the comments of the Council and other concerned parties. Those interested in obtaining a copy of the RMP should contact our Phoenix District Office.

Once the RMP is finalized, HMPs for areas such as the Little Horn Mountain Planning Unit and the Ajo Planning Unit will be initiated. HMPs in these areas will contain management objectives and habitat monitoring programs for tortoise populations.

An HMP for the Hualapai wildlife habitat area is being developed. This HMP will provide specific management objectives for approximately 32,000 acres of tortoise habitat. The public review period will occur during mid-summer of this year. Anyone interested in reviewing this document should also contact our Phoenix District.

The Phoenix draft wilderness Environmental Impact Statement (EIS) was recently completed. This EIS included approximately 6,400 acres of known desert tortoise habitat. An HMP which will specifically address the high-value desert tortoise habitat will be prepared for this area.

The Eastern Arizona Grazing EIS, a combined effort between our Safford and Phoenix District offices, is in preparation. Approximately 195,000 acres of potential desert tortoise habitat lie within the EIS boundary. The San Pedro and the Winkelman Planning Units, which encompass the majority of this potential habitat, have historic records indicating scattered tortoise populations and habitat. However, we currently do not have adequate data to determine the amount of tortoise habitat or size of isolated populations. Until adequate data can be acquired, proposed management actions will be evaluated to determine their potential impact, if any, on tortoise habitat.

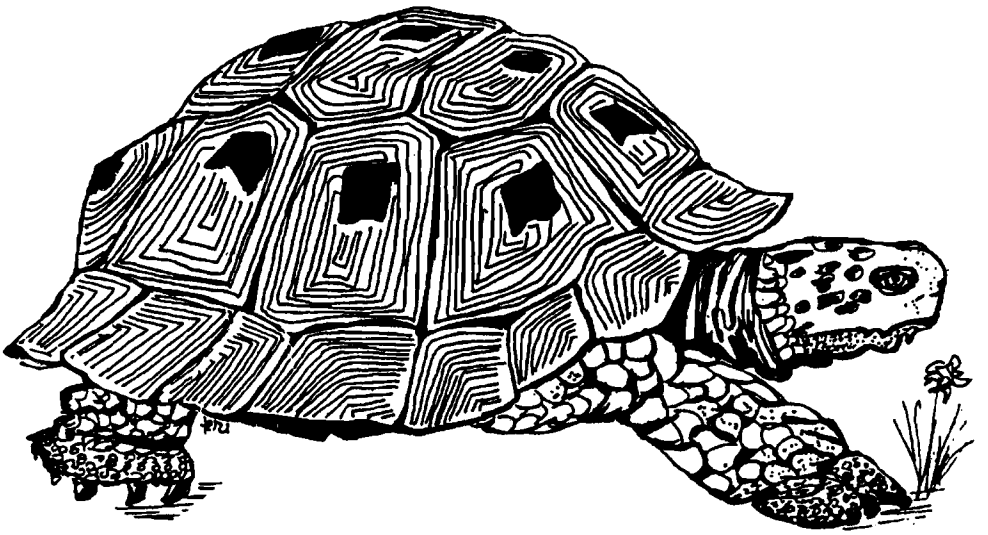
Yuma District

During 1984, the Draft Yuma RMP was completed. This plan recognized a need to further delineate tortoise habitat throughout the District. The comment period for the Draft Plan RMP closes 19 April. Anyone interested in reviewing this document or finding out more about the proposed study should contact our Yuma District Office. Through existing HMPs on the Yuma District, approximately 125,000 acres of tortoise habitat have been identified. A study proposal for re-evaluating existing data and surveying all potential tortoise habitat within the Yuma District is currently under review in our State Office and should be available for contracting by 1 May.

Statewide

On a statewide basis, we have planned approximately $20,000 in separate monitoring and study efforts to re-evaluate known tortoise sites and improve existing District monitoring programs. We have also solicited the help of

the U.S. Fish and Wildlife Service in evaluating known sites and demonstrating techniques which may increase the available data for Arizona. Through our efforts, both singularly and cooperatively, we will continue to take management actions which we believe will improve conditions for the desert tortoise on public lands so that it will not need to be listed in Arizona. In our opinion, the desert tortoise is not threatened or endangered in Arizona. Listing of the desert tortoise in Arizona as an endangered species would unnecessarily complicate the positive actions that the BLM is taking to manage desert tortoise habitat on public lands.



Desert Tortoise Council Symp. Proc. 1985:75

DESERT TORTOISE (*GOPHERUS AGASSIZII*) HOME RANGE AND HABITAT USE IN THE PICACHO MOUNTAINS, PINAL COUNTY FINAL REPORT

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Abstract.—Home range and habitat use of 14 desert tortoises were monitored by radio telemetry between 7 April 1982 and 29 September 1983 in the Picacho Mountains, Pinal County, Arizona. The mean home range size of all 14 tortoises was 19 ha. There was no significant difference ($p > .05$) between 1982 and 1983 home range sizes. Home range size for 5 males (26 ha) was not significantly different ($p > .05$) from that of 9 females (15 ha). Data for each habitat parameter was compared between seasons. Tortoises occurred from the mountain bajadas and associated washes in summer (mean elevation = 597 m) to upper mountain slopes in winter (mean elevation = 609 m). Tortoises selected for slopes of 41-80% in winter and 41-60% in spring. Tortoises selected for east aspect slopes in winter and northeast aspect slopes in spring. Tortoises occupied deeper dens in summer (mean = 162 cm) than in autumn (mean = 106 cm), winter (mean = 109 cm), or spring (mean = 126 cm). Tortoises occurred only in the Arizona Upland Subdivision of the Sonoran Desert. Greatest percent dry weights of vegetation in tortoise diets, by season, were: spring, forbs 82%; summer, forbs 50% and shrubs 31%; and autumn, shrubs 78%. Forbs (50%) and shrubs (33%) comprised the greatest percent annual dry weight in tortoise diets. Vegetation types with the greatest frequency of occurrence in tortoise diets by season were: spring, forbs 57%; summer, forbs 40%; and autumn, shrubs 37%. The plant species with the greatest total dry weight of all samples were *Argythamnia lanceolata* (15%), *Janusia gracilis* (15%), and *Lupinus sparsiflorus* (26%).

Desert Tortoise Council Symp. Proc. 1985:76-78

DESERT TORTOISE PRESERVE COMMITTEE 1984 STATUS REPORT

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This is the tenth anniversary of the founding of the Desert Tortoise Preserve Committee (DTPC), a private nonprofit corporation. The principal purpose of the committee is to promote the welfare of the desert tortoise (*Gopherus agassizii*) in the wild in the southwestern United States and with the purpose of establishing and maintaining a Desert Tortoise Natural Area in the Western Mojave Desert. That Natural Area was formally established by the Bureau of Land Management (BLM) in 1980 as a Research Natural Area to protect the desert tortoise populations and habitat. The Natural Area was also designated as an Area of Critical Environmental Concern (ACEC) in the BLM's 1980 Plan for the California Desert Conservation Area. Also, as part of the 1980 Plan, the Western Rand Mountains ACEC was identified. This area is adjacent to the northeastern part of the Natural Area and was established to protect wildlife values including the desert tortoise and the state-listed rare Mohave ground squirrel.

The Natural Area is located in a part of California which historically included the highest density of tortoise populations in the United States. The region had tortoise populations estimated at 500 to 2,000 per square mile. At the time of establishment of the Natural Area, the population was only 10 to 40 percent of the historical numbers. This paper reports on the status and activities of the DTPC in 1984.

The founding members of the Committee envisioned the relatively simple job of some concerned citizens working with a committed Bureau of Land Management to establish a tortoise Natural Area in Kern County as identified several years earlier by Dr. Kristin Berry. They would then raise a few thousand dollars for fencing to put around the perimeter to keep out grazing animals and off-road vehicles. The balance of the task would be development of interpretive facilities and management of the area. It is probably good that we sometimes start volunteer tasks with a simple view and clear goals. If the real scope of the task were known, many worthwhile tasks would not be accomplished. That is most certainly the case with the Desert Tortoise Natural Area (DTNA).

The goals which the Committee set for itself are still relevant and a great deal has been accomplished. A Natural Area has been established, most of the perimeter has been fenced, and visitor interpretive facilities are in place. However, many complex issues remain which include private land inholdings on the DTNA, fence completion, unauthorized grazing trespass and vandalism, encroachment next to the DTNA, and habitat degradation. To better meet these critical areas of concern, the DTPC formally reorganized some of its internal functions. There is now a President and three Vice Presidents, one each for DTNA Stewardship, Government Affairs, and Communications. With this

reorganization we can improve our personnel resource utilization along functional lines. We also have improved our identification of and planning for short- and long-term goals.

The short-term goals of the DTPC are to pursue critical land parcel purchases, provide immediate maintenance of DTNA visitor trails and perimeter fence, and to urge the BLM to complete a tortoise inventory on selected study plots in 1985. Progress has been made in each of these areas. The Committee closed out 1983 with a 40-acre land purchase and acquired another 6.5-acre parcel in 1984. An offer was also made on another 10-acre parcel.

The perimeter fence had no regular maintenance done for almost two years, and approximately 50 critical repair actions were needed. Many of these were large fence sections removed due to natural flooding from heavy storms in recent years. Others were deliberate cuts with heavy off-road vehicle use into the Natural Area. To remedy this, two weekend work parties were held, one each in spring and fall. The DTPC/BLM work crews accomplished repair of the major breaks and many of the smaller repair actions. The balance will be left to the following year's work parties. The DTPC also performed nature trail and exhibit maintenance in time for the spring visitation period. Tour guide training was also accomplished and three public tours were held.

To further tortoise awareness by the public, DTPC members presented 132 programs which reached 3,700 people. There were an additional 22 programs given by BLM personnel to 900 additional people. Programs which reach this many people from school age through adult each year will have a positive cumulative impact on tortoise sensitivity in the long term.

An action being promulgated by the BLM would have had a long-term negative impact on the DTNA. They prepared a draft "Management Plan for the Rand Mountains Recreation Area and Western Rand Mountains Area of Critical Environmental Concern (ACEC)." The DTPC position was that this was inadequate as an ACEC plan, and that expanding the plan to include recreation was incompatible and was done without public input or review. After considerable discussion of our concerns with the BLM, they have decided to defer releasing the plan until further internal review is performed.

In another area, as part of their reviews, the BLM asked for an evaluation on their Desert Plan Goals and information on trends in resource condition in the California desert. The Committee responded with comments on the BLM Wildlife Goal regarding desert tortoise and Mohave ground squirrel habitat, and their Motorized Vehicle Recreation Goal regarding the proliferation of roads and trails.

In the longer term, there are several more general DTPC goals. These are to work with the BLM to improve menagement of the Natural Area, to establish DTPC land acquisition priorities and a program of accomplishment, and to improve the public interpretation of the tortoise and its protection status.

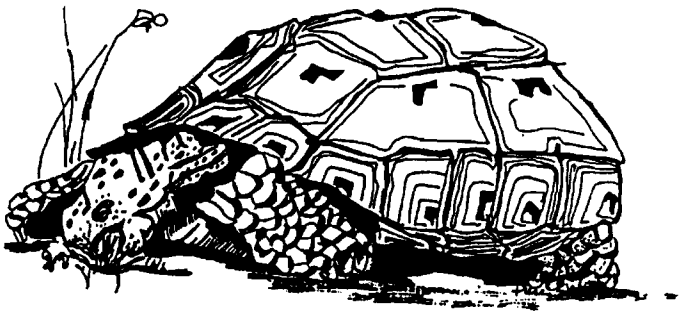
There has been committee action and some progress on these goals. The Committee has held discussions with the BLM on ways to further improve management of the Natural Area. It was agreed that we should try to establish a

cooperative agreement for the management of the Natural Area. A first draft was prepared and submitted to the BLM for review. Another task to improve DTNA management was the BLM decision to update its DTNA habitat management plan. The current plan was released in October 1979 and needed updating. The Committee volunteered to provide the BLM with a draft plan and they accepted. We are now in the process of researching and analyzing the needs to input to a draft plan.

The land acquisition program has reviewed past acquisitions and established priorities of parcels we would like next to acquire. The highest priorities are perimeter parcels to allow completion of the fence and then the larger interior parcels with a bias toward those in the best habitat. We have discussed with The Nature Conservancy (TNC) the possibility of renewing efforts to effect land exchanges with the BLM. There have also been efforts to acquire land in the DTNA as part of the mitigation measures for construction of the Celeron/All American Pipeline Project. That effort was not at all successful, but the philosophy of DTNA land acquisition as part of construction mitigation will be pursued in future cases as a matter of DTPC policy.

As a part of the DTPC work to monitor the habitat condition on the DTNA, we have undertaken a photomonitoring project. Monitoring sites will be selected across a wide portion of the Natural Area to obtain baseline data on the condition of the land. In future years, habitat condition will be compared to this baseline and recommendations made as part of the management plan.

As the final part of this report, the Committee was cognizant of the petitions filed with the U.S. Fish and Wildlife Service in September to list the tortoise as endangered or threatened. We were glad to see these actions taken and will support the listing at the appropriate time. It is hoped that final listing of the tortoise will have beneficial effects on tortoise preservation and our efforts to complete and manage the Natural Area located in the Western Mojave Desert.



Desert Tortoise Council Symp. Proc. 1985:79-81

THE MOJAVE DESERT RANGE RESEARCH PROJECT: WHY AND WHERE WE ARE GOING

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Before I go into the main subject of my presentation, the Mojave Desert Range Research Project (MDRRP), I would like to give some background on the Cooperative Extension Service. The Cooperative Extension Service was authorized by the Smith Lever Act of 1914. Under the provision of the Act, the major function of Cooperative Extension is: "To aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics; and to encourage the application of the same." The California State Legislature accepted the provisions and requirements of the Smith Lever Act on 17 May 1915, authorizing the Regents of the University of California to carry on this work.

The University of California Cooperative Extension Service has interpreted this broad charter as clearly identifying Extension function as one of education for action. We use this nonformal, distinct type of education to help people solve the various day-to-day problems they encounter in agriculture, family and consumer science, and related subjects. The other states the MDRRP represents established their respective Extension Services in a similar manner and have similar purposes and goals as California.

Now, I would like to talk about the formation, purpose, and objectives of the MDRRP, as well as where we have been so far and where we are going. The purpose of this project was to develop an interstate range program focusing on the Mojave Desert. Due to the distance from major universities, relatively low productivity and low population, there has been limited University Range Research or Extension activities in the Mojave Desert.

Jack Artz, who at the time was Associate Director of Cooperative Extension at the University of Nevada, Reno, often discussed the absence of a Range Extension program on the Mojave with academicians and other range professionals from California, Arizona, and Utah. With Jack's guidance, the discussion moved into action with the initial and formative meeting of the Mojave Desert Range Research Project in April of 1983. From our first meeting we set the resolution of multiple use issues on Mojave Desert rangeland as our general objective. To meet this objective, we identified four major roles for our group:

1) To identify range issues in the Mojave Desert area;
2) To identify data sources for resolution to these issues;
3) To recommend and facilitate research to resolve these issues; and
4) To facilitate the communication of pertinent information for the resolution of these issues.

In implementing our first role, we identified numerous issues which we tried to prioritize by the importance placed on them by the desert users and managers. From this process, we identified and prioritized six issues.

First. The desert tortoise in relation to grazing management.

Second. Urbanization, i.e., vandalism, theft, off-road vehicles and disrupting livestock, wildlife, and natural habitat.

Third. Livestock production economics, i.e., nutrition, breeding, markets, etc.

Fourth. Desert bighorn sheep and their relationship to grazing management.

Fifth. Grazing systems, i.e., ephemeral range characteristics and management, accounting for browse in the diet, etc.

Sixth. Vegetation monitoring in the Mojave Desert.

As to where we are going, our first function was to address the desert tortoise issue by sponsoring the Desert Tortoise Workshop to aid in our education and to help in making recommendations for further research. I wish to thank Dr. Kristin Berry and the Desert Tortoise Council for their help and participation. Proceedings from the workshop are in the review stage at this time. We made recommendations to the respective Agricultural Experiment Stations for research on the desert tortoise (*see* below). Now we need to follow up and facilitate the process. We have a range monitoring workshop planned in April, where we will also be looking at slide sets and publications that can be used as educational tools to address the urbanization issue and its inherent problems — a common problem that has affected the desert tortoise as well as other wildlife and livestock. I feel good about the progress we, as a group, have made. Although we are still in a formative stage, we are gaining administrative and popular support. Hopefully we can be productive and meet our goals.

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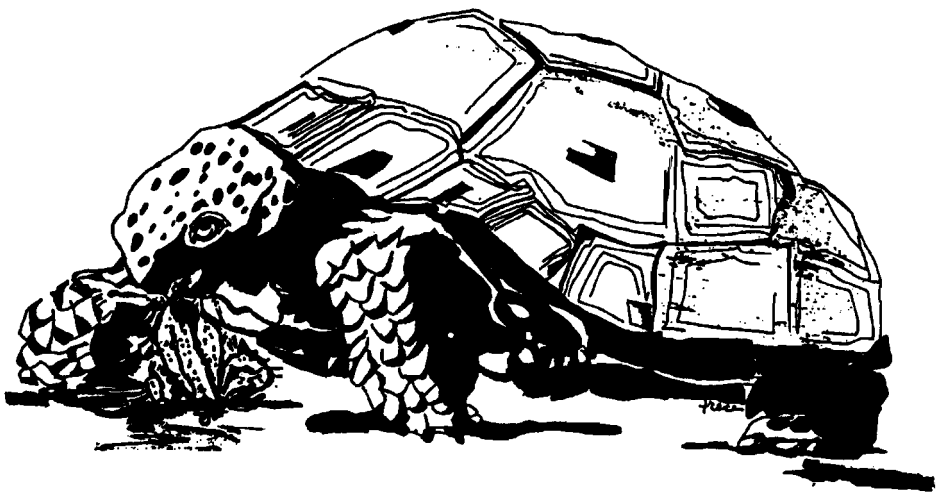
Forage Requirements of the Desert Tortoise in the Mojave Desert: A Problem Statement

While the desert tortoise (*Gopherus agassizii*) has attracted increasing interest in recent decades, research on the species has focused on point in time population parameters and obvious problems or curiosities. Numerous human-caused impacts to tortoises and tortoise habitat have been indicated by research and observation. Livestock grazing is generally included in lists of hazards to the species, and studies have shown an overlap in diet between tortoises and cattle or sheep. Yet this overlap in diet does not necessarily indicate competition for a scarce resource. To provide a foundation for resolution of this issue the following information is required.

Quantitative and qualitative nutritional requirements of the desert tortoise must be identified for both maintenance and reproduction. The nutrients should be stated in terms of energy, protein, and the minerals calcium and phosphorus. These nutrient requirements should be correlated with animal weight, stage in life, sex, and ecotypic variation associated with gene pools adapted to a modal and bimodal precipitation pattern.

The diet preferences of desert tortoises must be analyzed in correlation with available forage in a suitable research area containing both annual and perennial herbaceous vegetation. Variation in diet preference and forage availability caused by change in time of year and type of year should be quantified. Research in a dry year with minimal production of annual forage is most important. Concurrent with this research, forage should be analyzed regularly for nutritional quality, i.e., energy, protein, calcium, phosphorus, and crude fiber.



Desert Tortoise Council Symp. Proc. 1985:82-90

A CARBON DIOXIDE TRAP FOR SAMPLING THE ECTOPARASITE *ORNITHODOROS PARKERI* COOLEY 1936 (ACARI: ARGASIDAE) IN THE BURROWS OF THE DESERT TORTOISE, *GOPHERUS AGASSIZII*, AND OTHER VERTEBRATES

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Abstract.—Desert tortoise trend studies indicate that the soft tick *Ornithodoros parkeri* Cooley 1936 is found on fewer than 10% of the tortoises in any of the populations evaluated. These long-lived acarines parasitize a variety of vertebrates, but are normally nidicolous and rarely observed on the host. Traps, baited with dry ice, were set within the burrows or nests of desert tortoises (*Gopherus agassizii*), kit foxes (*Vulpes macrotis*), Burrowing Owls (*Athene cunicularia*), desert woodrats (*Neotoma lepida*), and other rodents to sample the ectoparasite population. Based on the results from 102 trap-nights, most kit fox natal dens and Burrowing Owl nests had ticks and/or fleas, whereas slightly less than half of the tortoise burrows yielded soft ticks. A single hematophagous ambush bug (*Paratriatoma hirsuta*) was recovered from a desert woodrat nest. Ectoparasites were infrequently retrieved from other burrows.

INTRODUCTION

The soft tick *Ornithodoros parkeri* is the major ectoparasite of desert tortoises (*Gopherus agassizii*) in California, Nevada, and Utah, and probably occurs throughout the entire range of this host (Greene 1983). Trend studies have suggested that less than 10% of wild tortoises are infested with these acarines and, although Ryckman and Kohls (1962) reportedly obtained more than 100 ticks from a captive, most observations have revealed fewer than 10 specimens.

Soft ticks, which belong to the family Argasidae, normally feed to repletion in less than an hour and are most frequently encountered in burrows or nests rather than on their hosts (Furman and Loomis 1984). In large numbers, these ectoparasites may become a significant stress factor due to the removal of blood and introduction of infectious organisms. Furthermore, because of their longevity and ability to tolerate prolonged starvation, argasids have been implicated as the reservoirs of several disease agents. This includes *Borrelia parkeri* which causes relapsing fever in humans and is primarily transmitted by *O. parkeri*.

This study attempts to accurately portray the relationship of *O. parkeri* to several potential hosts by utilizing a carbon dioxide trap to evaluate the infestation rates associated with the burrows of various desert vertebrates.

MATERIALS AND METHODS

The trap used in this study was based on the design of Miles (1968) with modifications to facilitate interchangeability, field assembly, and burrow accessibility. The basic components of this system are a carbon dioxide reservoir and funnel trap, both of which include adaptors to allow their connection via a nylon hose. These adaptors are fashioned from 38.1 X 6.4 mm (1-1/2 X 1/4 inch) nylon anchors (# 2415 48010, Star Comp., Mountainville, N.Y.) modified by removal of the metal core and enlargement of the bore with a drill press. Circles, cut from a sheet of nylon screen (2.8 fibers per mm) using a cork bore with a diameter of 10 mm, are then attached to the top of each anchor using Dow® silicone sealer.

The reservoir is a plastic, 1.5 litre, food-freezing container with two 6.4 mm holes drilled into the upper walls of opposing sides. Adaptors are inserted outward through these holes and siliconed into place. The extra adaptor is normally capped with a piece of flexible tubing, but can be opened if a second trap is needed.

The trap is formed from empty 35 mm film canisters which have had 6.4 mm holes drilled in the bottom. Adaptors are inserted through these holes from within and secured with silicone. The lids are altered by removal of their centers, leaving the lips intact. Strips of 40 mesh brass strainer cloth (Flynn & Enslow of Long Beach, California), cut to approximately 120 X 60 mm, are rolled along their long axis, passed through the rims, and around the outside of the modified lids. The edge of the screen is then inserted into the lip while the remainder is formed into a funnel which, when the lid is snapped onto the canister, will open 15 mm from the adaptor.

The reservoir and trap are connected using 0.4 to 2 m lengths of rigid nylon hose (used for swimming pool slides) which can be inserted directly into burrows and is apparently less palatable to rodents than flexible laboratory tubing.

In the field, each reservoir is baited with a 1 kg block of dry ice wrapped in newspaper to slow sublimation. The components are then carried along a transect and assembled as burrows are located. The trap is prepared by removing the funnel/lid and attaching a hose to the adaptor, while counterpressure supports it from within. After replacing the brass screen, the reservoir is similarly connected and located away from the mouth of the den to allow unrestricted movement of the host. Finally, the trap is inserted deep into the burrow, then slightly withdrawn in order to maintain floor contact without obstructing the funnel orifice.

Traps are set in the afternoon and retrieved the following morning. After removing the funnel, the contents are poured into a white pan and sorted. Most of the recovered arthropods remain briefly anesthetized but fleas and flying insects must be captured immediately, using a camel hair brush or aspirator, and placed in 70% ethanol. Ticks were transferred to empty vials and stored in a cool location, or preserved as above. A field number was assigned to each trap containing arthropods and the specimens described.

Traps were set over six nights in May and June of 1984 in locations within and adjacent to the Lane Mountain study plot, north of Barstow, San Bernardino County, California (35° 02' N by 116° 57' W) and near a site where ticks had been reported on tortoises (Ryckman and Kohls 1962), north of Hi Vista, Los Angeles County, California (34° 47' N by 117° 44' W).

Burrows were categorized on the basis of shape, size, feces, number of entrances, or observation of inhabitants. Woodrat nests were recognized by construction. Although it was rarely possible to determine the immediate state of occupancy, obviously collapsed or debris-filled tortoise cover sites were recorded as inactive. The sampling frequency of various domicile categories was not numerically representative as rodent holes were frequently ignored while fox dens and owl nests were actively sought. Traps were washed after each use and the reservoirs cleaned between excursions. Several vertebrate burrow occupants were observed to behave normally after overnight exposure to the attractant, suggesting that this method of parasite collection may be less detrimental to potential hosts than trapping and examining them.

TABLE 1.—Soft tick (*Ornithodoros parkeri*) infestation rates as determined by carbon dioxide (dry-ice) traps placed in vertebrate burrows.

Type of burrow, den, or nest	Trap-nights	Percent with ticks %	Number of ticks in each trap	Mean $\bar{X}$	Standard deviation
Kit fox natal den	12	75	83, 37, 15, 14, 5, 3, 2, 2, 1	18.0	26.9
Burrowing Owl burrow	8	75	55, 8, 7, 4, 1, 1	12.7	20.9
Active tortoise burrow	14	43	20, 6, 3, 3, 2, 2	6.0	7.0
Other types of carnivore dens	10	10	1	1.0	Not applicable
Burrows of other rodents	41	10	6*, 6, 1**, 1	3.5	2.9
Woodrat middens	10	0			
Inactive tortoise burrow	7	0			

* These ticks were taken from a rodent burrow within that of a tortoise.

** This tick was in a rodent tunnel 4 m from an infested owl burrow.

TABLE 2.—Probability of obtaining the previously observed results, assuming that the soft tick infestation rate, of the burrows being compared, is actually equal. Calculated using the Fisher Exact Test.

Type of burrow	Kit fox natal	Burrowing Owl	Active tortoise	Other carnivore	Small rodents	Woodrat middens	Inactive tortoise
Kit fox natal	. . .	N.S.	N.S.	<.005	<..001	<.001	<.005
Burrowing Owl			N.S.	<.05	<.001	<.005	<.01
Active tortoise				N.S.	<.05	<.05	N.S.
Other carnivore					N.S.	N.S.	N.S.
Small rodents						N.S.	N.S.
Woodrat middens							N.S.
Inactive tortoise							. . .

RESULTS

Unengorged *Ornithodoros* (*Pavlovskyella*) *parkeri* Cooley 1936 (identified on the basis of Cooley and Kohls 1944, Clifford et al. 1964, and Furman and Loomis 1984) were the most frequently recovered ectoparasites represented by 18 larvae (6.3%), 253 nymphs (87.4%), and 18 adults (6.3%). Although one trap held 83 of these acarines, 20 of the 26 samples consisted of fewer than 10 ticks, averaging 2.8 per trap-night and 11.1 per positive trap. Table 1 summarizes these data.

The infestation rates (Table 1) were statistically evaluated (Fisher Exact Test; Zar 1974) by pairing each burrow type and calculating the probability of obtaining the observed results (null hypothesis: the infestation rates are actually equal). The matrix presented in Table 2 summarizes this analysis.

Approximately 36 fleas were retrieved from four carnivore burrows and identified as either *Echidnophaga gallinacea* or *Pulex irritans*, species previously reported in association with the kit fox (Egoscue 1962, Morrell 1972). A late stage nymph of the hematophagous ambush bug *Paratriatoma hirsuta* (det. E. L. Sleeper) was collected from a desert woodrat (*Neotoma lepida*) nest near Lane Mountain on 24 May 1984. The observation that engorged ectoparasites were infrequently attracted suggests that repeated treatments would be required to control the tick population within a burrow, and that this method is best utilized for sampling.

DISCUSSION

Members of the family Argasidae are often found in the nests of vertebrate species that annually use the same domicile. As an adaptation to hosts which are migratory or that seasonally shift habitations, many of these ectoparasites may become torpid until aroused by the detection of some host stimuli (Harwood and James 1979). Francis (1938) reported that several adults of *O. turicata* fed normally (and transmitted relapsing fever spirochaetes) after five years without sustenance, and remained alive for at least two more years. Although dependent on many factors, the facilitative dormancy and multistadial development of these acarines indicate that they may have a life span of more than a decade. Most published records of *O. parkeri* have been from the excavations of colonial rodents and Burrowing Owls, domiciles that are occupied for decades by successive generations of hosts (Jellison 1940, Cooley and Kohls 1944, Miles 1968). This combination, of tick longevity and habitual tenancy of a host species within the domicile, appears to have produced the observed infestation pattern.

Although kit foxes (*Vulpes macrotis*) were neither examined nor previously implicated as hosts for *O. parkeri*, this study found that 75% of their natal dens were tick infested. These excavations, which have multiple entrances, are generally older than single-mouthed daily shelter burrows (O'Farrell and Gilbertson 1979). Complete life history data remain unavailable, but it is believed that these domiciles are used irregularly except for the three months following whelping. During this period, the altricial offspring of these canids are probably affected by ectoparasite activity and because of their size, can sustain large soft tick populations. Egoscue (1956) noted that natal dens were frequently abandoned when the pups were half grown and speculated that the build-up of ectoparasites might be responsible. Consequentially, it is not remarkable that the highest burrow infestation rates were associated with these habitually occupied excavations.

O. parkeri were found to inhabit half of the 18 Burrowing Owl (*Athene cunicularia*) burrows surveyed in Washington state (Jellison 1940). This observation, based on a migratory population, contrasts with that of the present study, which estimated that 75% of the resident owl domiciles were infested. However, the importance of discontinuous host tenancy should not be discounted as Jellison also reported removing 318 ticks from a burrow which had veen used by nesting owls annually for 32 years.

The cover sites of desert tortoises can be separated into short-term, perennial, and winter den classes. The former predominate in Utah, where the activity of cattle, sheep, and rodents frequently cause them to collapse (Woodbury and Hardy 1948) and probably prevent the establishment of viable tick populations. However, the adjacent, diuturnally inhabited, winter dens were tick infested (Woodbury and Hardy 1948). At the Arden Study Area in Nevada, Burge (1978) found that 83% of the excavations inhabited by tortoises in 1974 were also utilized in 1975. This annual host occupancy pattern favors argasid colonies and probably contributed to her observations of soft ticks on several of these reptiles and in the sand lining their tunnels. No winter dens were located in the present study and, while larval, nymphal, and adult ticks were seen on only 5 of the 50 chelonians inspected, 43% of the

tortoise burrows were infested. This suggests that many of these cover sites were occupied annually by *Gopherus agassizii* and perennially by *O. parkeri*.

In contrast to the previous burrows, several domicile categories were infrequently infested and presumedly unsuitable for active colonies of *O. parkeri*. As an example, inactive (collapsed and debris-filled) tortoise cover sites often contained more than 10 cm of eroded sand. Because soft ticks estivate in the loose sand lining the tunnel floor, until hosts become available, the additional material may insulate them from the carbon dioxide attractant, preventing their normal response, and effectively entomb them.

The "other carnivore" category consisted primarily of the single entrance dens typically used as daily shelters by adult kit foxes and other large mammals. Although several fleas were trapped within one burrow, a single soft tick was the only acarine recovered. Unlike natal dens, these excavations are of recent construction and are apparently abandoned when conditions become unfavorable. The lack of susceptible hosts and their brief occupancy seemingly renders these domiciles unsuitable for argasid colonization.

Small desert rodents, which are primarily non-colonial, construct, utilize, and abandon numerous burrows each season. Once unoccupied, these domiciles rapidly deteriorate impeding the multi-stadial development of argasids. Carbon dioxide trapping was attempted in 41 of these shelters and resulted in the recovery of 14 nymphal *O. parkeri* from four excavations. Of these acquisitions, 6 ticks were in a tunnel branching from the bottom of a tortoise cover site and an additional individual was retrieved from a burrow located 4 m from an infested Burrowing Owl nest. These observations suggest that the refugia of small desert rodents do not commonly sustain the populations of *O. parkeri* which are frequently found in the perennial colonies of some ground squirrels and prairie dogs (*Spermophilus* spp. and *Cynomys* spp.).

Woodrats construct their middens by accumulating a palisade of sticks and cacti around their nest. Once assembled, successive generations of rats inhabit and maintain these structures so that they are often extremely old and may contain a variety of ectoparasites. However, these domiciles are apparently unsuitable for *O. parkeri* since none were collected, nor were any records of this association found. *N. lepida* nests, in areas of Utah and California thought to be inhabited by *O. parkeri*, have been reported to contain other soft ticks such as *O. sparnus* (Kohls and Clifford 1963). This includes a midden in the Kramer Hills, an area that is comparable and interjacent to the locations trapped in this study (Furman and Loomis 1984).

In summary, *O. parkeri*, like many argasids, primarily infests domiciles that are annually inhabited by potential hosts. Those animals that exhibit this diuturnal pattern of burrow occupancy, such as kit foxes, Burrowing Owls, and desert tortoises, are then parasitized by the soft tick. Few *O. parkeri* were trapped in woodrat houses, collapsed desert tortoise cover sites, or transiently inhabited excavations.

Once established within a burrow, the size and stadial diversity of a soft tick population is linked to the recent host occupancy. Following the successful whelping/fledging of young foxes or owls, a large and heteroge-

neous colony of ticks should be present. As hosts fail to reinhabit the excavation, the parasites succumb to starvation and the population declines. In the case of late-stage nymphs and adults, this die-off may last several years and be responsible for the large standard deviations presented in Table 1.

The "boom or bust" cycle, suggested in the previous example, is less apparent in the recoveries from desert tortoise burrows. Furthermore, although soft ticks were observed to feed on tortoises in the lab and field, most of those captured on wild tortoises were unengorged but fed readily when placed on suckling mice. These observations suggest that *G. agassizii* is less vigorously exploited by *O. parkeri* than are the young of suitable endothermic hosts.

Soft ticks generally attach, engorge, and depart from their hosts within an hour and are rarely encountered away from the nidus. Occasionally, some individuals do remain attached for hours or days, and may be disseminated if the host resumes surface activity. This dispersal mechanism, in which transfer is incidental to the parasitic event, is especially credible in the case of Burrowing Owls which freguently fly to adjacent excavations, thus providing any attached ectoparasites with rapid transport into a favorable environment.

Unlike other hosts, desert tortoises are often observed with clusters of soft ticks on the rear of their carapace or where damaged and overlapping scutes provide sanctuary. Although some ticks were obviously imbibing from between the seams, most had their mouthparts free and were not attempting to feed. These congregations of unengorged *O. parkeri* were often covered by dust or mud and appeared to have remained on the tortoise for an extended period. The probable cause of this gathering is an assembly pheromone similar to that emitted by *O. (P.) tholozani* (Leahy et al. 1975). It is associated with recruitment of sexual partners, locating oviposition and resting sites, and assisting in host detection. Briefly, a tick that fortuitously locates on a non-abraded part of the carapace will begin to secrete the pheromone alluring other recently disturbed individuals to the site and inducing further aggregation. Since tortoises visit 10 or more cover sites per season (Burge 1978), ample opportunity exists for the cluster to colonize previously uninfested burrows. This passive dispersal mechanism does not require host detection or feeding and would be a type of immigration rarely observed among the argasids.

CONCLUSIONS

The results of this study indicate that the use of a carbon dioxide trap is an efficient means of sampling the soft tick *O. parkeri* and other nidicolous ectoparasites that are associated with burrowing vertebrates. The trap is easy and economical to construct, transport, operate, leaves both the parasite and host unaffected, and eliminates the need for collecting and examining potential hosts. Using this device, 43% of desert tortoise burrows were found to be infested with *O. parkeri*. This figure is fourfold greater than was estimated from carapace inspections. Most kit fox natal dens (75%)

and Burrowing Owl burrows (75%) were also infested, occasionally with large numbers of ticks. Argasids were rarely located in old/inactive tortoise burrows, carnivore daily shelter dens, woodrat middens, or the tunnels of small desert rodents.

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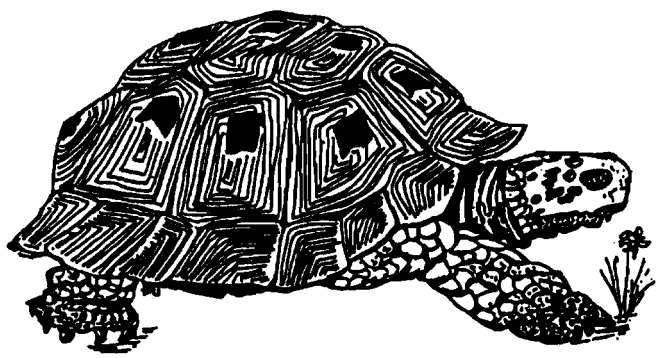

Desert Tortoise Council Symp. Proc. 1985:91-99

NESTING OBSERVATIONS OF FREE-LIVING DESERT TORTOISES (*GOPHERUS AGASSIZII*) AND HATCHING SUCCESS OF EGGS PROTECTED FROM PREDATORS

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Abstract.—In the eastern Mojave Desert near Goffs, California, egg production of 26 female desert tortoises (*Gopherus agassizii*) was monitored by X-rays at ~10-day intervals between 8 April and 9 July 1984. Twenty-five females produced at least one clutch. Of 23 females monitored for the entire period, 14 (61%) produced a second clutch. The average clutch size was 4.28. From X-ray evidence we predicted approximate laying dates. Nests were located by radiotracking females. Of 26 nests, only 1 was not associated with a burrow. After 11 clutches were destroyed by predators, most within a few hours after laying, we shifted our emphasis to potential hatching success, and clutches thereafter were protected from predators. Fourteen clutches were removed from natural nests and placed in cages designed to provide soil conditions and temperatures comparable to natural nests, while protecting eggs from predators and enabling hatchlings to exit. During September and October, 46% of the caged eggs hatched; 30% are overwintering. Final values of fetal death, fertility, and hatching success will be determined in the spring of 1985.

INTRODUCTION

Much of the habitat of the desert tortoise has been and continues to be seriously disturbed by human activities. One source of impacts is the development of energy facilities, including solar and photovoltaic energy projects that may require several hundred square kilometers of lowland desert habitat over the next 20 years. Such projects would disturb or destroy desert tortoise habitat. Southern California Edison Company needed data on dynamics of natural tortoise populations to understand potential impacts of energy development and to develop mitigation measures. In 1983 they began supporting research on a desert tortoise population, with emphasis on recruitment and mortality (Turner and Berry 1984). This paper deals with part of the 1984 work—nesting observations, some physical attributes of nesting locations, and hatching success of eggs protected from predation.

METHODS

Study Sites

The study site is in Fenner Valley southwest of Goffs, San Bernardino County, California, about 56 km (35 miles) west of Needles. A description of the study area and details of site development are in Turner and Berry (1984).

Egg Production

We monitored tortoise egg production by X-radiation using methods described by Gibbons and Greene (1979). Twenty-six adult female tortoises (189-246 mm carapace length) bearing radio transmitters were recaptured at ~10-day intervals between 8 April and 9 July 1984. For details of radiotelemetry, X-ray equipment, and general procedures see Turner and Berry (1984). Records of 23 of the 26 females were sufficient to calculate clutch frequencies. Three females could not be located during part of the season due to faulty transmitters. Data from these three females were only used in calculations of mean clutch size.

From the cycles of egg presence and absence evident in the X-rays of 19 females monitored in 1983, we predicted in 1984 that laying would occur 18 to 23 days after the first appearance of eggs. The six-day range in predictions was partly a function of the interval between X-rays. We referred to this period as the "laying window."

Locating Nests

To locate nests, we followed females beginning a day or two prior to their laying window. From our field observations of predator-excavated nests in 1983 and from the few reports of nesting in free-living tortoises, we knew that nesting commonly occurs inside tortoise burrows but may occur elsewhere (Berry 1974, Burge 1977). For this reason several daily checks of each female were made during the periods she was likely to be aboveground. Our observations of egg laying and the descriptions by Lee (1963) and Burge (1977) indicated that the complete process of nesting requires at least two hours. These factors determined the frequency of our location checks. For logistical reasons it was not possible to check all females.

When we discovered that most females were nesting in burrows, we did not have to locate them as often. We concentrated on checking for nests in burrows that were used by these females. Checking for nests involved reaching inside the burrow as far as possible, gently digging through the soil by hand, working toward the opening, feeling for the tops of the uppermost eggs. If the soil of the apron just outside the opening was loose or showed signs of fresh disturbance, it also was checked. We checked burrows in the morning after the tortoises emerged, and again in the late afternoon after the tortoises emerged from their mid-day retreats. If a tortoise did not emerge for one or both activity periods, we checked as much of the burrow channel as we could without disturbing her. Tortoises usually faced into their burrows

while resting. If a female did not emerge after assuming a face-out position, she was watched closely for shifting movements that might indicate nesting. The burrow was then examined as soon as possible after she had emerged or had turned facing into the burrow.

Facing directions (aspects) of openings of burrows nsed for nesting (n = 97) were recorded as one of eight cardinal directions. Nests other than those observed while monitoring females with transmitters were indicated by eggshells exposed by predators. Aspects of 100 additional burrows in current use were also recorded. Differences in aspects of these two groups were tested for goodness of fit against a random distribution using the log likelihood ratio test (G-test) with Williams correction.

Determining Hatching Success

Of the first 10 nests located, 7 had been excavated by predators. For this reason we changed our emphasis to potential hatching success of clutches protected from predators. We built protective cages 0.6 m in diameter and

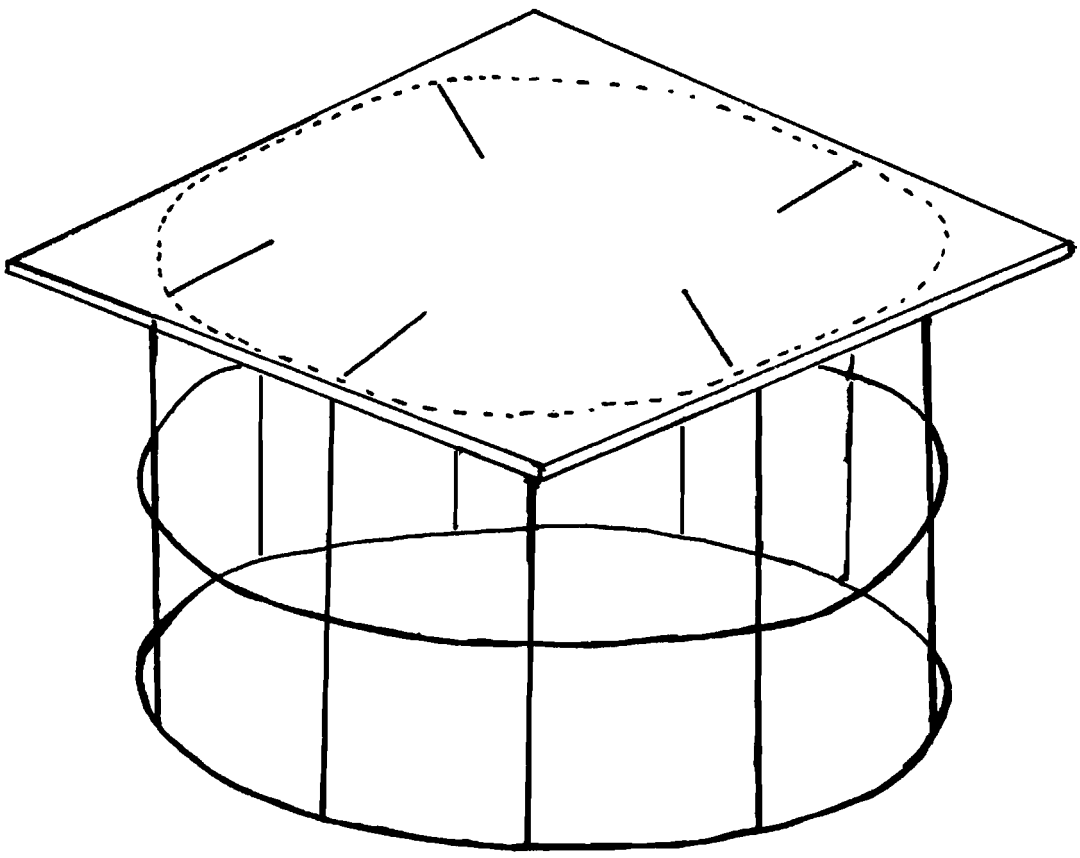

FIG. 1.—Reenforcing wire frame and lid of cage used to protect tortoise eggs at Goffs in 1984. Poultry wire not shown.

0.3 m high. The vertical wall and bottom of each cage was of poultry wire (2.5 cm mesh) with vertical support provided by 10 gauge concrete reinforcing wire (Fig. 1). We placed the cage within a few meters of the natural nest on the north or east side of a creosote bush (*Larrea tridentata*). The cage bottom was set 17 cm below the soil surface. About 8 liters of soil surrounding the eggs in the natural nest was removed. A layer of this soil, 3 cm deep, was placed in the middle of the cage floor and the eggs were placed on it at one level, touching each other. This was 10-14 cm below the level of the desert surface. Choice of this depth was based on natural nest depths. The remaining soil was added to surround the sides and top of the eggs. The soil level inside the cage was raised to that outside by adding soil that had been removed to make the cage hole. A cardboard liner was placed against the inside surface of the cage, with about 12.5 cm extending below soil level, and 7.5 cm above. The liner served to direct the hatchlings to a single hatchling-sized opening that we cut in the cardboard and cage wire at ground level. Tortoises typically attempt to go directly through a barrier if they can see through it. The cardboard prevented injuries. For security and shade a pegboard lid was affixed by threading the free ends of the reinforcing wire cage supports through holes in the cardboard and bending them at right angles to hold the lid firmly against the cage rim. This allowed easy removal for access to the cage interior.

Transfer of eggs to cages was done during the cooler hours of the day. Eggs were moved singly, not rotated during transfer, and were exposed to ambient conditions for about 1 to 3 minutes.

Tracking of females, checking for nests, and caging of eggs extended from 11 May to 3 July — the period of egg laying. We found 15 intact nests with 61 eggs laid by 12 individuals. Four eggs from two clutches broke during laying and were not transferred to cages. One clutch contained only one egg so it was caged with another clutch. Thus 57 eggs were placed in 13 cages.

Cages were examined for signs of hatching at least every third day between 13 September and 8 October. The cages were checked again on 1 November.

Estimates of the stages of development of embryos and dead fetuses in eggs opened in the fall of 1984 were made by comparing their appearance with the photographic series of developing *Chelydra serpentina* (Porter 1972) incubated at a constant temperature. Adjusting for difference in total incubation period was done by calculating the corresponding stage as an equal proportion of the total period.

RESULTS

Egg Production

Only one of the 26 females with transmitters did not produce eggs. Of the 23 females monitored for the entire laying season, 14 (61%) laid 2 clutches. Clutch size ranged from two to seven. The mean size of the first

clutch was 4.29, the second 4.27, and the overall mean clutch size was 4.28. Mean clutch frequency was 1.57. In 1983, the overall mean clutch size was 4.17 and the mean clutch frequency was 1.89 (Turner and Berry 1984).

Characteristics of Nests

We observed 26 nests of transmittered females. Twenty-four were 1-60 cm inside burrows ($x = 24$ cm $\pm$ 15 [S.D.]). One nest was 5 cm in front of a burrow concealed under a dense canopy of white brickelbush (*Brickellia incana*). The single nest not associated with a burrow was located at what appeared to be an old pallet or predator excavation under shrub canopies. Two nests were presumed to be more than 60 cm inside burrow openings and two others inside active kit fox dens. These four could not be reached so were not confirmed.

Tortoises used both established burrows and freshly dug burrows for nesting. Burrow length varied but in late spring females tended to use longer burrows for nesting and general use than in early spring, often 100 cm or more in length.

Both the observed distribution of aspects of nesting burrows and other burrows differed significantly from a random distribution. The values respectively were $G = 21.0 > X^2_{.005[7]} = 20.3$ and $G = 17.9 > X^2_{.025[7]} = 16.0$. The two sets of burrows were tested for homogeneity using the G statistic test for independence. They did not differ significantly: $G_H = 3.5 > X^2_{.9[7]} = 2.8$.

Burrows with northerly aspects (N, NE, and NW) were found to be fewer than expected. To investigate the non-northerly trend, the burrow aspects were grouped into two classifications: northerly as above, and non-northerly (S, E, W, SE, and SW) and tested to determine if they differed significantly from a random distribution using a two-way table with G-test and Williams correction. The nest and other-burrow aspects tested at a higher significance than when aspects were not grouped. Nest burrow aspect values were: $G = 14.6 > X^2_{.001[1]} = 10.8$, and other-burrow aspects: $G = 9.6 > X^2_{.005[1]} = 7.9$. The two burrow types still showed no significant difference when compared with aspects grouped: $G = 0.4 > X^2_{.9[1]} = 0.02$. Thus, the aspect distributions of burrows used as nests and other burrows both differed from random, and, the two distributions did not differ from one another. There was no apparent correlation between aspects of nest burrows and distances of nests from openings.

Nesting Behavior

We observed actual egg laying only once — the nest that was not associated with a burrow. When the female was encountered at 0854 h, she had almost finished digging her nest hole. She seemed oblivious to what was going

on around her. Her behavior did not change, even with the approach of an observer to within 0.6 m.

Nest Predation

Predators included coyotes, kit foxes, and possibly badgers and skunks. On two occasions nests apparently were excavated while the tortoises were in the burrows. Predation generally occurred at night. Only one of the seven clutches for which we knew laying dates was preyed upon after seven days. This was the only nest away from a burrow. It was excavated between 7 and 11 days after deposition. The only sign of predator interest in the cages was what appeared to be a shallow mammalian excavation at the outer edge of one cage, and an occasional kit fox scat on lids.

Hatching Success

By 13 September hatching had begun, and it continued through early October. On 29 September we dug to egg level and candled intact eggs.

TABLE 1. — Fate of 57 eggs incubated in 13 artificially protected nests at Goffs in 1984.

Cage number	Number eggs in cage	Number eggs hatched	Eggs opened		Eggs unopened
			Development apparent prenatal death	No development apparent	Condition not known as of 1 April 1985
N3	5	0	2	0	3
N6	6	5	1	0	0
N8	5	3	1	0	1
N15	3	0	1	2	0
N18	5	5	0	0	0
N21	4	3	0	0	1
N23	5	1	2	0	2
N25	4	0	0	0	4
N26/24*	4	2	2	0	0
N27	3	0	0	3	0
N28	5	0	0	0	6
N29	4	4	0	0	0
N30	3	3	0	0	0
Totals	57	26	9	5	17

* N24, a single egg, was placed in cage N26.

Fourteen that exhibited little or no development or contained dead or dry contents were opened and examined. The rest were replaced.

The results of incubation as of 8 October are shown in Table 1. No hatching occurred after 8 October. Of the 14 caged clutches, 8 (57%) produced 1 or more hatchlings. Total hatch occurred in 3 clutches (21%) and partial hatch in 5 (36%). Five eggs (9%) showed no development, 9 (16%) contained embryos or fetuses estimated to have died at developmental stages of about four weeks and near term, and 26 (46%) hatched. As of 1 April 1985, 17 (30%) remain in cages with the possibility that some may hatch during spring of 1985.

Incubation Periods and Hatchling Behavior

For many eggs we only have approximate incubation periods because hatching had started before our September cage checks, checks were not daily, and emergence holes were not always distinct. We were reluctant to dig to egg level during checks because we knew from experience with captives that eggshells near term are thinner than when laid and may crack from the slightest external pressure. We observed the tendency to crack in several pipping eggs, and where fetuses had died near term. The shortest incubation period of which we are certain was between 84 and 88 days; the longest of which we are certain, 97 days. After pipping, two or three days elapsed before hatchlings came to the surface. Most eggshell fragments remained below the surface. Hatchlings apparently found their way out of the cages without difficulty. Most were not seen after hatching despite careful searches of a 10 m radius around the cages.

DISCUSSION

Burrows used for nesting appear to reflect preferred aspects of burrows in general for April, May, and June. The aspects may be affected by the slope of the bajada which is to the south at about 2 percent and/or have thermal implications.

Nest construction and egg laying in both captive (e.g., Miller 1932, Grant 1936, Stuart 1954, Lee 1963) and wild desert tortoises (Berry 1974, Burge 1977) have been described. Ehrenfeld (1979) reported that oblivion to outside disturbance is widespread among tortoises, fresh water turtles, and sea turtles. It has also been reported in desert tortoises by Miller (1955) and Lee (1963). We do not know at what point in the egg-laying procedure of desert tortoises that this apparent oblivion begins.

Auffenberg and Weaver (1969) found that predation on eggs of *Gopherus berlandieri* and *G. polyphemus* is apparently highest within seven days after deposition. Landers et al. (1980) reported that of 73 unprotected *G. polyphemus* nests, 65 (89%) were destroyed by predators shortly after laying.

Hatching success in protected tortoise clutches has been reported. Landers et al. (1980) reported that 86% of the eggs in protected *G. polyphe-*

mus nests hatched. Swingland and Coe (1978) found a 60% emergence success for *Geochelone gigantes* on one Aldabran island, and 80% on another island. Fowler de Neira and Roe (1984) reported an emergence success of 65% for *G. elephantopus*. Data from natural *Gopherus agassizii* nests are as follows: one complete clutch hatch (Berry 1974); one 50% hatch (Burge 1977); and one complete hatch (Burge, BLM files, Ivanpah Valley permanent study plot, 1977). There is one account of incubation period duration in a natural nest in the eastern Mojave Desert. Burge (1977) reported 98 or 99 days for the one nest she monitored.

CONCLUSION

Final values of fetal death, fertility, and hatching success from the cages at Goffs will be determined in the spring of 1985.

We believe that closely following females and moving eggs to the protection of cages is an effective method for preventing predator destruction when predation prevents gathering adequate data on natural hatching success.

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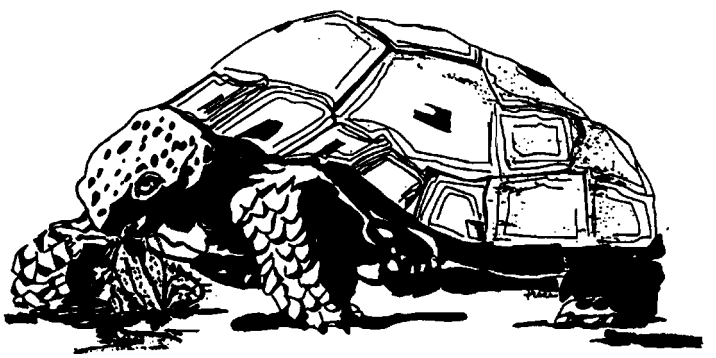

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CAPTIVE REPRODUCTION OF LEOPARD TORTOISES (*GEOCHELONE PARDALIS*)

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A female leopard tortoise (*Geochelone pardalis*) laid six clutches of 9 to 12 eggs between July and November of 1979, for a total of 61 eggs (Table 1). The eggs were collected as they were laid, placed in styrofoam egg cartons, and incubated at 85°F. The eggs hatched in periods varying from 118 to 161 days. Forty eggs hatched, giving a 66% hatch rate for the six clutches. Two hatchlings, born with deformed shells, died within the first year. The remaining 38 hatchlings are over 5 years old at this time.

As the tortoises hatched, they were left in the egg cartons until their yolk sacs were absorbed, and then were placed in heated terrariums. Each terrarium included Litter Green® as a substrate, a hot-brick-type reptile heater, a thermometer, and an incandescent light fixture. Early diet items for the hatchlings included weeds, flowers, soaked dry cat food, bean sprouts, tofu, high protein baby cereal, and a wide assortment of fruits and vegetables.

The hatchlings were marked in ink with a letter for easy identification. They were carefully observed daily to make sure that each animal was eating well, and were weighed each month. By the time they were 1½ years old, males could be distinguished from females by their greatly enlarged tails. By the age of five years, the plastrons of males were beginning to become concave.

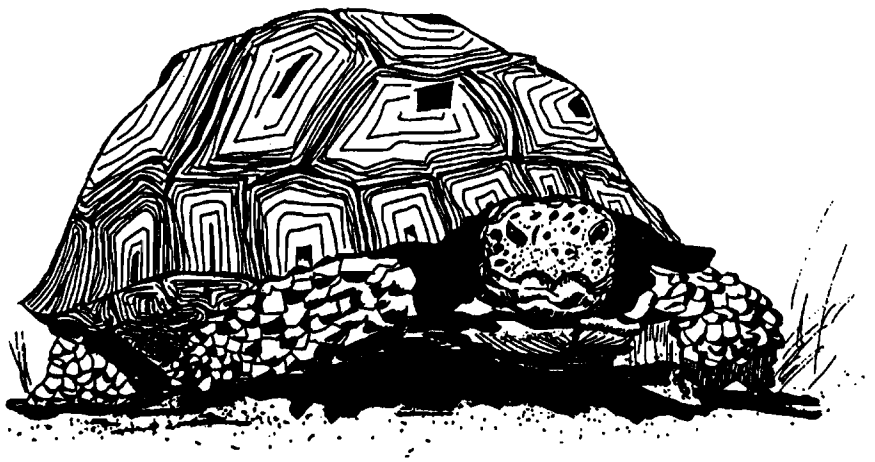
TABLE 1. — Leopard tortoise hatchlings from six clutches of eggs laid by one female between July and November of 1979.

Clutch No.	1	2	3	4	5	6
Number of eggs	11	12	10	9	9	10
Number hatched	6	7	8	5	4	10
Percent hatched (%)	54.5	58.3	80	55.6	44.4	100
Days to hatch	137	124	120	132*	118	131
	137	124	120	140*	123	133
	137	132	127	154*	130	133
	137	132	137	154*	137	135
	137	137	140	161*		135
	159	143	143*			135
		143	155*			135
			160			136
						142
						152

* = males

At this time, several of the animals were over 12 inches long and weighed over 20 pounds. Eighteen percent of the hatchlings turned out to be males. Males were clustered at the end of clutch 3 and make up all of clutch 4.

Males were observed actively mating with females before the age of three years, with most mating activity taking place when the air temperature was over 85°F. By the age of four years, several of the females began laying multiple clutches of eggs about 4 to 6 weeks apart, with clutch sizes varying from 5 to 15 eggs. Egg laying occurred between June and December. Most clutches were laid in the late afternoon and early evening. While only about 5% of these eggs hatched, this does demonstrate that a leopard tortoise, under optimum conditions of diet and care, can viably reproduce by the time it is five years old.



Desert Tortoise Council Symp. Proc. 1985:102-105

THE PETITION FOR FEDERAL LISTING AND THE FUTURE OF THE DESERT TORTOISE

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My purpose today is to explain why Defenders of Wildlife petitioned to have the desert tortoise listed by the federal government, the timetable for the U.S. Fish and Wildlife Service (FWS) decision on the petition, what we are doing to influence the FWS decision, and what you can do to help. Survival of wild desert tortoises into the next century may hang on the decision of the Fish and Wildlife Service to accept or reject the listing petition. I've brought copies of our petition, a letter by Dr. Robert C. Stebbins, and a flier with names and addresses of people to write to.

Defenders of Wildlife submitted a petition with the Natural Resources Defense Council and the Environmental Defense Fund to point out to the FWS that the Desert Tortoise Council's March 1984 status report[1] constitutes sufficient information to justify listing the desert tortoise as an endangered species throughout its remaining range. In fact, I believe the Fish and Wildlife Service got more than it bargained for in the status report. The status report represents more detailed information on distribution and population trends than has been available for most previous federal listings. I think it adequately demonstrates a problem and provides a good start on efforts to recover the species. Almost half a million dollars has been spent on research on the tortoise. If the Service is unable to act on the available information, it is unlikely they will ever act.

The tortoise has been a candidate species for federal listing since the 1977 petition from the Desert Tortoise Council to list the Utah population. To list the tortoise, the Endangered Species Act requires only that the best

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[1] Berry, K. H. (ed.). 1984. The status of the desert tortoise (*Gopherus agassizii*) in the United States. Report from Desert Tortoise Council to U.S. Fish and Wildlife Service, Sacramento, CA. Order No. 11310-0083-81.

available biological information indicate that the tortoise is in danger of extinction throughout a significant portion of its range. Those factors which must be addressed in making the listing decision are: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) uverutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or man-made factors affecting its continued existence.

We believe that more than sufficient information is available from the status report to show the tortoise has suffered past reductions in range and density and that the tortoise is under threat of further decline due to continuing habitat destruction. Furthermore, we believe that unless the species is listed and an intensive conservation effort initiated, the long-term prognosis for the desert tortoise will be bleak. Decisions on land use are being made now that are irreversible and that will materially affect the tortoises' chances of survival. The best available information indicates that large tracts of high-density good quality tortoise habitat are required for long-term conservation of the tortoise. As the federal government is the landholder for approximately 70 percent of remaining tortoise habitat, only federal listing will ensure that grazing, off-road vehicle use, mining and energy development, military construction and maneuvers, and road, highway or utility transmission corridor construction do not destroy the tortoises' chances of survival along with its habitat.

We petitioned to have the tortoise listed as endangered to emphasize that most remaining tortoise habitat are small, isolated fragments of formerly extensive areas, heavily impacted by human uses, and occupied by tortoise densities at most a tenth of former numbers. Only two areas of California may contain populations sufficiently large to minimize the gradual loss of genetic variability and maximize chances of long-term survival of wild tortoises. One of these areas is even now being considered by the U.S. Bureau of Land Management (BLM) for a land trade with the Southern Pacific Railroad.

Furthermore, the history of BLM's commitment to tortoise conservation suggests to us that listing as endangered is appropriate. The Utah population was originally proposed to be listed as endangered. In exchange for listing the Beaver Dam Slope population as threatened, the BLM proposed to reduce grazing by 23 percent, to cease grazing between April and September, and to establish a 3040-acre natural study area for the desert tortoise. The BLM has effected little or no reduction of grazing pressure, the fenced natural area was reduced by half in 1983, and grazing continues two months beyond the April limit.

Only Arizona still allows wild tortoises to be collected as pets. Because collecting of breeding adults can have potentially significant impacts on a long-lived animal with low reproductive potential, we believe that programs similar to those of California and Nevada to encourage adoption of captive animals should be implemented to substitute for collecting animals from the wild.

The FWS provisionally accepted the petition 14 December 1984. Regional

Offices in Portland and Albuquerque and the Washington, D.C., Office unanimously recommended that the petition be accepted as presenting substantial scientific information that the petitioned action may be warranted. They are required to promptly publish a notice in the *Federal Register* soliciting comments and to initiate a status review. The notice should be published shortly, because it has been approved and sent to the *Federal Register*. The status review must be completed and a final decision that listing the tortoise is warranted must be made by 14 September 1985. If the FWS makes a positive finding on the petition, they will then prepare a proposed rule. They are allowed to postpone publication of the proposed rule only if precluded by ongoing work on other listing actions. In practice we can expect that proposal to be published within a year or two. They have generally moved petitioned species to the top of their priority list and published the proposals fairly promptly. There is a one-year deadline after publication of the proposal to solicit public comments and hold any requested hearings before publishing the final rule. In sum, the listing process is a slow one and even if the petition is accepted, we do not expect the tortoise to be listed for at least another year.

We are distributing the status report to some tortoise experts outside of the Desert Tortoise Council and soliciting comments from them. We would encourage all of you to submit at least a one-page letter expressing support for the listing. Comments should be submitted by 1 June 1985 for maximum impact on the Service's deliberations. In writing you should state your professional qualifications and offer any additional detailed information that is not in the status report. If there is no additional data to be offerred, it would still be pertinent to cite the status report and reiterate critical points from the status report in a short, concise one-page letter. Letters should be addressed to Robert A. Jantzen, Director of the FWS. Copies should be sent to the regional offices of the FWS, to your Congressman, and to any professional societies of which you are a member. I brought a handout giving addresses.

We view expert comment as essential to forestall litigation over the listing, but if listing fails, expert comment is essential in the effort to establish an administrative record for the lawsuit. A finding that listing of the tortoise is not warranted is subject to judicial review to determine whether the decision was arbitrary or capricious in light of the scientific information available concerning the tortoise's biological status.

We need to begin fundraising now for the contingency that we will need to sue to force the listing. We estimate that it would take approximately $10,000 above and beyond Defenders' present budget for desert tortoise work to mount a successful litigation effort. Funds expended on this purpose have potentially a far wider impact than previous fundraising efforts to purchase individual tracts of habitat.

I am writing an interview with Dr. Robert C. Stebbins on the desert tortoise and the plight of the tortoise for *Defenders' Magazine*. The article and a direct mail appeal to our members will solicit letters of general support for the listing. Although the decision is supposed to be made strictly on biological grounds, we view these letters as important to counter political pressure from grazing or other economic interests. In addition it will be

helpful to generate as much support in newspapers, radio, and television for the tortoise listing as possible. I would be happy to help some of you with media and fundraising efforts. Please talk to me or leave your name on the sign-up sheet.

****

Letter to: Robert A. Jantzen, Director
U.S. Fish and Wildlife Service
Washington, D.C. 20240

Copies to: Rolf L. Wallenstrom, Associate Director Federal Assistance,
John L. Spinks, Chief, Office of Endangered Species,
U.S. Fish and Wildlife Service
Washington, D.C. 20240

Richard J. Myshak, Regional Director,
Wayne White, Endangered Species Specialist,
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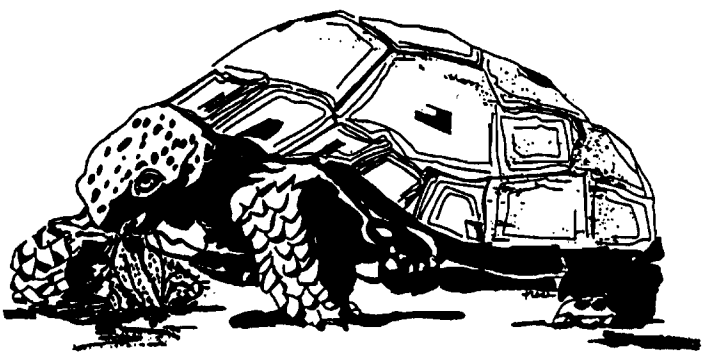
Galen Buterbaugh, Regional Director,
Don Rodgers, Endangered Species Specialist,
U.S. Fish and Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, CO 80225



Desert Tortoise Council Symp. Proc. 1985:106-107

THE U.S. FISH AND WILDLIFE SERVICE AND THE DESERT TORTOISE

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U.S. Fish and Wildlife Service
24000 Avila Road
Laguna Niguel, California 92677

The U.S. Fish and Wildlife Service (FWS) currently regards the desert tortoise (*Gopherus agassizii*) as a Category 2 candidate for Federal listing under the Endangered Species Act. Candidate species receive no protection under this act. Category 2 candidates comprise those species for which the FWS lacks information regarding status, distribution, and threats necessary to determine whether listing is warranted.

The listing process involves status reviews for Category 2 candidates. Information is gathered on past and present range, and population size. We examine the species based on the following listing criteria: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; and (5) other natural or man-made factors affecting its continued existence. We determine whether the degree of threats facing the species support listing. The FWS is required to annually review the status of all candidate species, and publishes a progress report on the progress of these listing actions in the *Federal Register*.

Under contract to the FWS, the Desert Tortoise Council has prepared a status report on the desert tortoise (Berry 1984). Additionally, the Defenders of Wildlife, the Natural Resources Defense Council, and the Environmental Defense Fund have petitioned the FWS to list the desert tortoise as endangered throughout its remaining range. This petition cited the status report prepared by the Desert Tortoise Council, stating that the report constitutes sufficient information to justify listing the tortoise. Therefore, the FWS is evaluating the petition to list the tortoise concurrently with the status evaluation already in progress. In this process, the FWS is reviewing the status report as well as other information available on the desert tortoise.

Two deadlines are to be met with respect to petitions to list species. First, the FWS has 90 days to decide if the petition presents substantial information that the action may be warranted (that is, whether or not to accept the petition). We have accepted the petition to list the desert tortoise. Second or finally, the FWS has 12 months from the date of the petition to make one of the following findings regarding the listing of the desert tortoise:

1) That the action (listing) is warranted. We would then proceed with a listing package. The listing may be precluded if, based on the national prioritization system, other listing actions take precedence. Thus, the tortoise would be reclassified as a Category 1 candidate, a species for which we believe we have the biological information needed to support listing.

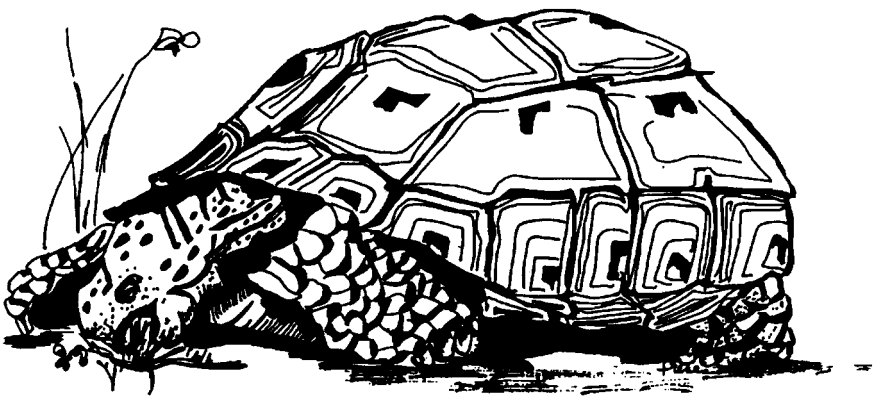
— OR —

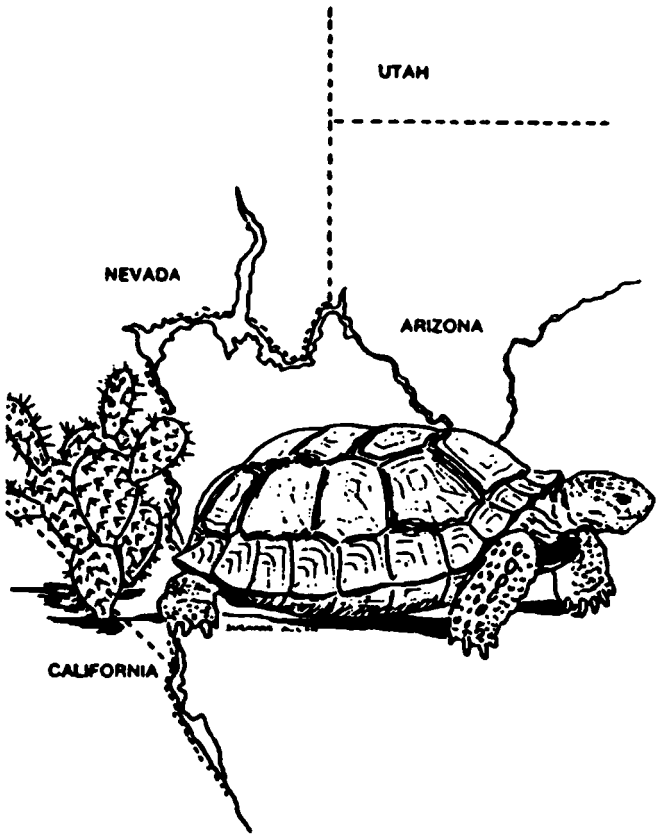
2) That the action (listing) is unwarranted. This decision can be made if there is a lack of information needed to make a decision (the tortoise would remain a Category 2 candidate), or if the degree of threat does not support listing at this time (the tortoise would be reclassified as a Category 3c candidate).

This decision will not be easy because the range of the desert tortoise encompasses portions of California, Nevada, Utah, Arizona, and Mexico; our evaluation must consider the entire range of the species. This range includes portions of Region 1 (Portland, Oregon), Region 2 (Albuquerque, New Mexico), and Region 6 (Denver, Colorado). The authority to respond formally to the petition rests in the Washington Office of the FWS. Region 1 is taking the lead on this complicated issue. Each regional office will gather information from its field offices. As the lead office, Region 1 will consolidate these comments and prepare recommendations to be sent to the Washington Office.

Reference

Berry, K. H. (ed.). 1984. The status of the desert tortoise (*Gopherus agassizii*) in the United States. Report from Desert Tortoise Council to U.S. Fish and Wildlife Service, Sacramento, CA. Order No. 11310-0083-81.





DESERT TORTOISE COUNCIL

APPLICATION FOR MEMBERSHIP

THE COUNCIL'S GOAL — To assure the continued survival of viable populations of the desert tortoise throughout its existing range.

Locations of the annual symposium and business meeting, usually held in March, will be varied to allow members from all areas to participate. Other meetings will be held as necessary; you will be notified of time and place. Minutes of all meetings will be sent to members.

DATE_____

NAME_____
Please Print

ADDRESS_____
Number *Street* *City*

_____ PHONE ( )_____
State *Zip Code* *Area Code*

I (We) hereby apply for the following membership:

( ) Regular ($8.00 per year)

( ) Student ($5.00 per year)

( ) Contributing ($20.00 per year)

( ) Organization ($25.00 per year)

( ) Lifetime ($150.00 or more)

ALL MEMBERSHIPS, EXCEPT LIFETIME, ARE RENEWABLE IN MARCH OF EACH YEAR.

Please make your check or money order payable to the DESERT TORTOISE COUNCIL and send with the application to:

DESERT TORTOISE COUNCIL
5319 Cerritos Avenue
Long Beach, California 90805