

# *sonorensis*

Arizona-Sonora Desert Museum Newsletter • Vol. 7, No. 3 • Fall 1986



Feature Article

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## THE DESERT TORTOISE

And Its North American Relatives

# MUSEUM NEWS

ARIZONA-SONORA DESERT MUSEUM  
NEWSLETTER • VOL. 7, NO. 3 • FALL 1986

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**sonorensis** is the Latin, scientific term indicating the species classification of many plants and animals of the Sonoran Desert region.

**On the cover:** Juvenile desert tortoise. Photo by Howard Lawler.

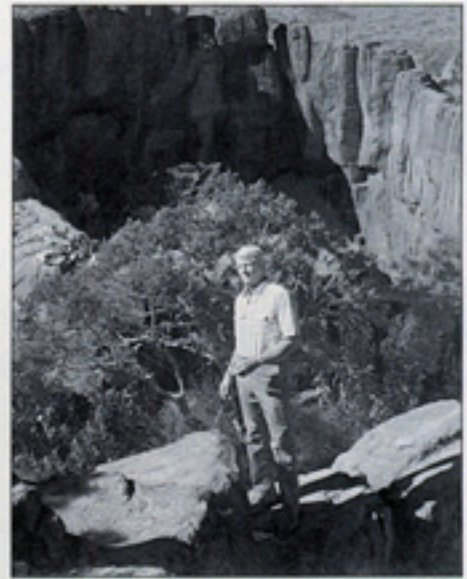
## FREE DAY

On December thirteenth, ASDM will end its membership campaign "DESERT MUSEUM MEMBERS BELONG: DO YOU?" with a free day at the museum. Staff, docents and members will be on the grounds with lots of energy and information about the desert's best lesson in natural history. Help us share the ASDM experience by letting all your non-member friends and neighbors know. Remember, if a new member uses your name to join the museum, you earn the number of guest passes a new member gets.

## Graves On The Mountain

**Peter Graves Narrates  
PBS Program Featuring  
Mountain Habitat**

Producers for "Discover: The World of Science" filmed a fifteen minute segment last July on the Mountain Habitat featuring ASDM Curators Peter Siminski and Mark Dimmitt. Hosted by Peter Graves, the segment will air in early December on all Public Broadcasting Service stations in the U.S.



DAVE BEAL

### *PRESIDENT'S REPORT*

## A Time To Retreat?

As I write this report the outside thermometer has reach 110°, matching Tucson's all-time record. The desert floor seems to hiss with heat, under a brittle blue sky. Time to retreat to an air-cooled corner and justify an I'll-do-it-later attitude?

Instead, against the summer background picture the following: Members and staff out and about gathering mesquite beans to later grind into flour; children of nine to twelve years in classes making friends with arthropods, small desert animals and birds; masked bobwhites going about the business of raising a family, understanding the advantage of thick grass and plentiful insects; teenage youngsters exploring geology on Mt. Lemmon, a real mine included; Curator Lawler and docents traveling with and explaining a mobile display on venomous animals; students and teacher on an earth sciences tour scrambling over sites in four mountain ranges; participants in a workshop harvesting and cooking saguaro fruit; children, after dark, led by our naturalists, exploring rainpools on Toadwatch Night; nightstalking members of all ages out in the night with tarantulas, snakes and assorted creepy crawlies; grounds staff members

endlessly pruning, clearing and renovating our native plants as they rush to grow and take advantage of the hot days they know to expect; bear cubs doing some heavy renovating in their own style, breaking and chewing on carefully nurtured trees and plants; and our desert creatures large and small going about their daily lives in the usual way because this part of the world is where they belong.

All of this activity and more has been taking place this summer at the Arizona-Sonora Desert Museum. The study of the value of the natural environment of the Sonoran Desert is our most important mission. Along with education and interpretation, quality research, too, is a vital component in the process of carrying out that mission. This issue of *sonorensis* should add to the reader's awareness of the importance of first class research.

I look forward to working with the outstanding staff and volunteers of the living museum in the year ahead. My love affair with this institution began on the day it began, and I am deeply grateful for the opportunity to serve as President.

Natalie Y. Davis, President  
Board of Trustees

## DIRECTOR'S REPORT

## IMS Grant To Boost Membership

Because the success of the Desert Museum's long range plans depends upon a broad based membership increasing at a rate equal to the Tucson metro area growth rate, we begin our new fiscal year with a renewed commitment to achieve this balance.

In early June of '86, the museum was informed by Senator Barry Goldwater's Washington office that a grant submitted to the Institute of Museum Services for general operating support, fiscal 86-87, in the maximum award amount of \$75,000 was approved. As an independent agency within the executive branch, IMS is the only federal agency that provides general operating support for museums of all disciplines; its award was based on the strength and quality of the ASDM's responses to the application questions. Quality for this competition was defined as "the judicious management of the museum's available resources to provide the best possible services to its community and the general public."

With this continued attention to quality programs and services, ASDM accepts the award with the intent to promote steady growth and broaden our support base within the community. As stipulated in the grant IMS funds will be used next year to implement the most aggressive membership campaign the museum has ever undertaken.

Three generations of Tucsonans have

benefited from museum programs; children attending school from grades K-12 are exposed to the museum's outreach at least once, probably more. For this reason Tucsonans are some of the most environmentally aware people in the United States with a profound sense of belonging. On December thirteenth we will culminate the membership campaign, "DESERT MUSEUM MEMBERS BELONG: DO YOU?" with a free day at the museum inviting everyone to become a part of the museum experience by taking advantage of the desert's best lesson in natural history.

In keeping with the museum's investigations of natural history through scholarly research, this issue of *sonorensis* features the work of paleoecologist, Tom Van Devender, Ph.D. and Curator of Small Animals Howard Lawler. In their discussion of the fossil history and modern ecology of the desert tortoise, we are reminded of our highest priorities of conservation and our commitment to the management and preservation of natural habitats. I'm sure you'll benefit from the reading of this on-going research and I again invite you to join us in our campaign to share the Desert Museum experience.

Dan Davis  
Director, ASDM

## Earth Sciences SPECIALS

Earth Sciences Holiday Specials will be part of the extra interpretive programming offered by the center's staff and museum docents once again. Programs are designed for all ages, in particular, family units. Cost is only \$3.00 for the first family member, and \$1.00 for each additional family member. Call the Earth Sciences Center at 883-1380,

ext. 266, to get on our registration list. Additional information will be sent as soon as we have your name and address.

"Monsters Through The Ages"—October 25 from 9:00 a.m. to Noon. This Halloween program will give you the opportunity to learn about some of the strange creatures that called Earth home ages ago.

"Christmas In The Desert"—December 20 from 9:00 a.m. to Noon. Experience an interesting combination of the Christmas season, the desert, and the earth sciences.

## "The Desert Speaks" with Lauray Yule

### ASDM/KOLD-TV Launch New Television Program This Fall

Beginning in late September or early October this year, the Desert Museum and KOLD-TV, Tucson's local CBS affiliate, will premiere a new half-hour weekly television program entitled, "The Desert Speaks." Per the museum's agreement with KOLD-TV the program will be taped on location at the Desert Museum and will air at a regularly scheduled time to be determined on either Saturdays or Sundays between 8:00 a.m. and 6:00 p.m.

Major responsibility for production and coordination of "The Desert Speaks" will be assumed by Lauray Yule who joined the ASDM staff on August 25. Ms Yule came to the museum with a strong background in natural science and television production. She earned a B.A. in Journalism at the University of Wisconsin with a special emphasis on science communications. For three



ASDM "The Desert Speaks" Co-Host/Coordinator Lauray Yule.

years she produced and moderated a public affairs program at the Public Broadcasting Service station in Redding, California. Prior to joining the ASDM, Ms Yule worked for two years as Special Assistant to the Director of Steward Observatory at the University of Arizona.

Joining Lauray Yule as Co-Host of "The Desert Speaks" will be KOLD-TV weatherman Jimmy Stewart, a popular Tucson television personality and veteran radio/television professional.

# THANKS TO 'SUPPORTING MEMBERS'

Eighteen months ago your Board of Trustees established new categories of membership for those interested in supporting the ASDM annually in amounts of \$100 or more. We gratefully acknowledge and sincerely thank the following Supporting Members as of July 31, 1986:

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# THE DESERT TOR

And Its North



Native and introduced grasses comprise the bulk of the desert tortoise diet. Otherwise, they eat any available edible plants including spring and summer annual wildflowers, forbs, and cactus fruit.

by Howard Lawler, ASDM Curator of Small Animals

*The tortoises comprise the turtle family Testudinidae consisting of thirty-nine living species in ten genera. Today, tortoises are found in Asia, Europe, Africa, oceanic islands and the Americas. Included among these are two gigantic forms, the well-known Galapagos tortoise (Geochelone elephantopus) of the Galapagos Islands in the Pacific Ocean and the Aldabran tortoise (G. gigantea) of the Seychelles Islands in the Indian Ocean. Given the long evolutionary history of tortoises in North America and the dynamic environment of the last thirty million years, it is indeed remarkable that the morphologies of the four living North American tortoises have changed so little from their ancestors. One of these, the desert tortoise (Xerobates agassizii Cooper) is found throughout much of the Sonoran Desert region and is therefore of special interest.*

*Tortoises may be distinguished from other turtle families by the following characteristics: the hindlegs are cylindrical and elephantine in shape; the feet are short, broad and club-shaped. In some genera, the forelimbs are flattened and adapted for digging and burrowing and the toes are completely unwebbed. The carapace (upper shell) is usually high and domed with the ribs modified in alternating triangular wedges. All are terrestrial and basically herbivorous, although they may occasionally eat invertebrates and carrion.*

*Until recently North American tortoises were grouped in the genus Gopherus; two distinct genera are now recognized. The primitive gopher tortoises, including the desert tortoise (G. agassizii) and the Texas tortoise (G. berlandieri), are now considered to be in the genus Xerobates. The gopher tortoise (G. polyphemus) and the bolson tortoise (G. flavomarginatus) are more advanced tortoises that remain in the genus Gopherus.*

**T**he desert tortoise, an ancient denizen of western North America, occurs today in the Mohave and Sonoran deserts in southwestern Utah, southern Nevada, southeastern California and western Arizona in the United States. In Mexico *la tortuga de tierra* occurs throughout most of Sonora, including Tiburón Island in the Sea of Cortez and south into northwestern Sinaloa. Considerable variation in its ecology, behavior and even morphology has been noted in different portions of its range. The desert tortoise lives in a variety of habitats from sandy flats to rocky foothills, with a strong proclivity in the Mohave Desert for alluvial fans, washes and canyons where more suitable soils for den construction might be found. It is found from near sea level to around 3,500 feet in elevation.

The desert tortoise reaches an average length of 6 to 14.6 inches, with males growing larger than females. A gigantic specimen, allegedly from Mexico, at the San Diego Natural History Museum, has a shell 15.9 inches long. Other large individuals have been found in the Mohave Desert in California.

The desert tortoise occurs in a number of plant communities ranging from sparse creosote bush desertscrub in the winter rainfall Mohave Desert to palo verde-saguaro desertscrub in the biseasonal Sonoran Desert and eventually to summer rainfall subtropical thornscrub in Sonora and Sinaloa. In the Sonoran Desert, tortoise density seems to be related to the density of perennial plants and plant species composition which are controlled by the amount of rainfall and winter freeze frequency. Prior to the early 1950s, many populations reached

# TOISE

## American Relatives

densities of several hundred tortoises per square mile. Today, most populations contain no more than five to fifty tortoises per square mile.

Native and introduced grasses comprise the bulk of the desert tortoise diet. Otherwise, they eat any available edible plants including spring and summer annual wildflowers, forbs and cactus fruit. Tortoises forage selectively, often sniffing or sampling various plants before consumption. Rocks and soil are also ingested, perhaps as a means of maintaining intestinal digestive bacteria and as a source of supplementary calcium or other minerals. Stones may function as gastroliths enabling more efficient digestion of plant material in the stomach.

The extent of the home range (total habitat area used to fulfill life functions) of the desert tortoise depends upon various factors such as the densities of food plants, and the age, size and sex of the tortoise. These factors and presumably the size of the home range vary throughout the species' range. There is some evidence that tortoises utilize their feces in marking home ranges, dens and burrows. They may be detecting secretions from cloacal glands. It has been suggested that tortoises rarely move more than two miles from their natal nest in their entire lives.

Well-adapted physiologically and

behaviorally to live in dry desert environments, desert tortoises derive almost all of their water intake from the plants they eat. A large urinary bladder can store over forty percent of the tortoise's body weight in water, urea, uric acid and nitrogenous wastes. Water conservation is further aided by an ability to precipitate solid urates in the bladder, allowing water and ions to be reabsorbed while uric acid is eliminated in semi-solid form. During periods of sufficient rainfall tortoises drink copiously from temporary rainpools and eliminate solid urates. A common defensive behavior when molested or handled is to empty the bladder, leaving the tortoise at a considerable disadvantage in drier conditions. For this reason, desert tortoises should not be handled when encountered in the wild. Other avenues of water loss include respiration, defecation and evaporation.

Activity patterns of the desert tortoise help in water conservation. It is chiefly active in the day (diurnal) or morning and evening (crepuscular), depending upon temperature and season. Summer estivation during the hottest, driest period of the year conserves water already stored in the body. This is especially important in the hot, dry Mohave Desert summers. Burrow humidity is often as high as forty percent

*Continued on page 10*

# The Fossil Record

by Tom Van Devender,  
ASDM Research Scientist

As we watch a desert tortoise lumbering through the brittle bush on a rocky hillside amidst the stately saguaros, it has the appearance of a truly ancient beast, a survivor from the primeval forests of the Age of Reptiles where dinosaurs roamed and pterosaurs flew. Fortunately, fossil turtles and tortoises are fairly common and can tell us about the history of these endearing desert reptiles.

Fossils are remains of past life that can be original biological materials such as insects in Baltic amber or sloth dung balls and condor skulls in Grand Canyon caves. More commonly fossils are mineral replaced bones or shells preserved in fine grained sediments. Most tortoise fossils are from sedimentary deposits millions of years in age. The sediments can also provide information about the age of the fossils, other members of the fauna, nearby vegetation, and past climates. It's the job of the paleontologist and paleoecologist to flesh out the evolutionary history and past environments from the relatively bare bones of a sparse fossil history.

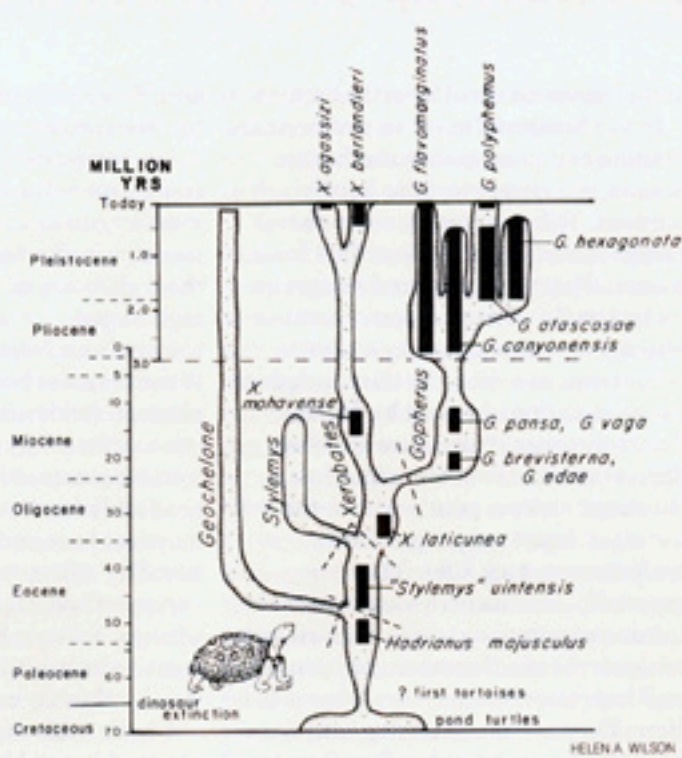
The fossil record tells us that tortoises are indeed an ancient lineage but one that began as the dinosaurs became extinct and the Age of Mammals started about sixty-five million years ago. Tortoises evolved from aquatic pond turtles and lived in tropical forests. Gopher tortoises (*Xerobates*) appeared in the fossil record about twenty-five million years ago in the Early Oligocene. The living desert tortoise and Texas tortoises are descendents of this early stock. The desert tortoise is the most primitive North American tortoise. Advanced gopher tortoises in the genus *Gopherus* diverged from the primitive stock by about twenty million years in the Early Miocene. The bolson tortoise and gopher tortoise are the living descendents of a Late Pliocene and Early Pleistocene radiation of giant *Gopherus* from Arizona to Texas.

For more information a detailed essay on the evolution of the tortoises is available from ASDM Research Scientist Tom Van Devender. ■



The mating posture is facilitated by a strong depression in the male's plastron that fits neatly onto the convex carapace of the female. The male's longer tail enables the penis to penetrate the cloaca. The nearly upright copulatory position of the male is further aided by the inward curve at the rear of the male's carapace.

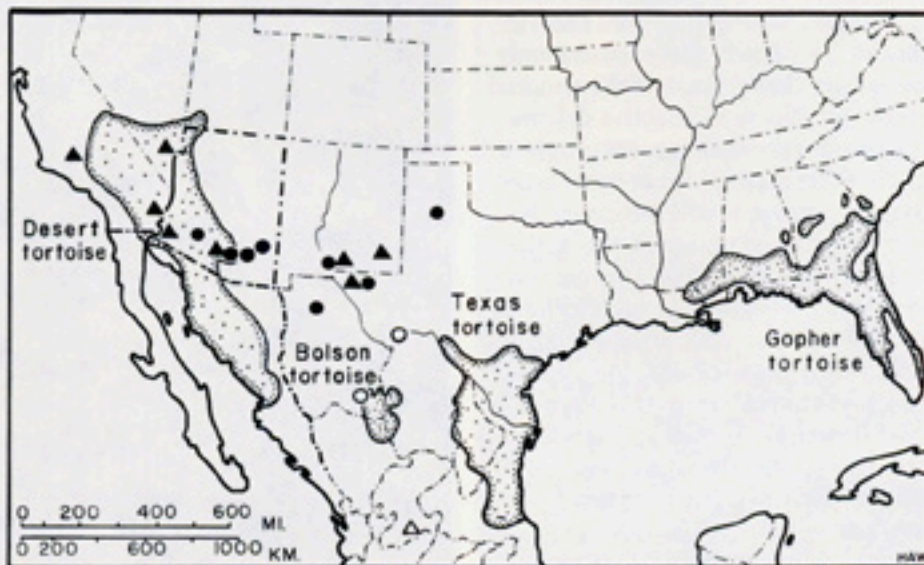




A phylogenetic family tree of the tortoises of North America. Note the divergence of the gopher tortoise genera (*Xerobates* and *Gopherus*) by the Early Miocene—about twenty-two million years ago. Solid bars indicate the actual fossil record.



A thirteen-inch fossil shell from Late Pliocene sediments from eastern Arizona. Two million years ago tortoises in the genus *Gopherus* were found from Central Texas as far west as Phoenix, Arizona. Some of the Arizona fossils have been identified as early bolson tortoises. Others have been referred to as the extinct Cita Canyon tortoise (*G. canyonensis*), the giant ancestor of the gopher tortoise. The Arizona fossils need further study to determine their true identity and their relationships to living tortoises.



Distribution of the tortoises of North America. Triangles = Late Pleistocene fossils of desert tortoise (solid) and Texas tortoise (open). Circles = Late Pliocene and Early Pleistocene fossils of bolson and Cita Canyon tortoises (solid) and Late Pleistocene fossils of bolson tortoise (open).



HOWARD LAMLER

*Male combat is more intensive in spring and late summer in the Sonoran Desert. During these encounters, each male stands as high as possible, making short rushes toward his adversary while attempting to use the gular horn at the front of the plastron to overturn the other or drive him away. An overturned tortoise can usually right itself using its head and a forelimb; if not, the tortoise may overheat and die under the desert sun.*

*Continued from page 8*

or more, thus reducing the rate of evaporation. Winter hibernation also aids in minimizing water loss. Burrows and dens are also used by the desert tortoise as an aid in regulating body temperature.

The flattened forelimbs of the desert tortoise and other gopher tortoises are capable tools for burrow construction. They dig with the front legs, stopping intermittently to sniff the soil. As soil is displaced, the tortoise will frequently exit the burrow and kick the excavated soil still further from the burrow entrance. The entrance is half-moon shaped and high enough for the tortoise to comfortably enter without fully extending the legs.

The location, extent and type of burrow or den varies geographically. Tortoises in the Mohave Desert in California and at the northern limits of the range in Nevada and Utah seem more inclined to construct extensive burrows, up to thirty-five feet in length. Such burrows stabilize temperature and humidity providing protection from intense winter freezes. They may be used year after year by one or more tortoises. As many as twenty-five hibernating tortoises have been found in one den, although a more typical aggregation would contain no more than five individuals. Some dens in southern Utah are estimated to be 5000 years old. Burrows are typically located under rocks or bushes, preferably along sloping terrain, and along washes, either

at the base or elevated from the bottom.

In the Sonoran Desert in southern Arizona and presumably south into Sonora, the desert tortoise hardly burrows. Refuges merely cover the carapace and are often modified from mammal burrows or natural refuges in rocky terrain. Sonoran desert tortoise retreats are often on rocky slopes in mountains, avoiding the deep soiled valley situations favored by Mohave desert tortoises. Pallets are shallow depressions constructed under low shrubs at various points within the tortoises' home range, providing temporary resting sites. They are especially prominent in southern desert tortoise populations where mild winters mitigate the need for extensive burrows and desert tortoises may not hibernate. Here, burrows are often dug into the base of packrat houses rather than in the gravelly soil.

Like most other burrowing animals, the desert tortoise creates a subterranean environment beneficial to other reptiles, mammals, birds and invertebrates. Animals which share tortoise burrows benefit from the permanent or temporary shelters afforded by the tortoise dens and burrows, although they offer little or nothing to the tortoise.

**M**any behavioral attributes of the desert tortoise are well documented. When confronted by a predator, tortoises typically withdraw their head, feet and tail, folding their front knees in front of their head, thus exposing only the shell and heavy scales of the armored forelimbs. This is an effective defense against most predators except people. If attempts are made to remove a tortoise from its burrow, it will retreat to the interior or extend the legs, wedging the carapace against the roof of the burrow. The defensive behavior of adult tortoises is usually passive while juveniles can be surprisingly pugnacious.

Social behavior consists of a series of head bobs for species and gender recognition, courtship and threat. Head bobbing normally precedes agonistic (combative) behavior between males, although females may also be aggres-

sive. Prominent chin glands in male tortoises produce a secretion which aids in sex recognition and often evokes combative behavior. Male combat is most intensive in spring and late summer in the Sonoran Desert. During these encounters, each male stands as high as possible, making short rushes toward his adversary while attempting to use the gular horn at the front of the plastron (undershell) to overturn the other or drive him away. An overturned tortoise can usually right itself using its head and a forelimb; if not, the tortoise may overheat and die under the desert sun. The desert tortoise produces a variety of sounds (hisses, grunts, pops, whoops, huhs, echs, bips, etc.) which seem to be most important when vocalized to an unfamiliar tortoise.

A loose male dominance hierarchy is apparently established by aggression. Dominant males court and mate with females more often than other males. Courtship involves extensive head bobbing as the male attempts to nip and bite at the edges of the female's carapace and legs while circling her. If the female is receptive, she will allow the male to mount her from behind. At this point the female will remain still as the male probes with his tail while grunting and

*The gopher tortoise is usually associated with the sandhill plant community characterized by longleaf pine (Pinus palustris), turkey oak (Quercus laevis) and wiregrass (Aristida stricta), although other habitats with well drained sandy soils are also occupied.*



HOWARD LAMLER

enthusiastically stamping his hind feet. The nuptial embrace continues until the female wanders away. The mating posture is facilitated by a strong depression in the male's plastron that fits neatly onto the convex carapace of the female. The male's longer tail enables the penis to penetrate the cloaca. The nearly upright copulatory position of the male is further aided by the inward curve at the rear of the male's carapace. The mature female differs in having a flat plastron, a shorter tail, and an outward curve at the rear of the carapace which probably provides a wider space for egg laying. The gular horn of the male is longer and more curved, the claws more massive.

While sexual maturity in the wild is estimated to take twelve to twenty years, it is a factor of growth and size rather than age. Tortoises reared in captivity may mature sooner. Mating has been observed from early spring to fall with the highest frequency in late summer in the Sonoran Desert. Viable sperm retained in the cloaca of the female has resulted in fertilization a year and a half after copulation. Other turtle species have laid fertile eggs as long as four years after mating. Sperm

retention is an excellent survival adaptation in non-colonial animals that wander and whose numbers can decline in fluctuating climates of deserts.

Nest sites are often selected in or near dens or pallets. The female excavates the nest hole using her hind legs. She urinates before, during and after the nest hole is dug as well as after covering the eggs, possibly to deter predators by camouflaging the nest and to prevent egg desiccation. In one observation, a female fought a Gila monster (*Heloderma suspectum*) attempting to eat newly laid eggs suggesting that nest sites may be defended for a period of time following egg deposition. Desert tortoises normally construct nests and lay eggs in May or June. In the southern portions of the range, a second clutch may be produced in late summer. These late summer clutches may undergo extended incubation periods hatching in the fall or the next spring. The normal incubation period is ninety to one hundred thirty-five days depending upon incubation temperature. The clutch size varies from two to fourteen eggs with an average of three to five although some eggs may not be fertile. The eggs are hard-shelled, moisture proof, white and nearly spherical to ellipsoid in shape. Mortality of both eggs and juveniles is extremely high due to predation and environmental conditions. Probably no more than one hatchling from every fifteen to twenty nests will reach sexual maturity in the wild resulting in very low recruitment to the population. The fifty to eighty

year average life span estimated for the desert tortoise suggests population turnover is not only low but should be very episodic following fluctuating climates. The desert tortoise could reach a "point of no return" as more reproducing adults fall victim to humanity's expanding impact on fragile desert environments.

**T**he desert tortoise has long been utilized by southwestern peoples. The tortoise was relished as food by the Piman, Paiute and Seri Indians. Shells were used as cooking vessels and as trade items. The Seris of the coast of the Gulf of California in Sonora used tortoise parts for medicine and shell rattles as musical instruments and toys. According to Felger, Moser and Moser, "If a woman has given birth to only female offspring, she is said to have eaten the reproductive organs of a female desert tortoise. If her offspring are all male, it is said that as a child she had been hit in the small of her back with the reproductive organ of a male desert tortoise playfully thrown at her by a girlfriend." Seri folklore features the desert tortoise, called *zix héhet cōqutij*, meaning "thing that sits in bushes." Later, tortoises were eaten by white settlers and prospectors. Mexican traders carried them alive as a source of fresh meat and water. Tortoises are

*The Texas tortoise is found from southern Texas southward through the Mexican states of Coahuila, Nuevo León, Tamaulipas and into San Luis Potosí. This attractive chelonian was once widely distributed through the subtropical Tamaulipan thornscrub and brushland to quasi-desert typical of the region.*



HOWARD LAWLER



FRANK ALCO

HOWARD LAWLER

occasionally eaten in Sonora today.

The current status of the desert tortoise from the standpoint of management and conservation is controversial. The species enjoys full protection in California, Nevada and Utah where limited and reduced populations occur. The status of the populations in Arizona is subject to differing interpretations. While some remote populations appear to be stable and viable, those near urban or recreational centers have declined to the point where their survival is in question. Numerous factors have contributed to this decline including suburban residential development, road construction, agricultural and mineral development, use of off-road vehicles, overgrazing, malicious vandalism and collection as pets. The population on the Beaver Dam Slope area of southwestern Utah has been designated as Threatened by the U.S. Fish and Wildlife Service. The remaining populations in the United States have been proposed for similar status. The main obstacle seems to be disagreement on the status of the species as a whole based on varying perceptions of individual populations. It seems clear, however, that many populations are rapidly declining and could become irrecoverable without positive action by state and federal wildlife agencies.

The highest priorities for the conservation of the desert tortoise are appropriate management, preservation of its habitat and protection from unnecessary exploitation throughout its range. The Arizona-Sonora Desert Museum advocates full protection from collecting in Arizona and discourages the keeping of tortoises as pets. The continuing desire of many Arizonans to possess tortoises, however, can be met through regulatory mechanisms and captive tortoise recycling programs like the Desert Museum's Tortoise Adoption Program. Modeled after similar programs in California, applicants are carefully screened for intent and responsibility before being assigned a tortoise, which remains the property of the State of Arizona. All tortoises placed are urban foundlings, unwanted captives or their progeny. The purposes of the program, sanctioned by the Arizona Game and Fish Department, are to provide appropriate care and custody

for tortoises already in captivity while vigorously discouraging the taking of tortoises from the wild. Records accrued at ASDM since 1981 indicate that thousands of tortoises are held in captivity. It is ironic that people's attraction to the tortoise has become a significant threat to its future. Release programs in the Mohave Desert have been largely unsuccessful without lengthy and expensive rehabilitation. Unfortunately, the same may be true in the Sonoran Desert as well. In fact, the release of captive tortoises is considered to constitute a high risk to existing populations because of the potential to introduce disease, disrupt population structure and mix genetic stock from different regions. Management of the total captive population as a separate entity from those in the wild may therefore help to alleviate one of the continuing obstacles to full protection in Arizona. Under Arizona law, the holder of a valid hunting license may remove one desert tortoise from the wild and possess it. One tortoise per family member may be possessed if they are obtained from a captive source and properly documented. A detailed information pamphlet on the captive care, diet and nutrition of the desert tortoise is available free of charge from the Arizona-Sonora Desert Museum.

## GOPHER TORTOISE

*Gopherus polyphemus*  
(Daudin)

**T**he extraordinary burrowing ability of the gopher tortoise, combined with its colonial nature, make it an important organism in its biotic community. The burrows average ten to fifteen feet in length although one burrow forty-seven and a half feet long has been recorded. These subterranean refuges offer vital protection from temperature extremes and desiccation, incidentally benefiting many commensal species that become more common when burrows are present. Over thirty arthropods have been found in and around the burrows along with numerous vertebrates, including the gopher frog (*Rana areolata*), eastern diamondback rattlesnake (*Crotalus adamanteus*), the Threatened eastern



*The desert tortoise lives in a variety of habitats from sandy flats to rocky foothills, with a strong proclivity in the Mohave Desert for alluvial fans, washes and canyons where more suitable soils for den construction might be found. It is found from near sea level to around 3,500 feet in elevation.*

indigo snake (*Drymarchon corais couperi*) and the Florida mouse (*Peromyscus floridanus*).

The gopher tortoise has been used by humans for thousands of years in Florida. Indians used them as food and money, their shells as utensils. During the Depression years they were known as "Hoover Chicken" in reference to their edibility during economic hard times. To this day, gopher tortoises are pulled from their burrows using long cables with hooks attached and eaten. While some states now regulate this practice, it still contributes to the decimation of many colonies.

The gopher tortoise is principally a sandhill grazer and is an important agent in the dispersal of native grass seeds. However, sandridges are often cleared for agriculture, livestock grazing, real estate development and road construction. The large scale

commercial harvesting of native pines for lumber and subsequent replanting of slash pine (*P. elliotti*) for pulpwood results in denser woods which reduces the grasses and forbs upon which the tortoises depend for food. In Florida, mining, citrus groves and urban encroachment have degraded thousands of acres of tortoise habitat.

Gopher tortoises are also gathered in numbers for locally sponsored tortoise races. Although sanctioned by state wildlife authorities, many tortoises are injured in capture or debilitated by lengthy periods of captivity.

Community sponsored rattlesnake roundups also impact colonies of the gopher tortoise. Collecting rattlesnakes, principally eastern diamondbacks, for these events normally occurs in the late fall and winter months when the snakes have retreated to the tortoise burrows



for hibernation. The standard technique utilizes a long section of flexible plastic hose which is inserted into the burrows and used as a listening device. If any sound is heard in the burrow, a quantity of gasoline is poured into the hose and blown into the burrow. If a snake is present, it will sometimes emerge. If not, the burrow may be dug up or the "hunter" will move to another burrow. This nefarious practice continues even though it is technically illegal in Florida and Georgia.

Biologists concerned about the gopher tortoise have recommended that colonies in different portions of the range be protected and monitored.

Habitat management practices such as pine thinning and burning should be encouraged. Frivolous activities such as tortoise races and rattlesnake roundups should be banned along with human consumption of tortoises. Without protection and management by state or federal wildlife agencies, many populations may be forever lost.

## TEXAS TORTOISE

*Xerobates berlandieri*  
(Agassiz)

The Texas tortoise uses a series of pallets within its home range rather than constructing a burrow. A variety of opportunistic refuges are also used, from cactus clumps and brush piles to abandoned mammal burrows. Well insulated winter refuges are rarely available and studies indicate a tolerance for lower temperatures, even below 0°C for brief periods. Activity is stimulated by rainfall during warm weather, although they retreat to shelter if precipitation persists over several days.

The diet is similar to that of the desert tortoise in that the local grasses, wildflowers and cactus parts, principally prickly pear (*Opuntia*), are consumed. A marked seasonal preference for the colors green, red and blue evidently corresponds to seasonal shifts in herb and fruit availability. This seems to confirm the presence of color vision in the Texas tortoise. Feces analysis has also revealed animal remains including beetle fragments, snail shells and even the claw of a crayfish.

The Texas tortoise was at one time heavily exploited for the pet trade. Thousands of animals were kept in appalling conditions by dealers. The State of Texas prohibited commercial exploitation of the Texas tortoise in 1967 and provided full protection in 1977. Although certain range and grazing management practices actually improve the habitat for the Texas tortoise, the loss of habitat throughout its range remains the primary limiting factor. Nonetheless, the Texas tortoise occurs over a wide area, much of it private land in the United States, and does not appear to be in imminent danger of extinction.

## BOLSON TORTOISE

*Gopherus flavomarginatus*  
(Legler)

The bolson tortoise reaches a larger average maximum size than any other North American species, although a few record sized desert tortoises may exceed this average. Mexican *campesinos* have alluded to bolson tortoises over a yard long and weighing up to 100 pounds! Unfortunately specimens approaching this size have not been measured.

The bolson tortoise shows a close ecological affinity with the tobosa grass (*Hilaria mutica*) upon which it feeds. However a variety of grasses, annuals, cactus fruit and parts of honey mesquite (*Prosopis glandulosa*) are also eaten. This opportunistic grazer often follows foraging pathways along established routes through edible vegetation. Juveniles have been observed eating the feces of other tortoises which may "seed" the intestinal tract with bacteria needed to help digest plant material.

The bolson tortoise is a secretive species, spending over ninety percent of its life in underground burrows. Like the gopher tortoise, it is colonial, and may use two or three burrows within the colony. Colonies are made up of five to fifty individuals. The burrows are themselves a marvel of subterranean engineering. The first three to six feet of the burrow are quite steep. The loose sand at the entrance serves as a lubricant allowing the visually alert tortoise to dive into the burrow as an intruder approaches and quickly slide to safety. The tunnel then levels off for ten to twelve feet where another dip may serve as a catch basin for water during the summer rainy season. The terminal portion usually turns up slightly providing an air pocket if the burrow is flooded. Tortoises have been observed to enter flooded burrow entrances presumably descending into a subterranean "island." Soil removed from the burrow during its construction is piled near the entrance. Here the tortoise basks within easy retreat from predators.

The burrow is important to the tortoise as a refuge from climatic extremes. The bolson tortoise seems to



JAMES JACOBSON

The bolson, or yellow-margined, tortoise is confined to a portion of the Bolson de Mapimi in the Mexican states of Chihuahua, Coahuila and Durango. Here they are restricted to desert-grassland habitats where they occupy well-drained flats and low slopes. At 4,000 to 5,000 feet, they occur at a higher elevation than any other North American tortoise although the colder temperatures are ameliorated at lower latitudes.



HOWARD LARKER

be highly susceptible to heat and desiccation suggesting that it evolved in a moister, cooler environment than the Bolson de Mapimi today. The bolson tortoise is only active in early morning and late afternoon hours during periods of moderated temperatures and humidity. They are most active during the rainy season from July to early October although activity may occur at any time when conditions are favorable. Normal outings last no longer than twenty to forty minutes. In particularly dry years, young tortoises have been found dead, apparently casualties of exposure, their withered carcasses showing no signs of predation. In historic times, this tortoise has been used extensively by people as food. Today, *tortugueros* (Mexican turtle hunters) use a long hooked wire, called a *gancho*, to snag and pull tortoises from their burrows. Residents near the Sierra

## MUSEUM NEWS

### THANKS from page 5

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de los Remedios in Chihuahua even "harvested" the tortoises by providing supplemental food and carefully "culling" tortoises for human consumption. Increasing human populations have undoubtedly increased such predation. To compound the problem, extensive habitat destruction is occurring due to agricultural development and overgrazing by goats and cattle.

Existing populations of the bolson tortoise are estimated to number no more than 5,000 to 10,000 individuals. Without protection, the tortoise and its habitat is likely to become extinct in the foreseeable future. The species has an Endangered status with the U.S. Fish and Wildlife Service, is protected by Mexico and listed on Appendix I (Endangered) of the Convention on International Trade in Endangered Species (CITES). Exportation of living



Biologists including Dr. David Morafka and ASDM consulting veterinarian James L. Jarchow are developing a conservatory for the incubation of eggs and head-start rearing of hatchlings in the Bolson de Mapimi.

specimens and their parts has been largely curtailed by these measures. The greatest threats to the tortoise's existence remain due largely to the difficulty in enforcing the regulations in Mexico.

Mexican and U.S. biologists are

working together to learn more about the biology and conservation needs of this unique creature to help insure its survival. Gustavo Aguirre of the Instituto de Ecología heads a team of tortoise specialists based at the Mapimi Biosphere Reserve in Durango. Some populations are receiving protection by private property owners in Mexico. One captive program established by Mrs. Ariel Appleton in Elgin, Arizona, has had notable success in the breeding and rearing of the bolson tortoise.

The story of the bolson tortoise provides a glimpse of the plight facing other North American species now or in the future. As we grow in our understanding and appreciation of these ancient inhabitants of the North American continent, perhaps we will gain the insights and wisdom necessary to insure their perpetuity alongside the human species. ■

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# SPECIAL EVENTS FOR MEMBERS

## AUTUMN & WINTER 1986-87

*One of the special privileges of your Desert Museum membership is the opportunity to participate in our outdoor fieldtrip and workshop programs for the whole family. What a meaningful and enriching way to learn more about our Sonoran Desert home! If you have friends who would like to take part in these field experiences, tell them how they too can become a member.*

Mary Erickson  
 Special Events Coordinator

### SEPTEMBER

**BIRDING BASICS**  
**Wednesday, September 24**  
**9:00 a.m.-12:00 p.m.**

A flash of color, a familiar trill, the flutter of a flock of beating wings; evidence of birds is pervasive even in an urban environment, yet many of us really don't know who our avian companions are.

Is learning about birds something you've always meant to do? The Sonoran Desert is rich in bird life and with the aid of an expert you can quickly learn the distinguishing characteristics of bird families. A new awareness of habitats also helps to pinpoint the identity of a particular bird. This birding primer allows for pursuing the topic further on your own, or the confidence to join group outings with more experienced birders.

The fee of \$8 (non-members \$14) covers handouts, supplies and expert classroom and field instruction.

### OCTOBER

**BOOJUM COUNTRY: OVERLAND  
 INTO BAJA'S CENTRAL DESERT**

**Monday through Wednesday (10 days)**  
**October 27-November 5**

Camping in the deserts of Baja for 10 days with Dr. Robert Humphrey, renowned expert and author of *The Boojum and Its Home*, will be an adventure and a unique educational opportunity. After crossing at Tecate on the California border we'll drive through the agricultural areas of northern Baja to get to the boojum forests of the central deserts. Dr. Humphrey will share his knowledge of this fascinating terrain where his research has led him.

Besides the boojum, this region is home to the huge saguaro-like cardon, fan palms, the elephant tree and the rock fig tree which spreads its roots over bare bedrock. Human influence in the region will not be overlooked as we visit a number of historic missions and also see Indian rock paintings. A visit to an island off Bahia de Los Angeles on the Sea of Cortez will allow us to see blue-footed boobies and other sea birds as well as chuckwalla and sea lions.

Trip fee of \$895 (non-members \$925) covers all transportation, camp needs, a complete learning packet, and expert guides. This has always been a popular event—early registration is suggested.



## SPECIAL EVENTS

### NOVEMBER

**WINTER RAPTORS AND WATERFOWL**  
**Sunday, November 16**  
**5:00 a.m.-5:00 p.m.**

Every autumn thousands of northern birds escape the ice covered ponds of the north and migrate to the nutrient rich, open waters of the southern United States and Mexico. Southeast Arizona's desert grasslands and agricultural areas dotted with artificial lakes, ponds and mudflats provide the perfect habitat for a variety of winter visitants including at least twelve species of hawks and eighteen species of waterfowl, shovelers, pintails, and ring-necked ducks which can often be seen busily involved in their colorful courting displays.

We will begin this full day birding extravaganza at 5:00 a.m. to ensure our arrival at Sulphur Springs Valley by sunrise. Our trip leader, Birds and Mammals Curator Peter Siminski, will point out other wildlife we may see along the way, such as pronghorn antelope, in addition to the masses of red-tailed hawks, Sandhill cranes and ferruginous hawks.

Fee of \$20 (\$26 non-members) includes transportation, handouts and expert guidance by ASDM staff. Trip leaves from the southwest corner of El Con Mall parking lot.

**DESERT HARVEST BAZAAR**  
**Saturday and Sunday**  
**November 22 and 23**  
**9:00 a.m.-4:00 p.m.**

With the heat of summer well in the past, it is a pleasure to stroll in the balmy air and smell the mesquite smoke that drifts into the sunny sky at this annual fiesta celebrating the wonders of the Sonoran Desert. Whether you're sampling prickly pear punch, marveling at the fine handiwork of Indian baskets and textiles, admiring a Seri wood-carving, or savoring hot fry bread dripping with honey, you'll leave with a greater appreciation of our desert region.

Now in its seventh year as a unique educational event and fund raiser, the Harvest Bazaar also offers much to interest children; be it grinding blue corn or mesquite beans, having their portrait drawn by a desert cartoonist, learning about birds of prey and venomous animals, or watching the puppeteer, children and adults alike may share in the many events.

A large variety of cactus and succulents will be offered for sale as well as specimens in dish gardens and stoneware pots which make wonderful gifts. The selection of gems and minerals available at the Harvest Bazaar is breathtaking. Novices will find many interesting specimens for less than a dollar, and the veteran collector will have access to a myriad of fine display pieces. In addition, the finest in new Natural History books will be for sale.

Don't miss this opportunity to celebrate the fruits of the desert on the weekend before Thanksgiving.

### DECEMBER

**DESERT WREATH WORKSHOP**  
**Saturday OR Monday**  
**December 6 OR December 8**  
**8:00 a.m.-4:00 p.m.**

The plants of the Sonoran Desert have provided Native peoples with food, fiber and shelter for thousands of years. Today we are less likely to depend directly on these plants for our survival but some can be used to decorate our homes and remind us daily of the need to conserve the desert.

Tucsonan Ruth Hamilton is known throughout the country for the everlasting heirloom wreaths she makes from Sonoran Desert plant material. With Ruth's instruction, each participant will design and craft a wreath from yucca fruits, coyote melons, desert spoons, saguaro fruits and acacia beans. The natural history of these plants will also be discussed.

Fee of \$30 (\$36 non-members) includes all materials, handouts and expert instruction. Class size will be kept to a minimum so register early for this brand new event!

**MEMBERS' BEHIND THE SCENES TOUR**  
**Wednesday, December 31**  
**9:00 a.m.-1:00 p.m.**

Find out what makes the Desert Museum tick during this special behind the scenes tour for ASDM members. Led by Interpretive Naturalist Rich Dulaney, the tour will highlight the many changes which occurred on the grounds in 1986.

There is no fee for this special event but pre-registration is a must. Participants must be ASDM members; group size is limited to 25.

### JANUARY

**ARIZONA'S ANCIENT LIFEFORMS**  
**Saturday, January 10**  
**9:00 a.m.-12:00 p.m.**

Roll up your sleeves, grab an old toothbrush and a magnifying glass and journey with us back to a time when animals swam or scuttled or flapped through this region we now know as the Sonoran Desert. By examining fossils which were found in the back country and roadcuts of Arizona we can learn about how each animal lived, how it moved and what it ate. Curator of Earth Sciences Dave Thayer will help us piece the parts together sharing the dynamic story of lifeforms in Arizona throughout the ages.

Thayer will also have slides to show us modern examples of ancient environments and the drastic way habitats have changed as the seas evolved, volcanoes blew and oozed lava mesas and as climates changed with the gradual drifting of our continent over the eons.

The course fee of \$8 (\$14 non-members) covers handouts, refreshments and hands-on instruction from our Museum staff. Course meets in the ASDM classroom.

### FEBRUARY

**CAMPFIRES IN DESERT AND LAVA**  
**Friday through Sunday**  
**February 20-February 22**

Less than 200 miles southwest of Tucson in Sonora, Mexico lies one of the most stark and arid regions in all of North America. A rugged land of abrasive black lava flows, the Gran Desierto is an area of windswept sand dunes, cindercones and volcanic craters, so moonlike it was used as a training ground for Apollo astronauts.

A geologist, a botanist and other naturalists will help us learn about these land and lifeforms as we explore the vicinity of the dominant shield volcano Pinacate Peak, a fascinating landmark of the area.

Fee of \$175 (\$205 non-members) covers transportation, interpretive guides, a complete information packet, and delicious camp cookery. February is the ideal time to visit these desert mountains, but even under ideal

## SPECIAL EVENTS

circumstances this area is rugged; one must travel self-contained. Plan to carry your own water supply and practice wise water conservation. A \$50 deposit will hold your place on this limited, first-come basis.

### MARCH

#### CREATIVE LANDSCAPING WITH DESERT PLANTS

Saturday, March 7

9:00 a.m.-3:00 p.m.

Anyone who has visited the Desert Demonstration Garden on the ASDM grounds has experienced the lush variety and color that drought tolerant plants can provide. In this one day workshop we will introduce you to desert trees, shrubs and wildflowers that perform well in Tucson gardens and help you design your own mini oasis which includes instruction on the practicalities of hole digging, maintenance and drip irrigation.

Fee of \$26 (\$32 non-members) covers attentive personalized instruction, materials for hands-on learning, information packet and refreshments. (You can bring a lunch or eat in the ASDM restaurant.) Meet at ASDM's Education Classroom with walking shoes, hat, notepad and work clothes. With the knowledge gained from this workshop, your purchases at the Spring Native Plant Sale will be all the wiser.

#### TUCSON MOUNTAIN WILDFLOWER WALKS

Wednesday, Saturday OR Sunday  
March 18, 21 OR 22

We can't promise hillsides of poppies, larkspurs and lupines straight out of *Arizona Highways* but even in our wildflower "off years" desert canyons hold pockets of delicate blooms. En route, our naturalists will lead you to these treasures and discuss the natural history and ethnobotany of the plants. Group size is limited so be sure to sign up soon for this popular activity. Meet at the ASDM front entrance equipped with canteen, brimmed hat and hiking shoes. Fee of \$5 (\$11 non-members) covers wildflower book, handouts and a naturalist guide.

#### BAJA MIGRATION WITH THE GRAY WHALE

Saturday through Monday (10 days)  
March 21-30

Each year thousands of gray whales travel southward along the North American west coast to escape the ice packs of the Arctic waters. For hundreds of these magnificent giants the final destination is the calm waters of Baja's tidal lagoons and bays where they calve and nurse their young—a migration of more than 6,000 miles.

With this trip we are fortunate to have an opportunity to unobtrusively enter the gray whales' "nursery lagoon,"

Laguna San Ignacio. Viewing these graceful mammals close at hand, we will hear and perhaps feel the spray from their breath, and when our presence is noticed maybe even enjoy a visit from a curious calf. Truly it is a thrill of a lifetime.

Our journey begins in San Diego where we will board the eighty-seven-foot *Pacific Queen*. Having made numerous trips to the island and lagoons of Baja, the yacht's owner, Captain Ed McEwen, the crew and two staff biologists will share their knowledge of the whales, dolphins, sea lions, elephant seals and marine birds seen on this ten-day natural history expedition.

En route we will have a chance to hike and explore various offshore islands, each with its own unique desert habitat, and during the two and a half day stay at Laguna San Ignacio we will travel by skiff with the whales. Evening slide shows on board illustrate a range of topics from the behavior and ecology of the northern elephant seals, to the adaptations, niches and habitats of oceanic and coastal birds.

Trip fee of \$1,050 (\$1,090 for non-members) includes ten days with homecooked, sumptuous meals on board ship, entry fees to museums, an extensive information packet, and expert guides with expertise in the native flora, fauna and geology. A \$200 deposit reserves a space.

*NOTE: Transportation to San Diego is not included in the fees. Participants must provide their own transportation. We will be glad to assist with car pool arrangements.*

Members and public are cordially invited to our trip Preview and slide presentation in March. Call the Special Events office for details.

### FOR PLANNING AHEAD . . .

- Spring Plant & Mineral Sale—April 4 & 5
- Salt River Rafting Trip—5 days April
- Southeastern Arizona Birding Marathon—3 days May
- Volcanoes of Northern Arizona—Late June

Watch for details in the next issue of *sonorensis* or check the appropriate box on the current registration form and return it to the Special Events office. Details of the trips will be sent to you as they become available.



Patience photographer scoots nearer sea lions on Isla Angel de la Guarda in the Sea of Cortez.

## SPECIAL EVENTS

### Special Events Registration

**REGISTRATION AND RESERVATION INFORMATION:** Registrations are accepted *by mail or in person only* and are processed in the order that they are received. Please fill out the form below and mail with a *separate check for each event*. If one of your chosen events is filled we will return the appropriate check. Notice will be sent confirming your reservation. Please call us if you do not receive your confirmation within 10 days. When a trip deposit is sent, the balance is due one month prior to the trip date.

**CANCELLATIONS AND REFUNDS:** All cancellations must be received in writing. Due to administrative planning costs and mailings, the charge for cancellations is \$4.00 for amounts under \$20, and 20% for events over \$20. No refunds can be made within seven days of any day event, or 14 days of an overnight event.

**ANY ACTIVITY MAY BE CANCELLED BY ASDM** if the minimum number of participants is not met. We reserve the right to refuse service to anyone in the interest of the group if necessary.

EVENT	DATE	FEE PER PERSON	NUMBER OF PERSONS	AMOUNT OF CHECK
Birding Basics	September 24	\$ 8 Members \$14 Non-members	_____	\$ _____
Boojum Country: Overland into Baja's Central Desert	October 27-November 5	\$895 Members \$925 Non-members	_____	\$ _____
Winter Raptors & Waterfowl	November 16	\$20 Members \$26 Non-members	_____	\$ _____
Desert Wreath Workshop	December 6 or 8 1st Choice _____ 2nd Choice _____	\$30 Members \$36 Non-members	_____	\$ _____
Members' Behind The Scenes Tour	December 31	No Fee	_____	\$ N/A
Arizona's Ancient Lifeforms	January 10	\$ 8 Members \$14 Non-members	_____	\$ _____
Campfires in Desert & Lava	February 20-22	\$175 Members \$205 Non-members (Pay \$50 deposit or full fee)	_____	\$ _____
Creative Landscaping with Desert Plants	March 7	\$26 Members \$32 Non-members	_____	\$ _____
Tucson Mountain Wildflower Walks	March 18, 21, or 22 1st Choice _____ 2nd Choice _____	\$ 5 Members \$11 Non-members	_____	\$ _____
Baja Migration with the Gray Whale	March 21-30	\$1,050 Members \$1,090 Non-members (Pay \$200 deposit or full fee)	_____	\$ _____
<b>TOTAL AMOUNT ENCLOSED AS SEPARATE CHECKS</b>				\$ _____

**PLANNING AHEAD:** Please send me information on the following upcoming Special Events.  
(Material will be mailed to you after the first of the new year.)

- Salt River Rafting Trip (5 days in April)
- Southeastern Arizona Birding Marathon (3 days in May)
- Volcanoes of Northern Arizona (late June)

**QUESTIONS?** Call Mary Erickson at 883-1380, extension 205

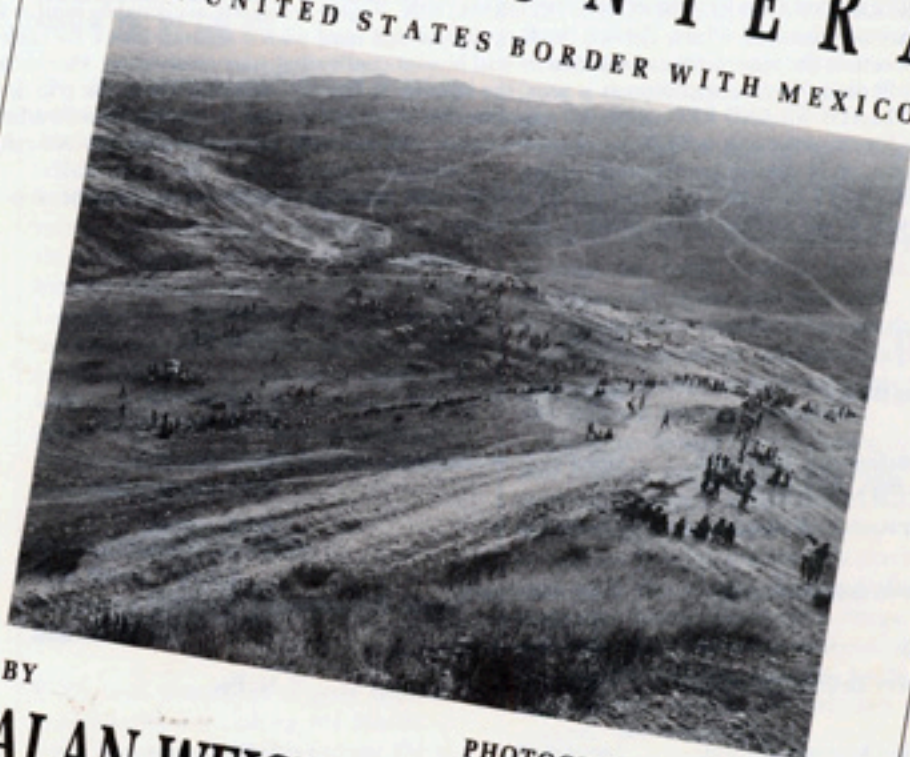
**SEND A SEPARATE CHECK FOR EACH EVENT PAYABLE TO:** Arizona-Sonora Desert Museum  
**AND MAIL TO:** ASDM Members' Special Events Office, 2021 N. Kinney Road, Tucson, AZ 85743

**PLEASE LIST BELOW NAME, ADDRESS AND PHONE NO. FOR ALL PARTICIPANTS (attach list if necessary)**

Participant #1 _____	Participant #2 _____
Address _____	Address _____
City _____ State _____ Zip _____	City _____ State _____ Zip _____
Membership No. _____	Membership No. _____
Phone: Home _____ Work _____	Phone: Home _____ Work _____

# LA FRONTERA

THE UNITED STATES BORDER WITH MEXICO



BY

ALAN WEISMAN

PHOTOGRAPHS BY

JAY DUSARD

The Desert Museum Gift Shop & Book Store is pleased to offer an autographed copy of *La Frontera: The United States Border with Mexico* by Alan Weisman and photographer Jay Dusard.

Journalist Alan Weisman, a member of the Association for Borderland Scholars and a frequent contributor to the national press on border issues, resided in the interior of Mexico for four years. Photographer Jay Dusard, who won a Guggenheim that resulted in the publication of his book *The North American Cowboy*, once worked as a cowboy on a border spread. The unique combination of talents they bring to their border odyssey from Brownsville/Matamoros on the Gulf to the Pacific twins of San Diego/Tijuana is reminiscent of the sensibilities of James Agee and Walker Evans in *Let Us Now Praise Famous Men*. Their awareness of the geography and history of this unique region, their understanding of the economic and social pressures that bring people

together even as political and cultural differences drive them apart, and their acute perception of the human values underlying abstract issues have created a compelling social document that makes comprehensible the conflicts and frustrations of border life. The words and images of this book bring home the truth of a much misunderstood part of the world in terms both immediate and personal.

*La Frontera* is 224 pages with 56 black and white photographs and clothbound measuring 10 $\frac{3}{8}$ " x 11". It will be available mid-October for \$29.95 plus shipping and tax.

Call (602) 578-3008 to order today.

## Desert Museum Gift Shop & Book Store

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