Above and following page: Artisans from the community of Tepehuajes, Mexico, produce quality ceramics inspired by sea turtles, giving them pride in protecting these vulnerable animals.

nesting colony. This was the first time the Kemp's received help outside of the agencies and nongovernmental conservation groups.

In 1966, biologists Humberto Chavez, Martin Contreras, and Dr. Rene Marquez (of Mexico's Instituto Nacional de Pesca) went to Rancho Nuevo to survey the remaining Kemp's ridley population and to establish a conservation effort for the diminishing population. In 1978, experts from Mexico and the U.S. determined that without drastic steps, the species would disappear. Students and biologists from the U.S. were sent to Rancho Nuevo to assist their Mexican counterparts at the primary nesting beach. The number of protected nests and hatchlings doubled that first season due to increased help and equipment.

Simultaneously, a second nesting beach in the U.S. at Padre Island National Seashore was established by transferring eggs there to hatch. Once experimentally imprinted on that beach, the hatchlings were gathered up and "headstarted" (raised to larger size) at the Galveston National Marine Fisheries Service Lab for several months to lessen the number of predators that are able to eat them.

The first few years of work were disappointing, with the numbers of nests declining to an all time low of 702 nests for 1985 (estimated 270 females). This species requires between 10 and 15 years to reach maturity. Almost the entire nesting population of Kemp's ridleys nested in this small, isolated stretch of beach near Rancho Nuevo. The effort began with five students led by Dr. Marquez and Dr. Peter Pritchard of the Florida Audubon Society. The Gladys Porter Zoo of Brownsville assumed responsibility for the U.S. crew in 1981, one of the few times that a nongovernmental entity has taken the lead for recovery implementation of an endangered species.

The population now appears to be expanding and is probably using historic nesting sites. Accordingly, the Mexican and U.S. teams now operate six camps in Tamaulipas and one in Veracruz, and collectively patrol more than 100 miles (166 km) of coastline several times daily to protect nesting females and eggs. In 2002, we protected more than 6,300 nests. We are on our way to achieving our goal of establishing the downlisting criteria of 10,000 females (as identified in the 1992 Recovery Plan).

Regardless of the legal protections and the potential for violation enforcement, recovery can only be achieved through the cooperation and commitment of the Tamaulipas communities. In the past, some local residents poached sea turtle eggs to sell in the lucrative black market for their supposed magical

and aphrodisiac powers. To deal with this, the traditional approach was to increase law enforcement. But such approaches can cause local resentment without effectively dealing with the problem. Instead, we pursued a nontraditional approach: addressing the need of the residents for a source of revenue to survive.

Thus was sparked the entrepreneurial spirit of the local residents. With the help of partners, the community created a beneficial economic venture that makes more money by protecting the turtles than by harming them.

The project blends the peoples' heritage with art and tourism in the community of Tepehuajes in the State of Tamaulipas. The people learned how to make ceramic items in turtle shapes and designs, such as salt and pepper shakers, wine coolers, and napkin holders. The local jurisdiction donated the lands to build the physical structure. The state donated the construction materials, engineering, and labor. Mexican university ceramic art experts spent three months training the local residents to make ceramic creations. The University of Texas at Brownsville sent expert kiln operator Nancy Sclight to teach the people how to use their equipment and helped with the selection of clays.

Partners in the seafood industry and at Ocean Trust are helping with the marketing plans and development of online catalogs to serve as outlets. After almost two years of training and many trials, the artisans from Tepehuajes are producing quality ceramics. When visiting their facility, pride shines in their eyes and their commitment is unmistakable. No longer do they steal turtle eggs, fearful of prosecution and guilt.

The community is also engaged in educational efforts with children. At the La Pesca Camp, a natural history museum was built with contributions from partners. Exhibits on sea turtles emphasize Kemp's ridleys, or *tortuga lora* as they are known in Mexico. The children are learning that their beaches hold the future of the Kemp's ridleys. The children will become the leaders and residents of these communities, and with their commitment to the natural environment, the Kemp's ridley and other species will survive.

Bryan Arroyo, Assistant Regional Director/ Ecological Services, Region 2; Dr. Patrick Burchfield and Luis Jaime Peña, both Gladys Porter Zoo; Les Hodgson, Conservation Director, National Fisheries Institute; and Dr. Patricia Luevano, Tamaulipas, Mexico.

The Turtles' Friends

This project represents a unique partnership of federal, state and local government agencies in both countries; industry; conservation NGO's; and the people of the Tamaulipas coastline: Mexico's Instituto Nacional de Ecología - SEMARNAT • State Government of Tamaulipas-SEDUE • U.S. Fish and Wildlife Service • National Marine Fisheries Service • National Park Service • Texas Parks and Wildlife Department • U.S. Geological Survey • Gladys Porter Zoo • Sea Turtle Inc. • San Antonio Zoo • Aquarium of the Americas • Help Endangered Animals-Ridley Turtles (HEART) • Center for Marine Conservation • CANAINPES • National Fisheries Institute • Texas Shrimp Association • Gulf States Marine Fisheries Commission • Marco Sales • Ocean Trust • fishing and shrimping industries of Mexico and U.S. • Darden Restaurants • Penguin Frozen Foods • Contessa Foods • Ocean Garden Products • Campeche Sea Food Products • Bubba Gump Shrimp Company • Zimco Marine • Eastern Fish • American Honda Motor Company, Inc. • H.E.B. • Phillips Petroleum • API Altamira • Universidad del Noreste • Universidad Michoacana de San Nicolás Hidalgo

Conserving Cacti in México

by Ariel Rojo and
Eduardo Peters

Some of the most attractive plants in the world are the cacti. These plants are associated mainly with deserts, though they can also be found in temperate forests and even in tropical zones. Their adaptations have caught the attention of many naturalists and scientists all around the world, and collectors appreciate enormously the great variety in their forms and flowers. The family Cactaceae, endemic to the Western Hemisphere, contains about 1,800 species. Although its origins may be in the Caribbean, diversification of cactus taxa has reached a peak in México, where 48 genera (73 percent endemic) and 850 species (85 percent endemic) are found.

One of the most amazing places where cacti have diversified is in the north of the country in the Chihuahuan Desert, the largest desert in North America, of which 80 percent is in México and 20 percent is in the United States. This ecoregion is considered one of the most biologically rich and diverse deserts in the world, with 3,500 plant species, many of them endemic.

The boojum* (Fouquieria columnaris) *has an appearance that fires the imagination. For most of the year it is leafless and looks like a giant upturned carrot. Its common name was coined by the explorer Godfrey Sykes, who found it in 1922 and said "It must be a boojum!" He was referring of the strange and mythical creature that the author Lewis Carroll called a boojum in his children's book, The Hunting of the Snark. The Spanish common name for this plant is* cirio*, referring to its candle-like appearance. It is not a cactus but a stem succulent.
Photo by Michael Bender

Threats

The cactus family is faced with growing environmental threats, including urban sprawl, expansion of the agricultural frontier, introduction of exotic species, overgrazing by cattle, uncontrolled tourism, and poaching driven by the demand of exotic plant markets. All of these threats are particularly harmful to cactus species because many of them have small populations, making them very vulnerable to extinction. Many of the genera are included on CITES (Convention on International Trade in Endangered Species) Appendix 1, and the entire family is on Appendix 2. Also, 34 percent of the species are included in the Plant Red List from IUCN (International Union for Conservation of Nature and Natural Resources). The IUCN includes 286 species and the Méxican Government includes 257 species in the NOM-ECOL-059 (México's endangered species law).

Conservation

This risky situation has prompted conservation actions at the federal, state, and local levels. Perhaps the most favorable action was the recognition of Natural Protected Areas, of which many exist in México. Along the México-U.S. border, the Pinacate and Altar Desert Biosphere Reserve, a marvelous volcanic region adjacent to Arizona, and the Cañon de Santa Elena in Chihuahua and Maderas del Carmen in Coahuila, both of them in neighboring Texas, are designated as Flora and Fauna Protection

Areas. Within interior regions we can find some other examples of protected areas with cacti relevance: the Vizcaíno Biosphere Reserve in Baja California Sur; the Colorado River Delta and Upper Gulf of California; and the Valley of the Cirios, one of the best-conserved natural treasures on Earth (with one of the most fascinating plants in the world, the Cirio or Boojum Tree) in Baja California. Near México City, the Tehuacán-Cuicatlán Biosphere Reserve in the states of Puebla and Oaxaca contains a great diversity of columnar cacti.

These actions seem to be the best approach because they encourage *in-situ* conservation. However, they do not include all the places a conservationist would like, and many endangered species do not inhabit these protected regions. Therefore, the Méxican government has been promoting, since about five years ago, the System of Units for Conservation and Management of Wildlife, known as UMAs. These units intend to revalue the wildlife–mainly its use, management, and sustainable appropriation of the resources. They are based on a management plan that incorporates activities such as censuses of the populations and demographic research about particular species. The underlying idea is to conserve the natural habitat and, at the same time, obtain some rewards from doing it. This scheme operates very well with regard to creating opportunities for hunting mule deer, turkeys, pigeons, and other game. The UMAs are focused on animals, but as an added value they conserve cacti and other species. By the year 2000, the UMAs strategy had incorporated almost 3,200 units that represent about 28 million acres (11,330,000 ha), mainly in the north of the country.

Hopefully, the increasing conservation efforts will be able to withstand the environmental degradation that the deserts in México have been suffering, and reduce the threats to their long-term sustainability.

Uses

Because of their unusual morphology and their attractive flowers, cacti are very attractive and many species have been commercialized intensively. In addition to their ornamental value, species have other uses, depending on places and cultures. Based on archaeological evidence–fossilized feces–it has been shown that cacti were consumed by humans at least 9,000 years ago. Even today, people use them as food in a great variety of dishes and presentations, for forage and fodder, as construction material to build fences, for medicinal purposes, and even in religious rituals.

There are some very specific uses for cacti. For instance, the Aztecs prized the rich red color extracted from the dried bodies of insects that were raised on cladodes (leaf-like branches) of many species of prickly-pear cacti. The cochineal dye of the Aztecs became highly prized in Europe. In the sixteenth century, Cortés was instructed to send as much of the pigment as possible back to Spain.

Future

In México, there is an increasing need to take urgent actions to protect cacti and their environments. Federal and state governments, research institutions, conservation groups, conscientious private-sector leaders, and ecotourism operators have been contributing to growing appreciation of the environment and recognizing the need for concrete conservation action. The challenge is to concentrate these efforts into real, long-standing sustainability.

Ariel Rojo and Eduardo Peters are with the Instituto Nacional de Ecologia, México, which has the mission of generating technical and scientific information about environmental problems, providing human resources training, providing information, supporting decision making, encouraging environmental protection, and promoting the sustainable use of natural resources.

Species in the cactus genus* Ariocarpus *are often called "living rocks" for their inconspicuous appearance. Most are endemic to México, but* A. fissuratus *(above) extends northward from México into parts of southwestern Texas.
Photo by Michael Bender

Black-footed Ferrets Thrive in Mexico

by J. Michael Lockhart, Jesus Pacheco, Rurik List, and Gerardo Ceballos

A captive-reared black-footed ferret peeks out of her new burrow home after release in northern Chihuahua, Mexico.
Photo by J. Michael Lockhart/FWS

Far right: Dianne Devison (Curator, Toronto Zoo, Canada) and Jesus Pacheco (Biologist, University of Mexico) release captive-reared black-footed ferrets on the "El Cuervo" prairie dog colony in northern Chihuahua, Mexico, in November 2002.
Photo by J. Michael Lockhart/FWS

In September of 2002, biologists from the University of Mexico (UNAM) were unexpectedly treated to a thrilling sight: the discovery of the first wild-born black-footed ferret *(Mustela nigripes)* kits in Mexico. These kits were the offspring of captive-reared ferrets reintroduced into northern Chihuahua, Mexico, in the fall of 2001 (see "Black-footed Ferrets Return to Mexico" in *Bulletin* Vol. XXVII No. 2). They are an exciting and highly significant step in the recovery of this critically endangered species.

The black-footed ferret is a carnivore that requires relatively large, healthy prairie dog colonies for survival. Few high quality reintroduction areas remain anywhere in North America, and the black-tailed prairie dog complexes found near Janos, Chihuahua, are among the best. The El Cuervo prairie dog colony alone is more than 15,000 hectares (37,065 acres) in size and overlays part of a large grassland basin on the eastern edge of the spectacular Sierra Madre range. It is the largest contiguous colony of black-tailed prairie dogs found in North America today.

In all, 91 ferrets were released in northern Chihuahua in 2001, and an additional 69 were reintroduced on adjacent areas of the El Cuervo complex in 2002. Follow-up population surveys were conducted in September 2002 (to document long term survival and production of ferrets released in 2001) and December 2002 (to examine short-term survival of additional ferrets released in October and November of 2002). The El Cuervo colony is vast, and much associated habitat was not accessible during the 2002 surveys. Still, initial survey results were promising, with at least 26 ferrets documented during the 2002 surveys, of which nine were wild-born. Observations of 23 additional "unknown" ferrets suggest that survival and production levels may be higher than detected.

All captive-bred reintroduced ferrets are tagged with two passive integrated transponder chips under the skin of their necks and rumps, and are therefore individually identifiable. Transponder reader devices are placed over the burrow entrances in which ferrets are found. The ferrets that were observed passing through working transponder readers and displaying no numerical readings were judged to be wild born kits, which lack transponder tags. Many other ferrets did not pass through transponder readers, or may have passed through them when biologists were not present, and they constitute the unknown ferrets.

Monitoring, trapping, and tagging will be intensified in 2003 to get more accurate data on survival and reproduction of the Mexican ferret population. The Mexico project is the eighth ferret reintroduction effort in North America. Since 1991, seven other reintroduction programs have occurred across six western states. Thus far, the success of those efforts has been mixed. In Montana and Wyoming, the introduced disease sylvatic plague has compromised reintroduction success and only small numbers of ferrets persist. However, on two reintroduction areas in South Dakota, where sylvatic plague is not present, black-footed ferret populations appear to be relatively large and self-sustaining, with no fewer than 250 animals in the wild today. Another reintroduction effort on lands overlying an area of western Colorado and eastern Utah also appears

to be making good progress, with a minimum of 34 animals detected on one core release area in 2002 and documented wild production every year since 2000. Yet another reintroduction effort in northwestern Arizona has had moderate success in recent years and has experienced at least two successive generations of wild born kits.

Although the black-footed ferret recovery program has experienced remarkable success since 1987 (when only 18 animals were known to exist), ultimate recovery of the species is far from certain. Black-footed ferret recovery depends on the successful establishment of viable populations spread over the species' historical range. Few suitable reintroduction areas exist today, primarily due to habitat loss resulting from conversion of native prairies into cultivated lands and extensive prairie dog poisoning programs over the last century. Sylvatic plague is perhaps the greatest obstacle to ferret recovery, with devastating impacts on both prairie dogs and ferrets. Only a few potential ferret reintroduction sites in South Dakota and Chihuahua are currently isolated from the effects of plague.

Establishment of a wild ferret population in Mexico, and in the other best remaining habitats of North America, is essential to species recovery. "Excess" kits produced in South Dakota and Mexico could soon help start ferret populations in other recovering habitat areas across the Great Plains and desert grasslands of the western U.S. and Canada. Fostering the establishment and growth of wild ferret populations while simultaneously improving habitat conditions to promote future recovery opportunities is the foundation of a pending revision of the Black-footed Ferret Recovery Plan, scheduled for completion in 2003.

J. Michael Lockhart, National Black-footed Ferret Conservation Center, USFWS, Laramie, WY.

Jesus Pacheco, Instituto de Ecologia, Universidad Nacional Autónoma de México (UNAM), Ciudad Universitaria, Ap. Postal 70-275, México D. F, 04510, México.

Rurik List, Instituto de Ecologia, Universidad Nacional Autónoma de México (UNAM), Ciudad Universitaria, Ap. Postal 70-275, México D. F, 04510, México.

Gerardo Ceballos, Instituto de Ecologia, Universidad Nacional Autónoma de México (UNAM), Ciudad Universitaria, Ap. Postal 70-275, México D. F, 04510, México.

Many helping hands

The development of a black-footed ferret reintroduction project in Mexico (and elsewhere) is possible only through the combined efforts and contributions of a myriad of program partners in Canada, Mexico, and the U.S. Black-footed ferrets available for release are primarily produced at six Species Survival Plan facilities, including: the Toronto Zoo, Canada; the National Zoo's Conservation and Research Center, Virginia; the Louisville Zoo, Kentucky; the Cheyenne Mountain Zoo, Colorado; the Phoenix Zoo, Arizona; and the U.S. Fish and Wildlife Service's National Black-footed Ferret Conservation Center in Wyoming. Excess ferrets released in Mexico were provided by all SSP facilities and an experimental pen breeding facility in New Mexico operated by the Turner Endangered Species Fund. The El Paso Zoo provided logistical support and staff to assist in the release of ferrets in Mexico. In addition, many agency and private partners associated with the Black-footed Ferret Recovery Implementation Team provided technical and field assistance to the Mexico program. Field reintroduction and monitoring efforts in Mexico are accomplished through the help of many staff biologists and students from the University of Mexico. Finally, the cooperation of the Jeffers Ranch and the peoples and Ejidos of El Cuervo, Casa de Janos, and San Pedro in northern Chihuahua have been essential to the successful implementation of this recovery effort in Mexico.

As with many endangered species, progress and eventual success of the black-footed ferret recovery program hinges on the considerable talent, energy, and committed resources represented in the many involved agencies, Tribes, conservation organizations, zoos, and other private interests. Only through such combined partnerships is there hope of restoring such an elegant and integral species to the North American grasslands and desert plateaus in which it belongs.

California Condors Return to Mexico

by Denise Stockton

A condor given the name Xewe dines on some road kill in its flight cage in Mexico prior to its release.
Photo by John Stockton

After a lengthy absence, California condors *(Gymnogyps californianus)* have returned to Baja California. The largest bird in North America is now soaring the skies over Mexico for the first time in more than 60 years. The site chosen for this historic event is situated approximately 125 miles (210 kilometers) south of the California border in a remote area of the Sierra San Pedro de Martir National Park at an altitude of about 8,200 feet (2,500 meters).

The first three birds were released on October 9, 2002, with approximately 70 dignitaries, including biologists, zoologists, and other interested parties from both sides of the border, watching excitedly. However, the birds decided it was not a good day to fly. They remained in the flight pen oblivious to the open door and freedom. With only a handful of biologists present, the next day turned out to be a better one in which to take wing. This release is the first step in a long-term effort to reestablish condors in Mexico. It is also a step closer to the goal of the California Condor Recovery Program, which is to establish additional self-sustaining populations in historic condor range through the release of captive-reared birds.

The California Condor Recovery Program is managed by the U.S. Fish and Wildlife Service in cooperation with the U.S. Forest Service, the California Department of Fish and Game, the Zoological Society of San Diego, the Los Angeles Zoo, the Peregrine Fund, and the Ventana Wilderness Society. They are now joined by their Mexican partners, which include the Mexican federal government office of the Secretary of the Environment and Natural Resources (SEMARNAT), the Instituto Nacional de Ecología and the Comisión Nacional de Áreas Naturales Protegidas, and the nongovernmental organization, Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE). The Baja site is being managed by these cooperating Mexican organizations and assisted by the San Diego Zoological Society.

"Day after day we hear about species that are endangered or become extinct. Very few times do we receive news of a recuperation and conservation effort," said Dr. Exequiel Ezcurra, President of the Instituto Nacional de Ecología. "This is why this day gives us reason to rejoice; 60 years have passed without condors in Mexico, and today we will see these birds open their wings where their ancestors once did."

"Working hand in hand, across international boundaries with our Mexican partners, our effort to reintroduce California condors into Mexico represents a truly binational, holistic approach to restoring an endangered species throughout its historical range. The strong commitment of the condor management community in the U.S. and Mexico will help to insure the success of this long-term project," states Marc Weitzel, Project Leader for the Service's Hopper Mountain National Wildlife Refuge Complex and a member of SEMARNAT's Technical Committee for the Reintroduction of the California Condor.

California condors are scavengers that have soared over mountainous areas of California since prehistoric times, but their numbers declined drastically in the 20th century. This was due in part to habitat loss, shooting, lead poisoning, and toxic substances used to poison predators. Condors were listed as an

endangered species in 1967. In 1982, the condor population reached its lowest level of 22 birds, prompting Service biologists to start collecting chicks and eggs for a captive breeding program. In 1992, the Service, through the Hopper Mountain Refuge, began releasing California condors back into the wild. Currently, the Service and its partners manage 74 condors living in the wild in California, Arizona, and now Baja California, Mexico. There are 126 birds in captivity at the breeding facilities for a total of 200 condors in existence.

Hopper Mountain has an agreement with the reintroduction project in Baja for the long-term loan of surplus field equipment. Mike Stockton, one of the refuge's condor biologists, drove the first of the much needed equipment (scopes, tripods, backpacks, etc.) down to Baja the last week of October. Stockton's arrival coincided with the delivery of a travel trailer that had been in use by Hopper Mountain field biologists and was no longer needed. The Mexican biologists had been living out of tents for months and were very pleased with their new accommodations.

Stockton was able to experience firsthand the challenges that the Mexican biologists face as they get this infant program off the ground. A steady supply of carcasses to feed the condors is still being worked out, so in the meanwhile road kill and the occasional dead horse or steer donated from a neighboring ranch will have to do. The steep terrain, while perfect habitat for the condors, is proving to be a problem for the biologists on the ground trying to track the movements of the released birds. This became evident when the newly released birds moved down low into areas where the biologists couldn't follow, and they became concerned when the condors were not coming back up to the feeding site. It was decided to trap all of the birds even though one of them was adjusting well to the area. They plan to rerelease them for short periods of time until they become accustomed to the area. Two all-terrain vehicles that the Hopper Mountain Refuge sent should assist considerably with this situation.

Stockton spent the rest of the week with biologists sharing condor management experiences and extending an invitation to visit the Hopper Mountain NWR Complex. Juan Julian Vargas Velazco and Maria Catalina Porras Pena, the Mexican biologists, came to Hopper Mountain in early February 2003 and joined refuge biologists in observing, feeding, and tracking condors on refuge and at off-refuge sites. From time to time over the next few years, refuge biologists will travel south to give technical support to the program in Baja.

Hopper Mountain NWR has been managing California condors for more than 10 years, and has worked closely with recovery program partners to develop and refine condor management methods. It is this wealth of firsthand knowledge that the refuge biologists will be sharing with their Mexican counterparts. Stockton was greatly impressed with the people he met during his stay in Mexico, "Everyone is 100 percent behind returning the California condor to this part of their historic range, from the local ranchers to the dedicated professionals and everyone else I came in contact with. I look forward to working with them again."

Denise Stockton is an Information & Education Specialist at the Hopper Mountain NWR Complex (telephone 805/644-5185 or email denise_stockton@r1.fws.gov).

Service biologist John Stockton and Mexican biologist Juan Julian Vargas Velazco track released condors in Mexico.
Photo by John Stockton

Nightly Wings, Nectar Sips

by Rodrigo A. Medellín and Steve Walker

***Lesser long-nosed bats are important pollinators for saguaros and agaves, such as this* Agave palmeri.**
Photo © Merlin D. Tuttle, Bat Conservation International

We reached the cave entrance at around 5:00 p.m. At that time, hardly anyone was around the impressive cliff, with striking overhanging vegetation, that contained one of the most species-rich caves in all of México. A young boy approached us and asked for one peso in exchange of him telling us about *los murciélagos que viven en la gruta* (the bats that live in the grotto). One of us hurriedly dug for the coins and gave them to the self-confident child.

The boy started telling us about how important bats are to maintaining the surrounding forest by pollinating the flowers of the ceiba trees, morning glory trees, agaves, and many other species, and dispersing the seeds of some soft-fleshed fruits, including those of the garambullo columnar cactus *(Myrtillocactus geometrizans)*. The bright-eyed boy also emphasized the importance of some of the other bat species in the cave, such as the insectivorous Mexican free-tailed bats *(Tadarida brasiliensis)* that roost there by the thousands. He mentioned not only that bats feed on important insect agricultural pests, but also that they provide rich organic fertilizer in the form of guano.

After the 10-minute lecture, the boy's mother joined us. She explained that she and her son, together with a few other people from the nearby town, had been designated cave stewards after having participated in an environmental education program presented by a coalition of scientists and educators from the National University of México and a U.S.-based organization, Bat Conservation International. She was referring to the *Programa para la Conservación de los Murciélagos Migratorios de México y Estados Unidos* (PCMM), or Program for the Conservation of Bats of México and the United States. She also explained how, as recently as two years ago, children used to throw rocks at the bats and sell fossils (limestone imprints of vegetation) to tourists, and how this activity slowly but steadily was destroying the cliff the people in town are so proud of. Today, the children earn money by telling tourists about bats and their important ecological roles and economic benefits.

La Gruta, near the western México town of Ciudad Hidalgo, in the same region as the world-famous monarch butterfly winter roosts, is one of the 15 lesser long-nosed bat *(Leptonycteris curasoae)* roosts the PCMM has been monitoring for up to seven years. The lesser long-nosed bat is listed by the U.S. as endangered and by México as threatened. Although the species can be found roosting in groups of up to 200,000 in some of the summer maternity colonies in the Sonoran Desert (see "A Bat Boom at Fort Huachuca" in *Bulletin* Vol.XXV, No. 6), many colonies have been dramatically depleted. This is primarily due to lack of knowledge about their role as pollinators and seed

Rodrigo Medellín (right) explains to 5th and 6th graders at Ciudad Hidalgo, Michoacán, México, about the bats at La Gruda, the cave near their school.
Photo by Brian Keeley, Bat Conservation International

dispersers on which so many plant species depend, or about the destruction of their habitat (which includes primarily dry tropical forests and deserts).

The PCMM works on a combination of research, environmental education, and conservation actions (such as the protection of roost sites) to determine and counter the causes that have harmed the bats. Eleven teams from universities, nongovernmental organizations, and government agencies are working to document the biology of this and other migratory species, and to determine their conservation needs. Some of the questions that we are addressing are: How far do the bats migrate each summer? What are the geographical/ecological factors determining their reproductive patterns? Do all lesser long-nosed bats migrate? This last question has sparked an interesting debate. We know there are two reproductive pulses in this species: one in the summer in the northern part of the species' distribution (the Sonoran Desert), and one in the winter in the dry tropical forests of western and southern México. We also know that at least some bats remain behind in central and southern México when most females are giving birth in Sonora and Arizona.

Migration is not a clear-cut pattern in which all bats move as a flock from one location to the other. Rather, migration is an evolutionarily adaptive response to selective pressures that are determined by when and where food is available. All habitats go through seasonal peaks of food availability. In some habitats, like the Sonoran Desert, food is virtually absent during the winter. But other habitats, such as dry tropical forests, contain food throughout the year in variable abundance, depending on the year, the region, and certain aspects of the habitat. That way, in the summer, when resources are scarce in the dry tropical forest, some bats are able to remain behind while others carry out the long migration to the north, where such foods as the flowers and fruits of the saguaro, cardon, and organ pipe giant cacti are plentiful.

This rather complex ecological cycle is slowly being pieced together with other conservation components as part of the species' recovery plan. Environmental education is a key long-term component that yields results soon after its initial application, but it needs to be extended in time to reach successive generations of people. Some caves have management plans in place, and all caves we have been monitoring show signs of bat population stability, a good initial step toward monitoring improvements in the population status throughout the species' range. The first results are encouraging, both in terms of the biology of the species and the response of local inhabitants that have adopted the cause of bat conservation. We hope the future will be one of plentiful, continuous, and widespread resources and undisturbed roosts for the welfare of our shared bat species, ecosystems, and ecological processes.

Rodrigo A. Medellín (medellin@miranda.ecologia.unam.mx) is a professor and researcher at the Institute of Ecology, National University of México, and Director of the Program for the Conservation of Mexican Bats. Steve Walker was Executive Director of Bat Conservation International when the article was written and is now Director of Resources, México Program, for The Nature Conservancy (swalker@tnc.org).

California Red-legged Frog: Jumping to Survival

by Douglas M. Krofta

California red-legged frog
Russell Smith, Los Angeles Zoo

Russell Smith (left) handles a California red-legged frog collected from Rio Santo Domingo in Baja California, Mexico, while Eric Mellink (right) assists.
Douglas Krofta, USFWS

Once made famous by Mark Twain in "The Celebrated Jumping Frog of Calaveras County," the California red-legged frog (*Rana aurora draytonii*) is considered the largest native frog in California. During the mid to late 1800s, their large size and abundance led these frogs to become a regular on restaurant menus. As overharvesting decreased the population, non-native bullfrogs were imported to subsidize the human appetite for frog legs. Once naturalized, the bullfrogs voraciously consumed any living organism around, including red-legged frog tadpoles, metamorphs, and adults. In addition to predation by bullfrogs and other non-native species, red-legged frog populations continued to decline in over 70 percent of their historic range from habitat loss and alteration due to urban and agricultural development. Consequently, the California red-legged frog was listed as federally threatened on May 23, 1996.

In 1997, a partnership developed to save the remaining population of southern California red-legged frogs, all located on The Nature Conservancy's Santa Rosa Plateau Ecological Reserve (Reserve) in southern California. The primary members included Carole Bell, reserve manager for The Nature Conservancy; Russell Smith, Curator of Reptiles for the Los Angeles Zoo; and the U. S. Fish and Wildlife Service. Our team is working with many other scientists and nonscientists to facilitate the non-native species eradication program and red-legged frog recovery effort.

Following the El Niño event in the winter of 1998, the frog population, which once numbered in the hundreds, had dwindled to three individuals–all males. The last female was believed lost to predation during the preceding winter. The partnership team began discussing options for recovering this population, which included evaluating the translocation of frogs from other extant populations.

Concurrently with these recovery efforts, Dr. Brad Shaffer of the University of California at Davis, in cooperation with the Biological Resource Division of the U. S. Geological Survey, analyzed tissue samples of red-legged frogs collected from many of the known populations throughout California and Oregon to investigate the across-subspecies and inter-subspecific genetic relationships. From Dr. Shaffer's preliminary results, we learned that the population on the Reserve was significantly different genetically from any other population sampled in California.

Our sights turned to two recently confirmed populations of red-legged frogs in north-central Baja California, Mexico, near the town of Colonet, approximately 250 kilometers (156 miles) south of the border and approximately 410 kilometer (256 miles) from our population at the Reserve. Based on ecological information collected at these sites, we believed that these populations warranted further investigation, including tissue collection for a genetic analysis. In the spring of 2000, we began developing a plan to obtain approval from the Mexican government for a two-part study. The first phase would be to survey, obtain population estimates, collect tissue samples from the two documented populations, and survey for additional populations. The tissue would then be analyzed, and if it genetically matched the population at the Reserve, we would start the second phase. This

Russell Smith (left), Erik Mellink (center), and a graduate student (right) prepare to survey for frogs in Rio San Telmo in Baja California, Mexico.
Douglas Krofta, USFWS

phase would include collecting live frogs to bring back to the Los Angeles Zoo and Reserve, raise them in captivity for several months to quarantine them, grow them to maximize survivability size, and then release them into the wild population on the Reserve.

As part of the process to gain approval from the Mexican government, we presented our proposal to the Canada/Mexico/United States Trilateral Committee for Wildlife and Ecosystem Conservation and Management in 2000, and then updated in 2001 and 2002. The Trilateral Committee endorsed our proposal and we were granted preliminary approval to begin the permitting process. To facilitate our proposed project, we forged a partnership with Dr. Eric Mellink of the Center for Scientific Research and Higher Education (CICESE) in Ensenada, Baja California, who expressed an interest in our project and wanted to join our team. Dr. Mellink had previously worked on many cross-border projects, including several with the Fish and Wildlife Service, and was able to bring valuable assistance and knowledge to the team.

In August of 2001, Russ Smith and I met with Dr. Mellink in Ensenada to start the first phase. We confirmed and surveyed the two previously documented localities along Rio San Telmo, south of Colonet, and documented a sizable new population in Rio Santo Domingo, near the town of Colonia Vincente Guerrero. We collected a total of eight tissue samples from the three populations.

Dr. Mellink was instrumental in this survey and collection effort by: 1) gathering historical and current information concerning frog localities for northern Baja California to focus our survey; 2) accompanying us on our survey and allowing us to work under his general scientific Mexican collection permit; 3) housing the tissue at his laboratory at CICESE; and 4) obtaining the necessary permits to export the tissue from Mexico.

The tissue samples were imported into California in April of 2002 and sent to Dr. Shaffer's laboratory for genetic analysis. In December, the tissue was analyzed with the results suggesting that the three populations in Mexico were genetically similar to the population at the Reserve.

We are now focusing on the second phase of the project for the Fall of 2003. This phase, if endorsed by the Trilateral Committee and Mexican government, will include: 1) conducting more detailed surveys of the populations in Mexico to ascertain population estimates; 2) collecting and exporting live specimens to raise at the Los Angeles Zoo and the Reserve; 3) releasing the collected specimens into the wild once they have been sufficiently quarantined and grown; and 4) repeating the effort annually until the resident U.S. population is self-sustaining.

This survey and recovery effort in southern California and Baja California for this beleaguered frog would not be possible without the collaborative efforts of the partner institutions in both countries. With this continued cooperation, we have a chance to recover at least the population and genetic line of the California red-legged frog on the Sant Rosa Plateau Ecological Reserve, and work toward recovering the subspecies as a whole in southern California.

Douglas M. Krofta is a biologist in the Fish and Wildlife Service's Endangered Species Program in Arlingtion, Virginia (Douglas_Krofta@fws.gov). He was formerly the Branch Chief for Listing in the Carlsbad Fish and Wildlife Office in Carlsbad, California.