



# the Tortuga Gazette

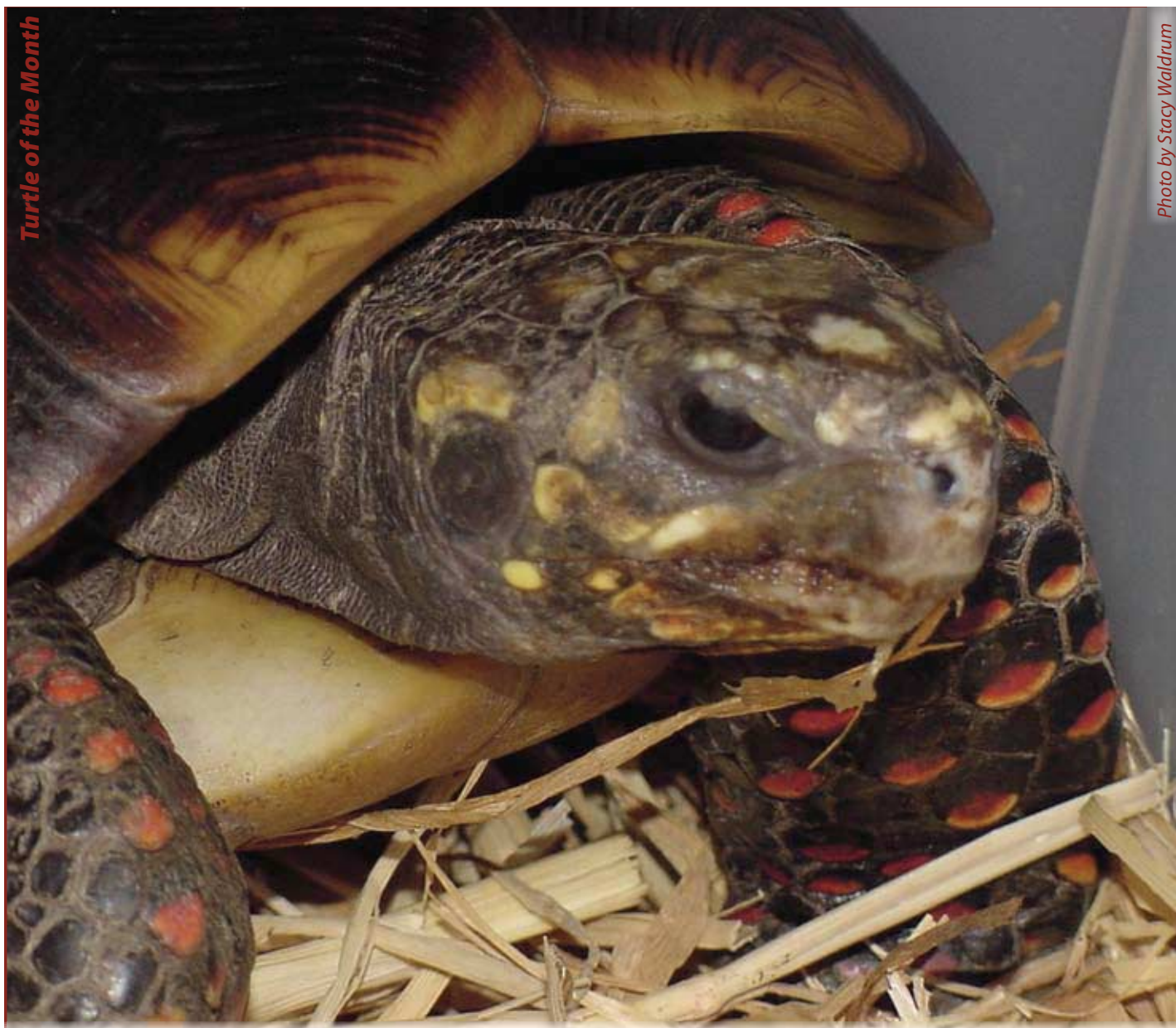
California Turtle & Tortoise Club Founded in 1964

Dedicated to Turtle & Tortoise Preservation, Conservation and Education

January/February 2008

Volume 44, Number 1

## Red-footed Tortoise (*Geochelone carbonaria*)



Turtle of the Month

Photo by Stacy Waldrum

### Breeding the Red-Footed Tortoise in Captivity by Eric M. Rundquist

“The Cenozoic came, and with it a progressive drought, and the turtle joined the great hegira of swamp and forest animals to steppe and prairie, and watched again as mammals rose to heights of evolutionary frenzy reminiscent of the dinosaurs in their day, and swept across the grasslands in an endless cavalcade of restless, warm-blooded types. Turtles went with them, as tortoises now, with high shells and columnar, elephantine feet, but always making as few compromises as possible with the new environment, for by now their architecture and their philosophy had been proved by the eons. And there is no wonder that they just kept on watching as *Eobippus* begat Man o’ War and a mob of irresponsible and shifty-eyed little shrews swarmed down out of the trees to chip at stones, and fidget around fires, and build atom bombs.” – Archie Carr, *Handbook of Turtles*

article on page 8



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# California Conservation Update

by Michael J. Connor, PhD

## Desert Tortoise Recovery Plan

The United States Fish and Wildlife Service issued an agency/stakeholders draft of the Revised Desert Tortoise Recovery Plan on 10/16/07.

Conservation groups criticized the Plan as a watered down version of the 1994 Plan that ignores science and will do little to reverse declining desert tortoise populations. The revised plan's strategy is to rely on "adaptive management." The first recovery action listed is "the development of a decision support system." Because desert tortoise populations will take many decades to show measurable response to any action, it is unclear how "adaptive management" or the "decision support system" will directly contribute to tortoise recovery.

At its October 20, 2007 meeting the CTTC Executive Board expressed its opposition to the draft plan by passing the following motion:

"Given the worsening plight of the desert tortoise brought about in part because the Fish and Wildlife Service has failed to fully implement the recommendation of the 1994 Recovery Plan, CTTC demands that the Service follow the mandate laid down by the Endangered Species Act and develop a revised recovery plan for the desert tortoise that incorporates:

(i) a description of such site-specific actions as may be necessary to achieve the plan's goal for conservation and survival of the species;

(ii) objective measurable criteria which, when met, would result in a determination, in accordance with the provisions of this section, that the species be removed from the list; and

(iii) estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal.

The primary focus of the Recovery Plan MUST be on-the-ground-recovery actions and not administrative and research efforts."

## Leatherback Sea Turtle

On September 26, 2007 the Sea Turtle Restoration Project filed a petition to seek Critical Habitat Designation off the California and Oregon Coast for the Endangered Leatherback Sea Turtle.

Despite a unanimous "no" vote by the California Coastal Commission at its August 2007 meeting, the fishing industry has once again submitted a request for an exemption to the ban on longline fishing off California's Coast. The California Coastal Commission will vote on the new request at their upcoming December meeting. On November 19, 2007, CTTC sent a letter to the California Coastal Commission urging them to vote "no" on this new request for an exemption to the ban. If approved, this exemption would allow the use of longline fishing gear off the coast of California in an area where it has been restricted to benefit the critically endangered Pacific Leatherback Sea Turtle and which is the same area proposed for designation as critical habitat.

## Western Pond Turtle

In April 2007, CTTC officially joined the Coalition to Save San Onofre. This coalition consists of groups opposing the routing of a toll road through San Onofre State Park in Orange County. The road would severely degrade San Mateo Creek, home to one of the last remaining Western Pond Turtle populations in Orange County.

In September, CTTC sent a letter to the California Coastal Commission urging the commission members to vote to stop the Transportation Corridor Agencies' plan to build a toll road right through the middle of San Onofre State Beach. The Commission's mission to "Protect, conserve, restore, and enhance environmental and human-based resources of the California coast and ocean for environmentally sustainable and prudent use by current and future generations," and we do not see how allowing the toll road is compatible with the Commission's mission. At the last minute, the hearing was postponed until February. This is good news for the turtles because it suggests that the road builders don't have the votes on their side. □

*From the Chair...* by Michael J. Connor, PhD, Chairman, CTTC Executive Board

## What does climate change mean for the world's turtles and tortoises?

Climate change is big news these days. Not just because Al Gore got his Oscar *and* a Nobel Prize (although that did help spread the message and spur action in Washington D.C.), but because it seems that almost every year the climate sets some new record high temperature or record low rainfall, or fires burn increasingly vast areas of open range and woodland. What does climate change mean for the world's turtles and tortoises? What does this mean for California's native species?

The Intergovernmental Panel on Climate Change reports that eleven of the last twelve years (1995-2006) rank among the twelve warmest years since 1850 when records of global surface temperature were first kept. The Panel predicts that in the southwestern USA average temperatures will continue to increase and rainfall will decrease. We may experience an increase of as much as 1°Fahrenheit over the next 50 years in the northern hemisphere.

One thing we all know about turtles and tortoises is that their biology is geared towards a long lifespan. Most chelonians take many years or even decades to reach adult size. Under favorable conditions, desert tortoises will reach adult size in 15-20 years in California's deserts. There is some dispute among biologists over how long desert tortoises live in the wild, in part because the tortoises' lifespan is so long it is longer than a typical biologist's career. However, the lifespan is at least 50 years. Known longevity of a number of captives considerably exceeds that number suggesting that 50 years is an underestimate. Clearly though, the longevity of desert tortoises and most chelonians is long enough that they will experience human-induced climate change during their lifespans.

An increase in 1°Fahrenheit (F) might not seem very big, but from what we know of tortoise biology it can be very significant. Many chelonians, including desert tortoises, have environmental sex determination meaning that the sex of the offspring is determined largely by incubation temperature and conditions. One laboratory study found that the pivotal incubation temperature for desert tortoise eggs was 89°F. A change in temperature of 2°F either way produced only single-sexed clutches.

Thus, the forecasted increase in global temperature could seriously influence desert tortoise demographics by changing the sex ratio of the offspring. We know nothing about actual nest temperatures in the wild but this is a topic that is obviously ripe for more for research.

How will climate change impact the constituent elements of the habitat they live in? With less precipitation and changes in rainfall patterns we can expect changes in the production of the annual plants that desert tortoises are so dependent on. Paradoxically, the greenhouse gas carbon dioxide can act as a "fertilizer" of sorts and under appropriate conditions increased levels can stimulate plant growth. However, in the hot deserts availability of water and other nutrients such as nitrogen are the rate-limiting factors. With less rainfall there would be less of the annual flowers and plants that the tortoises need to thrive. Scientists believe that environmental stressors helped underlay the Upper Respiratory Tract Disease epidemic that swept through many of the wild desert tortoise populations in the 1980s and 1990s. The same environmental stressor hypothesis predicts that some desert tortoise populations will be more susceptible to disease outbreaks in the future unless we act now to reduce those environmental stressors that we can control such as livestock grazing and off-road vehicle use.

Species of desert tortoise have lived in the southwest for millions of years. They have certainly experienced climate change before but have had the time and opportunity to evolve and adapt along with it. Unfortunately they now live in an environment totally dominated by human action. They cannot move easily into new habitat areas or higher elevations because they are constrained by the urbanization and industrialization of the desert, and the railroads, freeways and aqueducts that crisscross it. Fortunately though, the various desert tortoise populations are adapted to very different conditions across their range. For example, the West Mojave desert tortoise population is heavily dependent on the spring annuals that arise

from winter rains, while the desert tortoise populations of California's southeastern Colorado Desert areas that may experience summer monsoons make use of both spring and summer annuals. Recognizing this genetic diversity and conserving desert tortoise populations throughout their range should be a conservation priority in the face of global climate change.

Many of our endangered sea turtles exhibit "natal homing" and females return to nest on the very beach they were born on to lay their eggs. The females leave the ocean and drag themselves up the beach above the high tide mark. There they carefully dig their nests and lay their eggs. Like desert tortoises, sea turtles have environmental sex determination. However, unfortunately for them, along with rising temperatures has come rising sea levels offering a double whammy. There is now a real concern that important nesting beaches will suffer more frequent inundation by high tides and that could seriously set back sea turtle recovery.

It's not all bad news for chelonians. Relatively mobile species that live in major waterways such as snapping and painted turtles could extend their distributions northwards. On the other hand, opportunistic species such as escaped red-eared sliders may experience more optimal conditions in Canada and northern Europe and become more invasive than ever.

For more information on global climate issues, visit the Intergovernmental Panel on Climate Change Website at

<http://www.ipcc.ch/> □



*Wild desert tortoise taking a break from digging its burrow. Photo by Michael J. Connor.*



# Four Seasons in a High Desert Pond

written and photographed by Margaret Stewart, CTTC High Desert Chapter

My slider pond was first built in 1997 for a red-eared slider I adopted. Originally it was a pre-fab plastic pond 12" deep. In 2002, we took it out because of a leak. We enlarged the pond by digging the pond area down to 20" deep and 5' around with cut outs for plants. This time we put in a heavy plastic pond liner with rocks on top and a small waterfall. In 2003 I adopted a yellow belly slider that had gotten too big for the aquarium it was living in.

In November 2004 we had a snowstorm that dropped about 18" of snow. When the temperature starts to drop in late September-early October, I put in an underwater heater to keep the water semi-warm. The heater stays in the pond until the water warms up in late spring.



The pond has an underwater filter with a bio-bag and filter material that I clean as needed, depending on the weather. The sliders sun themselves by climbing up in the plants on warm, sunny days year round.

In winter on cold days they stay at the bottom of the pond. I don't feed them most of the winter; if they need food, they can eat the mosquito fish (*Gambusia* species) that live in the pond with them.

I didn't know until I kept them that pond sliders shed the lamella (outer shell coverings) of their scutes. I am always finding these shell pieces in the bottom of the pond. ☐

The Four Seasons, clockwise from the top:

- ① Winter - January
- ② Spring - June
- ③ Summer - September
- ④ Fall - November



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# Sea Turtles - Iconic but Going Extinct

by Shailendra Singh

SUVA, Aug 22 (IPS/IFEJ) - Reports of the extinction of China's iconic Yangtze River dolphins have some conservationists in the South Pacific fearing that the same fate awaits certain migratory species of sea turtles, which are similarly imperilled.

The Leatherback Turtle (*Derموchochelys coriacea*) the largest living species of sea turtle, is said to be in grave danger in Pacific waters. Turtles are among the world's creatures that survived the dinosaur age.

It could be the first of the turtle species to disappear from this part of the world unless remedial action is taken, says Penina Solomon, the Regional Marine Officer with the WWF South Pacific Programme.

Penina said WWF was saddened by the extinction of the whitefin dolphin. Asked if parallels could be drawn between the whitefin dolphins and turtles in the South Pacific, Penina answered in the affirmative saying that polluted waters, intensive fishing activity and busy shipping traffic posed similar threats to turtles.

"The Pacific can relate to an example of a cultural icon becoming extinct through human activity (and) it may be an opportunity to engage people's emotions to the possibility that their actions can drive an animal to extinction," she said.

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**"Once a species falls below a certain population size, they can fall into what we call an extinction vortex..."**

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Craig Morley, a conservation biologist at the University of the South Pacific, said the whitefin dolphins were driven to extinction first by relentless hunting, and then by habitat destruction such as building dams and draining water for agriculture as well as pollution. Morley said that the same destructive pattern could be seen in the Pacific.

Asked if turtles were similarly threatened Morley said: "Absolutely. Once a species falls below a certain population size, they can fall into what we call an extinction vortex -- driven by things like loss of genetic diversity (which increases the likelihood for disease and genetic inbreeding), demographic imbalances (more of one sex than

another), the allee effect (when they can't find reproductive partners), and they are more prone to environmental stochasticity (floods, droughts etc).

"The trouble is we are not learning the lessons of the past or what happens elsewhere," Morley said.

Just as the whitefin dolphins were iconic figures in Chinese culture and folklore, the sea turtle has been a key figure and symbol of Pacific island cultures and traditions.

But just as the whitefin dolphins' special status did not protect them, so it is with the turtles, which are prized for their meat in the Pacific Islands.

Morley said that many locals who defy bans and take turtles indiscriminately are opportunistic hunters.

They do it for commercial purposes even though this is illegal, and not always for feasts or cultural and traditional events for which hunting is sometimes permitted.

"Even though there is a turtle ban (in Fiji), it is a waste of time and a cop-out by the politicians as they provide no funds to enforce this ban," Morley said. Fiji is on a five-year moratorium (ending 2008) under which the commercial harvest and sale of sea turtles is banned but sale and consumption of turtle meat is common.

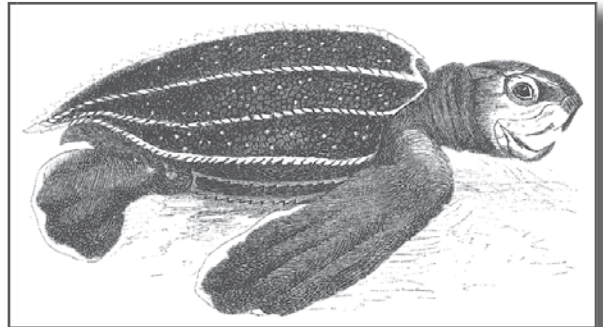
"This is typical of many conservation treaties -- people sign up thinking that this is all that is needed but nobody puts their money where their mouths are," Morely said.

While several species of sea turtle are taken for food, the giant leatherback turtle is said to be the most threatened as they are accidentally caught and killed in long line fisheries. It is currently identified as 'critically endangered' and many scientists fear that unless threats to these animals are negated, they could suffer the same fate as the white dolphins.

"At the current rate of decline, there will definitely be a point in time when turtles will no longer exist," said Penina.

According to Kenneth MacKay, the director of the USP's Institute of Marine Resources, around 1,000 leatherback females nest annually in the Western Pacific. This includes countries like the Solomon

Islands, Vanuatu, Papua New Guinea and Indonesian Papua, with occasional sightings in Fiji.



MacKay said 1,000 animals "were not very many" in terms of sustainable numbers.

The whitefin dolphins also succumbed to China's relentless drive to maintain its double-digit economic growth, with their habitat, the Yangtze River, having developed into one of the busiest shipping routes in the world.

Morely said that unchecked development posed a "potentially huge" threat to conservation efforts.

Along with fisheries, tourism is a key foreign exchange earner in many developing island states. "In some cases tourism is taking precedence over conservation and as a consequence, turtle nesting and feeding grounds are wiped out," Penina said.

She added that many small island developing states faced a lack of resources to effectively conduct conservation and recovery. As such, conservation efforts may not feature highly in their national priorities.

Political instability was another issue as it affected financial grants that could significantly contribute to conservation efforts, Penina added.

Government departments were cooperating, she said, but much more needed to be done, particularly with protecting turtles at their nesting beaches where they were at their most vulnerable.

She added that efforts from all stakeholders (governments, traditional resource owners and users, general public, media) needed to be more cohesive and collaborative.

The enforcement of policies such as the moratorium in Fiji and other fisheries regulations in other parts of the Pacific should be a priority also.

"Another area that needs strengthening is a shift in attitude towards these animals,

particularly so with recognising that turtles don't reproduce rapidly, but rather take years to lay eggs," Penina said.

According to Morley, the situation called for new and radical action. "Forget all the passive, old techniques.

"We need to make people sit up and realise what is happening -- for too long we have been silent about this because we could be deemed as being insensitive or it treads on someone's toes. And we need conservation to reach a much higher profile here that what it currently is."

The sense among experts here is that, while the demise of the whitefin dolphins may have set alarm bells ringing, turtles could soon follow suit and become historical monuments unless cohesive remedial action is taken urgently. □

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## Rescue...9-1-1

by Sharon Paquette

Orange County Chapter Co-Adoption Chair

The day starts out like any other. It's early as I go around and clean up the turtle and tortoise enclosures before letting everyone out of their houses for the day. I change their water, put out food and pick some treats off the plants that we grow just for them. I check everyone over as I go along, making sure they are bright-eyed and well.

Afterwards...it's on the computer where I check to see what the day has to offer. I return phone calls before going out and starting the "chores" of the day with the turtles and tortoises.

Just then the phone rings and a call comes in: "*Turtle in distress!*"

I grab my coat...put on a hat and plop a lollipop in my mouth as I run out the door. As I pull up to the scene, reporters are surrounding me -- asking questions as they shove microphones in my face. Camera flashes going off all over the place!

Hummm...Is this real? Or fiction? You guessed it...it's Fiction!

The work of doing rescue is not so glamorous...nor is it generally noteworthy to the public. It can be a lonely job where credit for what you do goes unnoticed. It is time consuming and expensive at times to care for the animals you rescue. There are many times of sadness as you see things that are heartbreaking and can chill you to the bone.

So... why do I do it? My reward comes from the feelings of accomplishment and the help I give to a turtle or tortoise. It's the relief I may provide to an owner who can no longer keep their beloved pet. It's helping them through the process of having to give up their pet and reassuring them I will do my best to find a safe home with someone who will love the turtle as they have. It's listening to their fears and concerns as they pass their pet along to someone new. Taking in a helpless turtle that is injured and in need and nurturing it back to health is a wonderful feeling. These are the things that make it all worthwhile!

It is not for the glamour or the notoriety of it all, as that is hard to find. You are just a face in a crowd to most people. But to that turtle or tortoise you help? You may be the biggest hero there is! The feeling of matching up the right turtle or tortoise with a new owner is wonderful. Or to find a home for a cast away pet, which is no longer wanted, is rewarding as someone new takes on the care, responsibility and joy of ownership.

Some say that rescue work is just a way of collecting animals at little or no cost. This statement can make my blood boil! I suppose there are those who may take this kind of opportunity to "help themselves." But for us? We have to laugh...It would be much cheaper and quicker to buy whatever we wanted than to wait for it to come thru rescue! Not only that...if we do keep an animal, we end up keeping the ones no one else wants! These are pets that come to us by the way of being "rejects." They are not "normal" or "perfect"...therefore they are not desirable to the average person. But does this mean they do not have the right to a good life? For us? The answer is "no."

We have kept, and still do on a very rare occasion keep, a turtle or tortoise. These are the animals that can't help but tug at our hearts. In the meantime we incorporate them into our own group after a quarantine period, so they can live in a natural setting rather than in the temporary housing we have for the rescues. Most of the "special needs" animals, however, are still up for adoption somewhere along the line!

We do what we can to provide the best housing available for rescues as they await their new homes. Water turtles are kept outdoors in horse-trough ponds with basking areas on which to sun themselves. Tortoises are kept separately in small outdoor enclosures as well. Each holding pen has a house, water dish and a small grazing

area. We try to keep them here as short of a time as possible. Getting them to their new homes quickly is of the utmost importance.

For Tom and me this meant giving up much of our backyard. We have ponds throughout with enclosures tucked wherever there is room. We even stack "upwards" when possible! This adds to the utility costs and grocery bill...but we feel it is all worth it.

If you have the opportunity to help out with the fostering of a rescue animal or to work on a rescue project...*please consider it!* It can be very rewarding, and the help is very much appreciated. □

### CTTC Meetings and Programs

- ♦ **Cen-Val** ♦ January 3; February 8
- ♦ **Chino Valley** ♦ January 18; February 15
- ♦ **Foothill** ♦ January 25; February 22
- ♦ **High Desert** ♦ January 7; February 11
- ♦ **Inland Empire** ♦ January 4; February 8
- ♦ **Kern County** ♦ January 15; February 19
- ♦ **Low Desert** ♦ February 4
- ♦ **Orange County** ♦ January 11; February 8
- ♦ **Santa Barbara-Ventura** ♦ meetings are held in members' homes.
- ♦ **TOOSLO (San Luis Obispo)** ♦ January 9; February 13
- ♦ **TTCS (Long Beach)** ♦ January 18: Silent Auction featuring items from Casa de Tortuga; February 15
- ♦ **Valley** ♦ January 18: Melissa Nicholson, "Turtle Conservation Experiences and the DTTC Recent Accomplishments"; February 15: Terry Christopher, "Tortoise Habitat Construction and Nutrition".
- ♦ **Executive Board** ♦ January 12: meetings are held at the Los Angeles County Arboretum in Arcadia, CA.

□ Check your Chapter website for the latest program information. <[www.tortoise.org](http://www.tortoise.org)> has links to all CTTC chapters. Programs may be scheduled after the newsletter is published.



# Breeding the Red-Footed Tortoise in Captivity

written by Eric M. Rundquist; photography by Stacy Waldrum

Like most folks, I have always had a fondness for turtles. In fact, it was a chance encounter with an ornate box turtle (*Terrapene ornata*) when I was four years old that led to my continuing fascination with and study of amphibians and reptiles. Of all turtles, I find tortoises to be the most interesting. Any animal that can generate that inspired piece of writing by Archie Carr is worthy of our respect and interest.

For eight years, I had the pleasure of working with a group of Red-footed tortoises (*Geochelone carbonaria*) and helped to initiate one of the most successful breeding programs for this species in this country. I would like to share some of my experiences with that group with you in the hope that you may be able to start your own breeding programs with this charming tortoise.

First off, I have to state that this turtle's common name is something of a misnomer. These tortoises would be more accurately named the Red-legged tortoise, as the bright color on their appendages invariably occurs on their legs, not their feet. In addition, many populations of this species have predominately yellow coloration, which leads to confusion with its sister species, the Yellow-footed tortoise (*Geochelone denticulata*). Finally, many specimens have a combination of red and yellow coloration.

For example, one may find tortoises with yellow heads and red legs, red heads and yellow legs, red and yellow heads and red and yellow legs, and other such combinations.

*G. carbonaria*, however share one characteristic by which they can be identified, in spite of their variable color. When viewed from above, most Red-footed tortoises appear to be constricted at mid-body. That is, they have a "waist." Yellow-footed tortoises, on the other hand, are rather smoothly concentric. They do not have the mid-body constriction. In addition, the rear margin of the carapace is flared in Yellow-footed tortoises, while the rear margin in Red-footed tortoise extends more or less straight down.

These are important distinctions in that you want to start off with the same species for your breeding program. I am aware of unsuccessful attempts to breed this species because the two types of tortoises have been mixed. Red-footed and Yellow-footed

can hybridize, but this should be avoided, particularly since the Yellow-footed tortoise may soon be a candidate for threatened or endangered species status.

## Pre-conditioning, Housing and Sex Ratio

On to the meat and gristle of tortoise reproduction. As with many species of herps, pre-conditioning is important to the ultimate success of breeding Red-footed tortoises. All specimens should be fed a high-quality diet.

I have used the following diet with great success: chopped kale, moistened rabbit chow, chopped apple and orange, shredded carrot, a bit of banana, and crumbled,



The mid-body constriction of *G. carbonaria* is evident in this view from above its carapace. This distinct curvature is often called the "waist" of the tortoise.

hard-boiled egg. The mixture should be sprinkled with a good quality calcium supplement such as Osteoform® and a mineral supplement such as Reptivite® or Nekton-Rep®.

I personally prefer and highly recommend the latter supplement. The ratio of greens to fruits and vegetables should be about 2:1 by volume. This diet should be offered twice a week if your tortoises are kept indoors and once a week if kept outdoors with access to other plant foods, for these guys love to graze.

Physical parameters are also important for successful breeding. I highly recommend getting your animals outside as much as possible. Once nighttime temperatures stabilize above 50°F, Red-footed tortoises

can be kept outside daily from spring through fall. If you are lucky enough to live in an area where temperatures rarely fall below that limit, these tortoises can be kept outside year-round.

There are some risks to keeping your specimens outside, though. These tortoises should always have access to some kind of shade. Dense shrubs or bushes such as honeysuckle (*Lonicera* species) are ideal. Red-footed tortoises cannot tolerate constant exposure to direct sunlight and in warmer areas of the country will quickly cook if exposed. Some sort of low-sided pond or soaking pool should also be available, preferably near the shrubbery. This allows your animals to drink at will and to cool off by soaking. Be aware that they can drown

if the water is too deep. Pool depth should be no higher than three-quarters the height of the smallest animal's shell.

If it is not possible to keep your turtles outside for extended periods, then you must construct some kind of enclosure indoors. Each tortoise should be al-

lowed at least three square yards of room for breeding purposes. Provide full-spectrum fluorescent lighting no higher than three feet above the substrate. An additional light and heat source in the form of either a white infrared or full-spectrum (Chromalux® makes good ones) heat lamps should also be placed in at least one, preferably more, corner of the enclosure.

Substrate type is not critical but concrete does get cold and damp and may lead to prolapse of the penis in some males. I have found that a mixture of ground peat moss and sand works well. It has another purpose that I will cover later. Provide low-sided water pans for the animals to drink from and in which to soak.

## Breeding

An area that I think is critically important to breeding success is the size and sexual composition of your group. Although it is possible to have success with 1:1 animals (one male and one female), I believe that larger groups stand a much better chance of succeeding. I would start with at least five specimens. In addition, I would make sure that I had at least two males in the group. Males are quite territorial, and I believe that competition and fighting by the males in an important factor in ensuring that you have fertile, or even interested males.

Check out Table 1 which lists year-to-year breeding activity for the group with which I worked. Notice that even though eggs were laid in 1984, none were fertile. This was the first year that an attempt was made to get eggs from our females. The group at that time consisted of one male and five females that had been kept together for at least three years.

Although I can't prove it, I feel that, because another male wasn't available to aggravate the existing male to stimulate his malehood, no females were inseminated by that male. Late in 1984, we obtained another male for the group and, surprise, surprise, during the next egg-laying season in 1985, we experienced our first fertile eggs and hatchling even though the clutch numbers and egg numbers (3 and 13) were not significantly different from 1984. Notice also that clutch numbers, egg

Table 1: *Geochelone carbonaria* reproductive success from 1984-91

Year	Clutches Laid (# eggs)	Fertile Eggs (%)	Eggs Hatched from Fertile Eggs (%)
1984	2 (14)	0 (0.00)	0 (0.00)
1985	3 (13)	4 (30.1)	1 (25.0)
1986	10 (38)	13 (34.1)	6 (46.2)
1987	17 (95)	71 (74.7)	64. (90.1)
1988	13 (46)	30 (65.2)	21 (70.0)
1989	17 (55)	45 (81.8)	38 (84.4)
1990	3 (12)	6 (50)	2 (30.0)
1991	14 (45)	27 (60.0)	22 (81.5)
<b>Total</b>	<b>79 (318 eggs)</b>	<b>196 (61.6%)</b>	<b>154 (78.6%)</b>



*G. carbonaria* enjoying a bit of banana.

numbers, fertilities and hatchlings also increased substantially over the next several years. Although other factors, such as additional females, may have had an effect on these numbers, only two males were available from 1984 to 1991 to service females. I rest my case.

## Oviposition

Now that you have your breeding group assembled and presumably displaying some breeding activity, your next step entails trying to get eggs from them. To simplify things a bit for me, I will detail the procedures we used and our results. I'll discuss some other matters that might apply to your situation later on.

Living in Kansas, we did not have the luxury of maintaining our animals outside year-round. The group was moved from its exhibit in late September or early October, prior to the first big cold snap of the year. Although the winter quarters shifted a bit from year to year, beginning in 1984, the group had a large nesting box made available no matter where they were kept.

This box was approximately four feet by six feet in dimension and had a depth of 17<sup>1</sup>/<sub>2</sub> inches, with standard 2x8 lumber for sides. A ramp at about a 40°

angle was placed at one end of the nesting box so that individual Red-footed tortoises could enter and leave at will. A mixture of ground peat moss and sand at about a 1:1 ratio filled the box and was lightly moistened. Heat lamps were placed at one end of the box, opposite the ramp.

I believe that the depth of the nesting material in the box was important to our eventual success. I have observed over the years that many kinds of turtles are very picky about the depth of the substrate in which they will lay their eggs. If the nestbox is too shallow, they will either not

lay their eggs in it or will scatter the eggs on its surface.

The latter is precisely what happened during our first attempt to induce egg-laying. Nesting material filled only about half the box at that time. When we filled the box to the top, we experienced no further instances of scattered eggs, except those that were dug up by other tortoises.

Prior to nesting attempts, we observed our females becoming restless and moving about the nest box rather constantly. These animals then typically dug one to three test holes one or two days before actually laying eggs. Nests are dug in typical tortoise fashion, one foot scoop at a time, and nest digging and egg laying can take up to three hours.

If you are lucky enough to be present as eggs are being laid, you can remove them from the nest before the female fills it. If not, take note of where the female has been digging holes and check those sites early the next day. One to six inches of substrate, which has been moistened by the female's urine and is a good marker of nests, will cover the eggs and the nest may be as deep as twelve inches.

Eggs, whether laid indoors or outside, should be removed as soon as possible for artificial incubation. This prevents predators (outside) from eating the eggs and also prevents other tortoises in your group (inside) from destroying the nest and even eating the eggs. Clutch size can vary from one to eight eggs.

Some herpetoculturists take great pains to carefully mark the top side of the eggs when they are removed from the nest. Although care should be taken not to shake or drop



the eggs, this marking procedure isn't really necessary as the developing embryo will migrate to the top of the newly-laid egg when it is set for incubation.

### Incubation

Incubation for this species is relatively simple. I used a moist, fine-grained vermiculite mixture at a 1:1 ratio of water:vermiculite by weight. Just about any sort of moist substrate will probably work. The eggs should be buried about halfway into the substrate.

Container size varies according to clutch size. I have used everything from butter tubs to plastic shoe boxes. The container should be sealed with plastic wrap and a rubber band. As long as the seal is tight, there is no need to add additional moisture during incubation.

Incubation will take from 97 to 202 days. The temperature at which you incubate your eggs depends on what sex you want the hatchlings to be. Temperatures below 82°F will produce males and those above 88°F will make females. Median temperatures will result in a mix of sexes.

This is a handy tool for captive management in that, rather than having to wait six or seven years to determine the sex of your hatchlings, you can virtually guarantee their sex from the start.

I must note an interesting incubation length phenomenon that we observed over the years. A herpetological truism is that reptile eggs which are incubated at high temperatures will hatch sooner than those incubated at lower temperatures.

After eight years of our breeding program, I punched in all the data we had gathered on the clutches into MY computer. One parameter we looked at was the effect of incubation temperature on incubation length. After all the numbers were crunched and standard deviations were run, I was very surprised to see that there was no significant difference in incubation length between eggs incubated at 82°F and those incubated at 87°F.

Why this is I am not sure and I am still analyzing the data in different ways to see if I can find the answer. Part of the reason may lie in the fact that the hatching time of individual eggs within a clutch is quite variable. All eggs in the clutch never hatch on the same day or even within a day or two of each other. I have had eggs in a clutch pip more than 50 days after the first egg in the clutch has pipped.

*Tortuga Gazette*

Table 2: Monthly reproductive output of a captive group of *G. carbonaria* from 1984-91

Month	Clutches Laid (# eggs)	Fertile Eggs (%)	Eggs Hatched from Fertile Eggs (%)
October	18 (74)	52 (68.9)	41 (80.4)
November	17 (67)	41 (61.2)	33 (80.5)
December	15 (67)	45 (67.1)	38 (84.4)
January	13 (53)	35 (66.0)	20 (57.1)
February	8 (36)	17 (47.2)	15 (88.2)
March	6 (15)	4 (26.7)	4 (100.0)
April	2 (6)	3 (50.0)	3 (100.0)

It thus behooves you to be patient if your eggs are fertile and do not all hatch within a week or so. If the egg is rotten or has exploded, which infertile turtle eggs sometimes do, they obviously should be removed. If they are nice and white and without a foul odor, leave them alone and wait to see what happens. You might be surprised.

Red-footed tortoise eggs can be candled like bird eggs to determine fertility. I found that the best time to determine fertility was about six weeks after they were laid. Although the embryo may not be visible at this time, you should see a "blood ring" at or near the top of the egg. This red ring is the beginning of the turtle's vascular system and will be quite distinct if the egg is fertile.

The eggs can be observed periodically throughout incubation to check the progress of development or to determine whether or not the embryo has died. The blood ring will dissipate without evidence of an embryo or the embryo itself will disintegrate. Be careful not to jar or drop the egg while candling and always replace it with the blood ring or embryo on top.

After the eggs pip, the neonate may spend one to four days in the egg while it absorbs most of its yolk sac. When it emerges from the egg, the sac may not be completely resorbed. The sac should be cleansed with a nontoxic disinfectant, such as Betadine® and the infant should be placed in a moist substrate such as long-fiber sphagnum moss until the sac is resorbed completely.

Neonates can be housed together in a standard reptile holding unit. Some moist sphagnum or other moist medium should be available to the youngsters to burrow into, as they have a tendency to dehydrate in the first couple of months of their lives.

Two to three days after emergence, you can begin to feed the new Red-footed tortoises. Offer a finely chopped version of the adult menu, minus the moistened rabbit chow.

Animals fed on a diet too high in protein will develop a shell condition called pyramiding. On a protein-rich diet, the carapacial scutes will grow so rapidly that each scute looks like a small pyramid. Although this does not appear to affect the health of the animal, you will eventually have some pretty funky looking tortoises.

Food should be offered daily for the first year, every other day for the second year, and bi-weekly after that.

### Some Observations and Afterthoughts

The *G. carbonaria* in our group displayed a distinctly seasonal cycle in oviposition, although some field studies indicate that this species can lay eggs any time of the year. Eggs from our group were deposited from October to the following April (see Table 2). Clutch numbers and egg numbers peaked in the first egg month and declined in the following months. Egg fertility was steady in the first four months of oviposition, then seemed to decline, although data was too meager for the last two months to draw any definite conclusions. Egg-hatch percentage from fertile eggs was approximately the same throughout all months, although there is an apparent decline in January and the data, again, from the last few months were too few to be meaningful.

On the other hand, some inferences can be drawn from these numbers. Red-footed tortoises are multiple clutchers. Whatever image that may bring to your mind, it means that females lay more than one clutch per nesting season and many laid three clutches. I suspect that one particularly heroic female laid four clutches one year.

Although I won't present the data here, I noticed that succeeding clutches from



certain females of which we were able to keep particularly good track had lower fertilities than preceding clutches. Since Red-footed tortoises are sperm-retentive, like many other turtles, in subsequent months the retained sperm perhaps became less viable and, subsequently, fewer eggs were fertilized, which accounts for the decline in fertile eggs observed.

As it requires considerable physiological effort to produce eggs, the decline in both clutch numbers and egg numbers is predictable as females use up whatever food stores they have available to produce eggs.

When you begin your breeding program, be advised that it may take a couple of years before you get viable eggs or substantial numbers of eggs. Again, check Table 2 and notice that clutch numbers and egg numbers increased for the first four years of the program, as did egg fertility. This pattern is typical of many turtle breeding programs I have observed. Take a cue from the Cenozoic tortoises' evolution. If you are patient and plodding, you should have great success. I wish you luck. □

### Acknowledgments

I must take this opportunity to acknowledge the efforts of my former colleagues and co-workers Terrie Correll and Dan Schupp in making this Red-footed tortoise breeding program a success.

Any errors of omission or commission in this article are strictly my own.

Reprinted from the *Tortuga Gazette*, Vol. 31, no.1 (January 1995).

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Red-footed tortoise (*Geochelone carbonaria*).  
Photo by David S. Lee.

**Press release: TSA Announces the Recipient of the 2007 Behler Turtle Conservation Award**

## J. Whitfield 'Whit' Gibbons

The IUCN Tortoise and Freshwater Turtle Specialist Group and IUCN Turtle Survival Alliance in 2006 established the John Behler Turtle Conservation Award, a major annual award to honor leadership and excellence in the field of turtle and tortoise conservation. The award honors John Behler, previous Chair of the IUCN Tortoise and Freshwater Turtle Specialist Group and Curator of Herpetology at the Bronx Zoo, Wildlife Conservation Society, who passed away in 2006.

The Behler Award is presented jointly by the IUCN Turtle Survival Alliance and IUCN Tortoise and Freshwater Turtle Specialist Group and includes an honorarium of \$3000. Co-sponsoring organizations for the award are: Chelonian Research Foundation, Conservation International, Chelonian Research Institute, Behler Chelonian Center, World Chelonian Trust, and Durrell Wildlife Conservation Trust.

The 2nd annual Behler Award was presented in Atlanta, Georgia, in July 2007 at the 5th Annual Symposium on Conservation and Biology of Freshwater Turtles and Tortoises. Presenting the award were Anders Rhodin, Chair of the IUCN Tortoise and Freshwater Turtle Specialist Group, and Rick Hudson, Co-Chair of the IUCN Turtle Survival Alliance.

The honoree receiving the 2nd Behler Award was Whit Gibbons, a life-long turtle researcher and conservationist, whose work and leadership in the field have been inspirational for many. Dr. Gibbons earned a BS and MS from the University of Alabama and a PhD from Michigan State University. He is Professor of Ecology at the University of Georgia and Senior Research Scientist and Head of the Environmental Outreach and Education program at the Savannah River Ecology Laboratory.

He has taught herpetology at the University's main campus in Athens, GA since 1978 and been major professor to 47 doctoral and master's students, many of whom are noted for their conservation efforts. His research interests have focused on the population dynamics and ecology of fish, amphibians, and reptiles, particularly turtles, with a primary goal of documenting and explaining the distribution and abundance patterns of herpetofauna. His emphasis has been on application of basic

research findings to environmental impact and conservation issues, with special emphasis on educating the public about environmental issues. Whit lives with his wife, Carol, in Aiken, SC.

He was a co-founder and first national chair of Partners in Amphibian and Reptile Conservation (PARC), president of the Association of Southeastern Biologists, the Herpetologists' League, and the South Carolina Herpetological Society. His honors include the 2006 Henry Fitch Distinguished Herpetologist Award 2006, the Southeastern Outdoor Press Association's First Place Award for the Best Radio Program, the South Carolina Governor's Award for Environmental Education, and the Meritorious Teaching Award presented by the Association of Southeastern Biologists, and now the 2007 John Behler Turtle Conservation Award.

Dr. Gibbons is the author of more than 300 scientific and popular magazine publications, and for more than 30 years has written a weekly newspaper column on ecology and contributed the section on Zoology for the Encyclopedia Britannica Book of the Year. He wrote the latest edition of "Reptile and Amphibian Study," the merit badge booklet for the Boy Scouts of America, and is author or editor of ten books on herpetology and ecology, including *Life History and Ecology of the Slider Turtle* (1990, Smithsonian Institution Press) and *Their Blood Runs Cold: Adventures with Reptiles and Amphibians* (1983, University of Alabama Press).

In addition to honoring the life-time achievements of leading turtle and tortoise conservationists such as Dr. Gibbons, the Behler Award plans to also honor current conservation efforts by mid-career individuals who are making major contributions to the field. Recognizing and valuing the often tireless and dedicated efforts made by these individuals is important, and the Behler Award hopes to provide some inspiration and reward for those working on the front lines of global turtle conservation efforts. □



Australian petroglyph



## Care from the Chair...

*Husbandry Tips From Michael J. Connor*



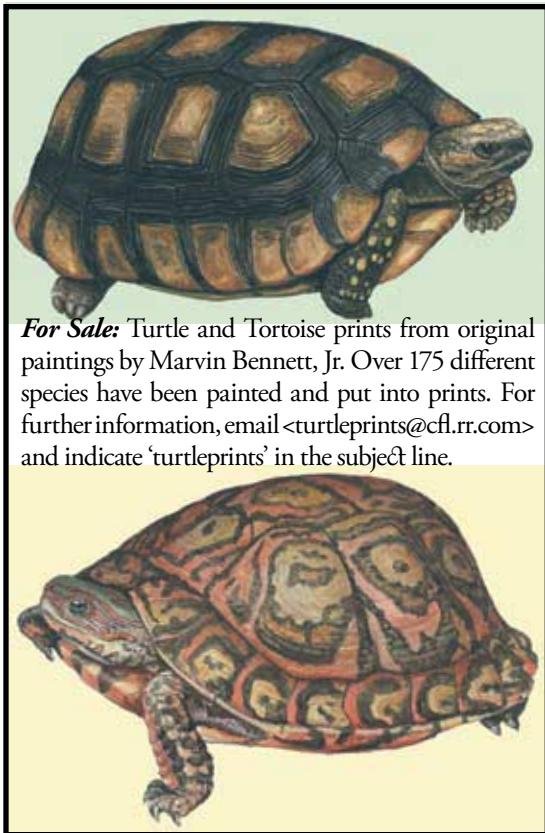
Mediterranean Spur-thighed Tortoise (*Testudo graeca*) female nesting on her hillside. Photo by Michael J. Connor.

Turtles and tortoises exhibit a fascinating range of behaviors and I get many hours of enjoyment observing them. Captive chelonians don't live the same lives as their wild brethren because it is simply impossible to completely recreate their habitat in captivity. I do the best I can to make up for this by enriching the habitats of my captive tortoises to widen their opportunities to behave as they would in the wild.

One of the simplest habitat enrichments is the provision of small "hills" in the pens. These are mounds of dirt piled to a height of about 18 inches with a slope of about 40 degrees. The hills get flattened and bulldozed by the tortoises' activities and by the rain so I top the hills up every winter with soil from elsewhere in my garden.

My Mediterranean Spur-thighed ("Greek") tortoises and marginated tortoises make good use of their little hills for a number of different purposes. The hills provide a visual block so that the tortoises can keep out of each other's line of sight. The sparse grasses and annuals that grow on the hillsides provide forage variety. The hillsides are popular basking sites on cool days in the early spring. The hilltop provides a look out post for the males. The females use the hillside as a preferential nesting site. □

*Try to be like the turtle -  
at ease in your own shell.*  
— Bill Copeland



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## Seychelles Giant Tortoise News by Justin Gerlach

Seychelles Giant Tortoise Conservation Project; Nature Protection Trust of Seychelles

We have held back with this latest newsletter in the hope that we would have some good news about new hatchlings. Unfortunately it has turned out to be a very unproductive year.

For the first time in 10 years, Eve had laid one proper egg which, as one might expect, was not fertile. Josephine on the other hand surprised us with three clutches, totalling 51 eggs. Much to our dismay, all except two of these were infertile and both fertile eggs stopped developing (one very early on and the other probably after 8 to 10 weeks). One clutch of 17 eggs is still in the incubator, so there is still a chance.

The building work across the narrow road is probably causing too much disturbance with the constant passage of noisy, smoky construction vehicles a metre from the fence, the atmosphere full of cement dust and of course the vibrations caused by bulldozers and earth compacting machines. It has been totally distressing for us, but we were never sure how it was disturbing the tortoises - they always look so calm and unperturbed.

The tortoises released at Grande Barbe are by contrast enjoying total peace and quiet. Both females laid, but so far no sign of any hatchlings. The strange thing about the Grande Barbe tortoises is that they have the whole island in all

its natural beauty to live in, but seem to associate buildings with security. Stan has chosen as his favourite sleeping place, the ruins of the old coconut drying shed, Adriana's chosen spot is in a corner of an extinct building where only the stone foundation walls remain. Clio was in the remains of the old church. Alida, on the other hand, had burrowed into a pile of coconut leaves and made herself a cozy cave. Hector, who had wandered further than the others, was found well away from any buildings, stretched out comfortably on a quiet grassy path - he at least seems to have overcome the need for the security of abandoned walls. □

Reprinted with permission from *Seychelles Giant Tortoise News*, No. 24, November 2007  
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## The Desert Tortoise Preserve Committee Invites You to Join Us At Our 33rd Annual Banquet and General Meeting January 26, 2008

The DTPC's Annual Meeting and Banquet will be held Saturday, January 26, 2008 at the *Signature Best Western Antelope Valley Inn "Apollo Room"* 44055 North Sierra Highway, Lancaster, California 93553 (phone: 661-984-4651). The afternoon Annual Meeting will feature reviews of the Committee's ongoing programs, achievements and plans for 2008, and guest speakers from the Bureau of Land Management and the Calif. Department of Fish and Game will give updates on important activities. The Banquet speaker will be Dr. Ken Nagy and the topic is "Conserving Desert Tortoises by Head-starting Juveniles".

### PROGRAM

- Annual Meeting 2:00 to 5:00 P.M.
- Banquet Event 6:00 to 9:00 P.M.

Featuring Guest Speaker: **Dr. Ken Nagy**

Title: "**Conserving Desert Tortoises by Head-starting Juveniles**"

"Dr. Ken Nagy grew up in Southern California and was fascinated with the reptiles he saw along the coastline and in the Mojave Desert. He went on to earn a Ph.D. at the University of California, Riverside in 1971, studying Chuckwalla ecophysiology, and has been on the faculty at UCLA doing desert biology since then."

His talk will describe ways to help tortoise populations recover and persist by increasing the number of young tortoises recruited into natural populations. This can be done by improving survivorship of eggs and of whole nests, and by enhancing juvenile body condition, growth rate, and survivorship. Results from ongoing studies at several military bases in the Mojave Desert will be summarized.

### To RSVP and For Additional Information Contact:

Melissa Nicholson, Preserve Manager & Office Administrator @  
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## Update on Bob the Tortoise: Suspect Sentenced to Jail

The *Ventura County Star* reports that Jose "Tony" Mosqueda was sentenced on Monday, November 5, 2007 to 270 days in jail and placed on probation for five years in connection with felony animal cruelty in a case involving the mutilation of a tortoise that belongs to a 6-year-old autistic boy.

The 40-pound African Spurred tortoise (*Geochelone sulcata*) was abducted July 7, 2007 from his owner's backyard, slashed and later dumped behind an apartment complex in Ventura.

At a September hearing, Mosqueda pleaded no contest to the charge.

In court on Monday, Ventura County Superior Court Judge Bruce Clark handed down the sentence, which also requires Mosqueda to pay \$5,400 in restitution for veterinarian bills and other costs.

According to the Associated Press, Mosqueda's lawyer reported that Mosqueda has apologized to the family and is absolutely remorseful about what happened. The judge also issued an order that Mosqueda is not allowed to own or have access to any pets.

His 270 days in jail will be reduced when he is credited for the 110 days he already has spent in jail and 55 days credited for good behavior. □



## Online [www.tortoise.org](http://www.tortoise.org)

Webmaster Michael J. Connor <mconnor@tortoise.org>

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Treas Bart Shrum (805) 967-7451  
Sec Maree Friend (805) 649-4713  
Adopt Wes Shipway (805) 491-2580

Meeting: Now meets in members' homes; check the chapter website  
for meeting time and location.

## TOOSLO (San Luis Obispo) Chapter <www.tooslo.org>

☒ P. O. Box 14222, San Luis Obispo, CA 93406  
Pres Johnny Rodriguez (805) 489-1401  
V-P Wesley Mello (805) 748-8927  
Sec Suzette Girouard (805) 801-4806  
Treas/Memb Jeanie McCombs (805) 481-6029  
Adopt Bob Thomas (805) 481-5222

Meeting: Second Wednesday, 7:00 pm @ PG&E Community Center,  
6588 Ontario Rd, San Luis Obispo, CA 93405

## Turtle & Tortoise Care Society <www.tortoise.org/ttcs>

☒ P. O. Box 15965, Long Beach, CA 90815-0965  
Pres Ralph Hoekstra (714) 962-0624  
V-P Richard Roosman richardinwalnutpark@msn.com  
Sec Lynda Bagley runjojo@ca.rr.com  
Treas Judy Belcher (562) 425-6798  
Adopt Peggy Nichols (562) 429-8002

Meeting: Third Friday, 7:30 pm @ University Baptist Church,  
3434 Chatwin, Long Beach, CA 90808

## Valley Chapter valleycttc@yahoo.com

☒ P. O. Box 2896, Canoga Park, CA 91396  
Pres Larry Reiners (818) 347-3878  
V-P Stephanie Pappas (805) 901-8746  
Treas position open  
Corr Sec Joe Martinez unavailable  
Rec Sec Joanna Bolt unavailable  
Adopt Corey Lagusker (661) 312-6311

Meeting: Third Friday, 7:30 pm @ Woodland Hills Christian Church,  
5920 Shoup, Woodland Hills, CA 91367

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 January/February 2008  
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Turtle of the Month:  
 Red-footed Tortoise  
 (*Geochelone carbonaria*)

- ◆ Breeding the Red-footed Tortoise
- ◆ Four Seasons in a High Desert Pond
- ◆ Leatherback Turtle
- ◆ Turtles and Climate Change



Photo by Stacy Waldrum