

DESERT TORTOISE COUNCIL

NEWSLETTER

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*New Study Identifies Secondary Contact Zone Between Agassiz's and Morafka's Desert Tortoises, Unprotected *G. agassizii* Populations*

By Taylor Edwards

The Colorado River has played a large role in the evolution of the two species of desert tortoise. Isolating the Sonoran and Mojave populations 4–8 million years ago, *Gopherus agassizii* and *G. morafkai* diverged independently from each other in what is a classic example of “allopatric speciation.” The river has played an important role in the management of these species as well, acting as the geographic barrier that defines a distinct population segment (DPS) of *G. agassizii* that was federally listed in 1990 as threatened under the U.S. Endangered Species Act. At the time, all desert tortoises were considered to be a single species and the DPS was defined as tortoises occurring west and north of the Colora-

do River. In 2011, Dr. Bob Murphy and colleagues formally split the species into the current Agassiz's desert tortoise (*G. agassizii*) and Morafka's desert tortoise (*G. morafkai*) based on the deep divergence of the two evolutionary lineages, facilitated by the isolation caused by the Colorado River.

In 1990, preliminary genetic work identified a possible population of *G. agassizii* east of the Colorado River in the Black Mountains of Arizona (Glenn et al. 1990) and then in 1999 Ann McLuckie and colleagues characterized the population as Mojavean based on mitochondrial DNA and morphometrics. The data available

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Habitat in the Black Mountains region of Arizona where secondary contact zones between Agassiz's and Morafka's desert tortoise populations have produced hybrids.
Photo by Daren Riedle and AZGFD.

Edwards, T., K. H. Berry, R. D. Inman, T. C. Esque, K. E., Nussear, C. A. Jones, and M. Culver. 2015. Testing taxon tenacity of tortoises: evidence for a geographical-selection gradient at a secondary contact zone. *Ecology and Evolution* 5(10):2095-2114. DOI: [10.1002/ece3.1500](https://doi.org/10.1002/ece3.1500)

Letter from the Editor

At long last—the new issue of the Desert Tortoise Council Newsletter is here! I hope you'll agree that this issue was worth the wait. I'm particularly pleased to share two featured articles from Taylor Edwards, who describes research that he and his colleagues recently published regarding evolutionary relationships between populations/lineages of desert

tortoises. Dr. Edwards led these research projects in pursuit of his PhD at the University of Arizona, and graduated earlier this year. Please join me in congratulating Dr. Edwards and thanking him for sharing his research with us here!

Also included in this issue are features on our 40th Annual Symposium, the DTC's Health Assessment Techniques work-

shops, a new film about desert tortoises, first use of a wildlife crossing by a Morafka's desert tortoise, and an update on the BLM-Bundy situation.

Enjoy!



- Michael Tuma

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Photo by Heather Parks

Desert Tortoise Council's 40th Annual Symposium

Commemorating the Past, Celebrating the Present, Contemplating the Future By Mary Cohen

The activities of the 40th Annual Symposium began with a field trip to several desert tortoise translocation sites in Nevada on 19 February. That evening, Southern Nevada Environmental Inc. (SNEI) sponsored a special mixer event.

The Annual Business Meeting took place prior to the beginning of the Symposium on 20 February. At 9:30, the Symposium commenced with opening remarks, and chronicles of the Desert Tortoise Council's early years (1975-1995) and the second 20 years (1996-2015).

The second session addressed research into the demography and genetics of the *Gopherus* species. Researchers gave presentations on sexual size dimorphism in *Gopherus* species, fencing at the Desert Tortoise Research Natural Area in the West Mojave, landscape genetic simulations and landscape genomics.

The next session profiled the work of various federal and state agencies for desert tor-

toise recovery. Representatives from Mojave National Preserve, Joshua Tree National Park, Bureau of Land Management (BLM) lands in Nevada, the Clark County Multiple Species Habitat Conservation Plan, Utah BLM, U.S. Fish and Wildlife, U.S. Geological Survey, and Quadstate Local Governments Authority reported on their recovery efforts.

The Friday program concluded with reports on coyote (*Canis latrans*) and American badger (*Taxidea taxus*) predation of desert tortoises, followed by a talk by the editor of Biology and Conservation of North American Tortoises. A book signing, buffet dinner and poster session comprised the Friday evening activities.

Saturday's program began with a special session on ravens. Numerous raven experts from California, Nevada, Idaho, Utah and Wyoming spoke about raven predation on desert tortoise, black-crowned night heron, sage grouse and snowy plover, and discussed

the efficacy and ethics of various raven control measures.

Saturday's afternoon sessions addressed a variety of issues. The nutritional value of two native and two nonnative desert tortoise food plants was examined in detail. The role of landscape genomics in the restoration of desert tortoise habitat in the Mojave Desert was presented through a case study of the desert shrub apricot mallow (*Sphaeralcea ambigua*). A post-construction revegetation project in Arizona and the restoration of degraded tortoise habitat in the Mojave Desert were detailed in botanically-oriented presentations. The best management practices for restoring desert tortoise habitat were characterized, and these have been published by the Desert Tortoise Council as a [set of fact sheets](#) available on the Desert Tortoise Council web site.

The next session focused on health and disease issues. The physiological response of the desert tortoise to habitat dis-

turbance was examined, as was the possibility of tortoise translocation changing desert tortoise contact networks into avenues of disease transmission. There were reports on the viability of *Mycoplasm* in the soil of tortoise burrows, and on the pathogens present in the desert tortoise nose.

The Saturday evening banquet featured a buffet followed by the annual awards ceremony. The banquet address profiled 16 conservation successes in American national parks. The traditional auction and raffle took place as the evening drew to a close.

The Sunday morning sessions began with presentations from non-profit organizations. Representatives from the Tortoise Group, the National Parks Conservation Association, the Desert Tortoise Council, the Desert Tortoise Preserve Committee, and the Center for Biological Diversity described the work of their organizations on behalf of the desert tortoise.

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DTC's 40th Annual Symposium (continued)

The Sonoran desert tortoise, *Gopherus morafkai*, was the focus of the next several sessions. Topics included habitat use by juveniles, ingestion of non-vegetation food items by juveniles, and reproductive ecology of females. The next presentations reported on preliminary findings from a relocation project, the tortoise's habitat use at Arizona's Yuma Proving Ground, and a secondary contact zone between the Sonoran and the Mojave desert tortoise populations.

Sunday's afternoon sessions began with accounts of surveying for Sonoran desert tortoises on Arizona lands where mining interests operate, and of techniques for tortoise occupancy assessments. The effects of post-wildfire vegetation changes on the Sonoran desert tortoise and its population declines were discussed, as was the 15-year-long Northwest Mexico Tortoise Project. A report on research into the distribution and genetic structure of Morafka's desert tor-

toise in Mexico, and presentations about the alien, invasive buffelgrass (*Cenchrus ciliaris*), thermal threats, and climate change impacts ended the session.

The final session of the Symposium focused on the themes of translocation, head-starting and animal behavior. Presenters spoke about post-release survivorship of head-started juvenile desert tortoises at the Mojave National Preserve, Edwards Air Force Base and

the Fort Irwin Study Site, and the tortoise translocations from the shuttered Desert Tortoise Conservation Center. A consideration of the personality and physical traits of tortoises with regard to relocation projects completed the session, after which the 2015 Symposium was adjourned.

To view the abstracts from the 2015 Symposium, visit the [Text-searchable Proceedings](#) page on the Desert Tortoise Council web site.

Notes from the 40th Annual Symposium Field Trip

By Peter Woodman

Twenty-five participants attended the DTC's 40th Symposium field trip to Trout Canyon Translocation Site on February 19, 2015, the day before the kick-off of Symposium activi-

ties in Las Vegas. Our thanks to Roy Averill-Murray, Kim Fields, and Linda Allison from the US Fish and Wildlife Service, Desert Tortoise Recovery Office who spoke about the goals and preliminary results of the translocation. Ross Haley, a

long-time southern Nevada desert tortoise biologist with Lake Mead National Recreation Area gave a more historical perspective of the area beginning with the mark-recapture plot assessments conducted in 1987 and 1992.

The weather was quite balmy and we found two live tortoises and a somewhat chilly Mojave rattlesnake. We hope you will join us for the field trip for the 2016 DTC Symposium.



*Secondary Contact Zone, Unprotected *G. agassizii* Populations Identified in New Study (continued)*

at that time could not identify if the Mojave-type individuals were hybrids nor could they predict the timing and origin of their introduction east of the river, such as if the population was founded by released or escaped pets. Intrigued by this anonymous population, Edwards and colleague saw this as a natural experiment to examine reinforcement of species' boundaries under natural conditions. In their paper titled Testing taxon tenacity of tortoises: evidence for a geographical-selection gradient at a secondary contact zone recently published in Ecology and Evolution, the authors characterize this interesting population and comment on its conservation implications.

The authors sampled 234 tortoises representing *G. agassizii* in California, *G. morafkai* in Arizona, and 53 undetermined individuals in the contact zone including and surrounding the Black Mountains. The Califor-

nia samples represent two different Federal Recovery Units (RUs): the Colorado Desert RU and the Eastern Mojave RU. Samples from the Colorado Desert RU are west of and across the Colorado River from the Black Mountains. The Eastern Mojave RU borders the Colorado Desert RU to the west and north but is geographically separated by mountain ranges. In their genetic analysis, the authors confirmed that the assumed Mojave-type individuals in the Black Mountains were in fact a pure-breeding population of *G. agassizii*. They observed a relatively small number of individuals of hybrid origin that occur at highest frequency in transitional habitat. They suggest that this is a result of selection acting against hybrids in the primary habitat of the parental types and/or assortative mating. The authors conclude that because the pattern of divergence is maintained along tran-



Sonoran Type tortoise in typical habitat, Hualapai Mountains, Arizona adjacent to the Black Mountains. Photo by AZGFD.

sitional habitat it suggests that each species maintains its identity through ecological segregation.

The Black Mountains and surrounding area exhibit a complex composition of flora where the Mojave and Sonoran desert ecosystems converge. The authors then used habitat suitability models to test hy-

potheses about habitat use between *G. agassizii* and *G. morafkai* where they co-occur. They assessed multiple topographic, vegetative and climatic habitat variables and found that the topographic position index (TPI) had the highest explanatory value in the separation between the two species.

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*Adult male *G. agassizii* specimen from the Black Mountains region. Photo by AZGFD.*



View of habitat in the Black Mountains region where Agassiz's and Morafka's desert tortoises maintain species identity through ecological separation. Photo by AZGFD.

*Secondary Contact Zone, Unprotected *G. agassizii* Populations Identified in New Study (continued)*

TPI classifies both slope position and landform category and this met the expectation that *G. agassizii* generally occurs in areas corresponding to alluvial fans and valley bottoms and *G. morafkai* tend to occur in foothills, hillside slopes, and more mountainous terrain. In addition, they predicted that habitat for *G. agassizii* is likely to extend further north of the Black Mountains, although there are not many affirmative tortoise localities across Detrital Valley and toward the north end of the White Hills, Arizona. This leaves open the possibility that the *G. agassizii* population east of the Colorado extends beyond the samples area.

The authors estimated that the Black Mountain population of *G. agassizii* was last connected to populations west of the Colorado River approximately 2,400 years ago – relatively recently. They explore various possibilities of how this “secondary contact” occurred,

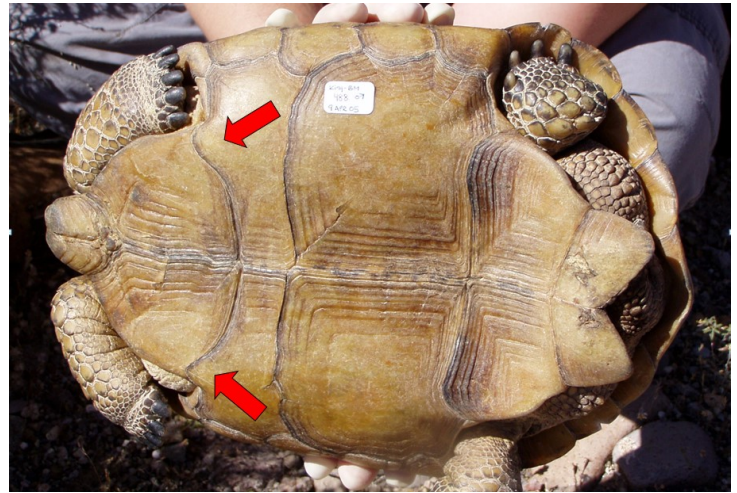
including transport by indigenous people. They conclude, however, that geological events provide the best explanation. During the last 10,000 years, the lower Colorado River and surrounding areas in the vicinity of the Mojave River Valley have undergone periodic cycles of aggradation, degradation, and avulsion. These regional, episodic increases in sediment supply resulted in valley-floor aggradation and incision of the Colorado River, consistent the timing of *G. agassizii* crossing the river.

As a result of their recent ancestry, the *G. agassizii* population in the Black Mountains does not constitute a genetically distinct population unto itself but closely resembles the cross-river, Colorado Desert RU population. In fact, it is more similar to the Colorado Desert RU population than the Colorado Desert RU is to the adjacent Eastern Mojave RU. These results are consistent

with work by Bridgette Hagerty and colleagues in that the Providence and New York mountain ranges are a strong barrier to gene flow between the Ivanpah Valley and the Chemehuevi Valley. This genetic differentiation corresponds to the divergence between northern and southern mitochondrial DNA clades which exhibit a deep split between these re-

gions. However, the presence of the Providence and New York mountains does not fully explain the limited introgression alone and may suggest a unique population history of northern clades and either recent secondary contact or continued maintenance of genetic structure via local adaptation.

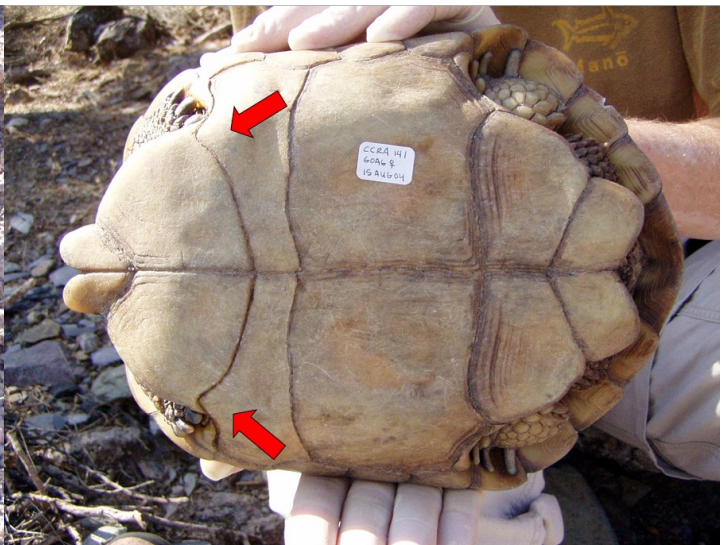
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Hybrid individual from the Black Mountains region of Arizona. Note dimples along pectoral and humeral seam. Photo by AZGFD.



G. agassizii from the Black Mountains region of Arizona. Note straight pectoral and humeral seam. Photo by AZGFD.



G. morafkai from central Arizona. Note dimples along pectoral and humeral seam. Photo by AZGFD.

*Secondary Contact Zone, Unprotected *G. agassizii* Populations Identified in New Study (continued)*

Gopherus morafkai is not federally listed, but became a candidate for federal listing in 2010, was withdrawn from listing consideration in 2015, and is considered a species of greatest conservation need in Arizona. The isolated, Arizona population of *G. agassizii* in the Black Mountains and surrounding area is not currently afforded protection under the ESA like its kin across the river because the listed population was geographically delineated; however, it is protected by the Arizona Game and Fish Department. Increasing development in this region of Arizona may threaten the viability of this small population of *G. agassizii*. The Arizona Department of Transportation and the Federal Highway Administration have been evaluating two potential north-south corridors for the future realignment/relocation of SR 95 in northwestern Arizona from south of I-40 to SR 68. SR 95 is the primary north-

south highway in western Arizona, linking the communities of Bullhead City, Arizona, and Laughlin, Nevada, with other towns and communities to the south along the Colorado River, such as Lake Havasu City, Parker and Quartzsite. The proposed realignment of SR 95 east of Bullhead City would pass directly through primary habitat of this population. The project is currently suspended due to funding constraints however the study phase of the project will be re-initiated once funds are available.

At the crux of managing the Arizona population of *G. agassizii* in the Black Mountains is that there is a difference between the legal definition of the "Mojave population of desert tortoise" as defined by the USFWS and the biological definition of *G. agassizii* based on taxonomy. If *G. morafkai* is listed under the ESA, its protection under the act will not

extend to the population of *G. agassizii* either, leaving the Black Mountain population of *G. agassizii* potentially susceptible to exploitation. This small population is certainly vulnerable based on its size and isolation alone. To be afforded federal protection, the Black Mountain (and surrounding area) population of *G. agassizii* would need to be petitioned as an independent DPS of *G. agassizii*. Complicating the matter is that *G. agassizii* and *G. morafkai* are challenging to distinguish in the field and hybridization naturally occurs in the area of overlap, so it may not be possible to easily determine one from the other without genetic analyses.

The authors conclude that, "In the context of species conservation, it is not possible for us to determine which individuals contribute most to the evolutionary potential of the species, or more importantly, which

adaptive traits will be most critical in the face of environmental change. For a species to persist, it requires genetic diversity to cope with changes in its environment. With unpredictable stochastic processes, such as climate change, the individuals that have the "best" adaptations may very well be the ones living on edges and in marginal habitats, such as the admixed individuals we observed in this study. Thus, the prudent approach to species conservation is to preserve the entirety of genetic diversity in a species including viable hybrids or populations where the species may benefit from limited introgression. Knowing that the evolutionary potential of a species is directly related to its genetic diversity, we would do best to include the full extent of genetic variation and its maintenance, including the potential for natural hybridization, in conservation efforts."

Council Offers Training in Desert Tortoise Health Assessment Procedures By Cristina Jones

The U.S. Fish and Wildlife Service's Desert Tortoise Recovery Office worked with San Diego Zoo Global, U.S. Geological Survey, Arizona Exotic Animal Hospital, Nevada Department of Wildlife, and several private tortoise biologists to develop a course to prepare biologists to conduct standardized health assessments that are required by the U.S. Fish and Wildlife Service prior to and following the translocation of

Mojave desert tortoises from project sites. The course presents information through lectures and specialized hands-on training using live desert tortoises, and the students' understanding of the concepts and ability to conduct health assessments and collect biological samples is evaluated by course instructors through a written and practical exam. During the practical exam students are evaluated on the following



The Desert Tortoise Council administered two advanced health assessment techniques training workshops in 2015. Photos by Bruce Palmer.

Health Assessment Training (continued)

skills: Handling, Biosecurity, Physical Exam/Body Condition Scoring, Oral Swab, Subcarapacial Venipuncture, Epi-coelomic Fluid Administration, and Sample Processing. Students receive documentation of participation in the course, as well as individual evaluation as to whether they have sufficient understanding of the course material and are capable of conducting health assessments and collecting biological samples independently, under supervision, or not at all.

The training was offered annually from 2011 – 2013 at the Desert Tortoise Conservation Center (DTCC), but was not offered in 2014 due to the closure of the DTCC.

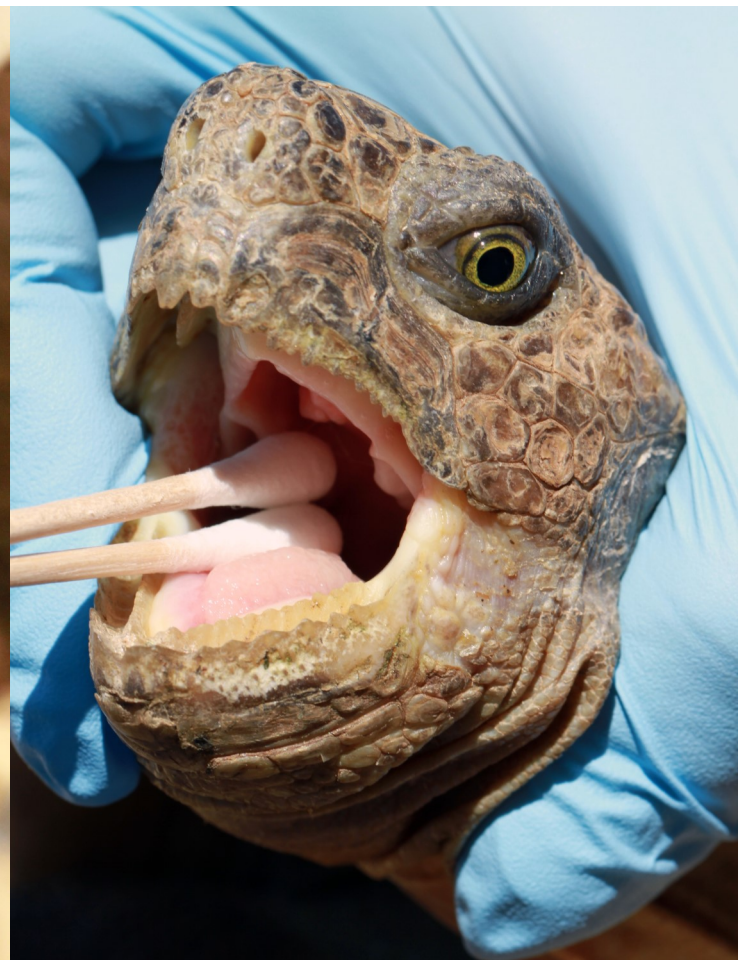
In Fall 2014, biologists from Arizona Game and Fish Department, Nevada Department of Wildlife, U.S. Fish and Wildlife Service, Clark County Desert Conservation Program, and members of the Desert Tortoise Council met to determine how we continue to offer this essential training. Our efforts were successful, and through this collaboration we were able to train 12 participants in March 2015 in Las Vegas, Nevada and 14 participants in August 2015 in Phoenix, Arizona. Instructors included Nadine Lamberski, DVM (San Diego Zoo), Peri Wolff, DVM (Nevada Department of Wildlife), Jay Johnson, DVM (Arizona Exotic Animal

Hospital), Kim Field (U.S. Fish and Wildlife Service), Kristina Drake (U.S. Geological Survey). Cristina Jones, Jason Jones, Bruce Palmer, and Peter Woodman (Desert Tortoise Council board members) and Rachel Woodard (Desert Tortoise Council member) assisted with the training. The next training is tentatively scheduled for Spring 2016 in Phoenix, Arizona. The course should be offered annually each spring, location to be determined.

Through 2015 the course has been limited to a waiting list of biologists primarily working on translocation projects associated with solar energy development, but open registration is planned in the future. Partici-

pants must have extensive tortoise handling experience and have been permitted by USFWS to handle desert tortoises on at least one project within the last 5 years as an Authorized Biologist (Biological Opinions or Habitat Conservation Plans) or as an Authorized Individual (listed on a Recovery Permit). Individuals with experience limited to the Range-Wide Monitoring Program need to have completed that training program in 2009 or more recently and walked transects for a minimum of two months.

Future courses will be announced on the DTC website and FaceBook page.



New Study Reveals Complex Evolutionary History of Desert Tortoises in Mexico By Taylor Edwards

It has long been recognized that desert tortoises in the southern part of their range in Mexico appear very different than those in the north. Charles Bogert and James Oliver noted morphological and coloration differences as far back as 1945. The first DNA analysis to note this distinction was in 1989 by Trip Lamb, John Avise and Whit Gibbons who found mtDNA divergence in the southern tortoises as distinct as that between those across the Colorado River (now separated as distinct taxa; *Gopherus agassizii* and *G. morafkai*). Due to a dearth of samples and disjunct sampling in these early assessments, it remained unknown if these dif-

ferences in Mexico occurred in a gradient from north to south, or if they truly represented a distinct break in the diversity of tortoises in the southern part of the range.

In "Shaping species with ephemeral boundaries," Edwards et al. (2015) address this question by examining the current distribution and habitat associations of Morafka's desert tortoise (*Gopherus morafkai*) and they test hypotheses on how landscape features and climate influenced the evolution of this species. A preliminary study by the authors confirmed the deep divergence between the northern and

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Edwards, T., M. Vaughn, P. C. Rosen, C. Meléndez-Torres, A. E. Karl, M. Culver, and R. W. Murphy. 2015. Shaping species with ephemeral boundaries: The distribution and genetic structure of the desert tortoise (*Gopherus morafkai*) in the Sonoran Desert. *Journal of Biogeography*: <http://dx.doi.org/10.1111/jbi.12664>

Data Accessibility available through [Dryad](#). Microsatellite data (GenePop file format) plus sample information.



Morafka's desert tortoise (Sinaloa type), Monte Mojino, Sonora, Mexico (in Tropical Deciduous Forest), 24 August, 2013. Photo by Taylor Edwards.

2015 Workshop Review: Introduction to Desert Tortoises and Field Techniques By Maggie Fusari, Workshop Coordinator

The Desert Tortoise Council concluded 2 identical, 2-day Introduction to Desert Tortoises and Field Techniques workshops this November on Monday-Tuesday (2-3) with 84 attendees and Wednesday-Thursday (4-5) with 40 people attending. The students left the final field exercise expressing that they enjoyed the course and learned a lot. They are currently (until December 15) taking the online test and will receive final letters by early February.

The course covers basic information about tortoises and their ecology, discussions of the methods used to survey for them in the field and information about the operation of federal and state agencies in

dealing with tortoise issues. The course does not authorize or permit anything, that is the purview of the agencies, but successful completion will support a person looking to work on tortoises in the field.

Speakers included Kristin Berry, Peter Woodman, Becky Jones, Alice Karl, and Ed Larue of the DTC, Carolyn Woods (BLM), and Ray Bransfield (USFWS). The field exercises, led by Peter Woodman also included Field Leaders Paul Frank, Rachel Woodard, T.G. Jackson, and Alice Karl. Assistance was provided by David Carr, Joe Probst, Wendy Turner, and Susan Moore. The DTC is very grateful to all these people for giving their time to improve the quality of

work that will be done on surveying for our desert tortoises. DTC tentatively plans to offer the course in November 2016 and encourages our member-

ship to watch the DTC webpage for the most updated information (including the 2015 syllabus); registration will begin in July.



southern forms and in this paper they investigate the role biogeographical features played in the evolution of these distinct lineages of Morafka's desert tortoise.

They sampled the full distribution of *G. morafkai* in Mexico and all representative habitats where this species occurs, including Sonoran desertscrub, Sinaloan thornscrub, and tropical deciduous forest. They collected blood from wild tortoises from Mexico ($n = 155$) and Arizona ($n = 78$) and tested samples for both mtDNA and nuclear microsatellite (STR) genetic markers. They performed several different types of analyses focused on each set of markers to assess the population structure and amount of gene flows among populations. They also combined markers in clinal analyses to determine the position and amount of introgression where lineages co-occur.

They used these data in a hy-

pothesis-driven approach to assess different models of how genetic diversity is maintained and distributed in *G. morafkai*. For example, if the pattern exhibited a gradient of genetic diversity following an isolation-by-distance model as it does in other parts of the species' range, then this would be consistent with *G. morafkai* comprising a single species. Or, if the pattern of gene flow was different between mtDNA and STR markers then this would suggest that gene flow occurred but females show limited dispersal relative to males. Similarly, they assessed if the pattern of divergence was associated with environmental factors that would suggest that selection might maintain the differentiation between lineages.

They found that *Gopherus morafkai* comprises genetically and geographically distinct "Sonoran" and "Sinaloan" lineages. Both lineages occur in

a relatively narrow zone of overlap in Sinaloan thornscrub, where it transitions into Sonoran desertscrub. At this transition zone (or ecotone) limited hybridization occurs but gene flow between the lineages does not introgress beyond this boundary and thus each lineage remains distinct. They describe this pattern as a geographical-selection gradient model strikingly similar to the natural hybrid zone observed between *G. morafkai* and *G. agassizii* near the Black Mountains of northwestern Arizona where each species maintains its identity through ecological segregation. However, they refined this description as a "mosaic model" because the ecotone between Sonoran desertscrub and Sinaloan thornscrub does not form a smooth gradient but instead is complex and patchy. Thus, the distribution of Sonoran and Sinaloan lineages in this patchy environment allows for each parental lineage to

have a high probability of coming into contact with the other, but mating results in less fit hybrids.

No major geographical barriers limit gene flow between the Sonoran and Sinaloan lineages, which suggests they may have evolved under a parapatric model as a result of adaptation to specific ecological niches. This is in contrast to the allopatric model observed between *G. morafkai* and *G. agassizii* which were separated during the formation of what is now the Colorado River. The three lineages of desert tortoise, Mojave, Sonoran and Sinaloan, all appear to have diverged around the same time 5-6 million years ago. The common ancestor of all three lineages may have been widespread throughout what are now the Mojave and Sonoran deserts. The region did not begin its drying trend until around 15-8

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Morafka's Desert Tortoise (Sinaloan type), Reserva La Sierrita, Sonora, Mexico, 22 August, 2013. Tortoise with transmitter as part of a radio-telemetry study conducted by Alice Karl. Photo by Taylor Edwards.

Ma (Van Devender, 2000). This changing environment offered new niches in the northern portion of the ancestral range of the desert tortoise. Drying could have driven adaptations to more arid conditions and in doing so initiated ecological divergence between arid and tropical ecotypes, ultimately resulting in the parapatric distribution of Sonoran and Sinaloan lineages.

This dynamic, ephemeral system undoubtedly influenced speciation of the desert flora and fauna other than just desert tortoises. Increased knowledge of the past and present distribution of the Sonoran Desert region's biota provides insight into the forces that drive and maintain its biodiversity. The authors conclude that in Morafka's desert tortoise, this has resulted in two distinct lineages, each uniquely adapted to different environ-

ments. They propose that despite incomplete reproductive isolation, the Sonoran and Sinaloan lineages of *G. morafkai* are on separate evolutionary trajectories and exhibit species-level differentiation.

The authors acknowledge the numerous volunteers that made field sampling possible over the span of this project as well and the generosity of the many individuals that helped to fund this research. Access to almost all of the collection sites in Mexico were made possible through the generosity of local land owners and the authors are extremely grateful for the assistance of ranch hands (vaqueros) who shared their local knowledge in the field. In addition, the authors thank the Desert Tortoise Council for helping to fund this project and for their support in ensuring that this research is "Open Access" so that the infor-



Peter Woodman processing a Morafka's desert tortoise (Sonoran type) near Punta Chueca, Sonora, Mexico (in Sonoran Desertscrub) with the Gulf of California in the background, 03 August, 2010. Photo by Taylor Edwards.

mation is freely accessible to researchers, land managers and conservationists on both sides of the border.

This recently published study is the culmination of an over 10 year multinational, collaborative effort to study desert tortoises throughout their

range in Mexico. While this research focuses on the genetic findings of the project, the project itself is a multi-faceted, collaborative effort to investigate crucial aspects of desert tortoise health, general biology and ecology south of the border to aid in conservation of the species throughout its geographical range.



Greta Bates and Art Schaub processing a Sinaloan-type tortoise found at Monte Mojino, Sonora, Mexico in Tropical Deciduous Forest (With Felix García Caballero in background), 24 August, 2013. Photo by Taylor Edwards.

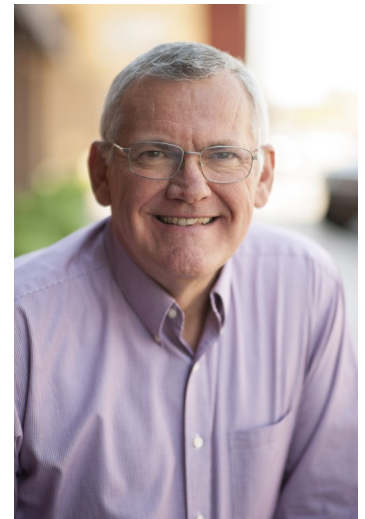
Board of Directors Spotlight

Bruce Palmer

Bruce Palmer has been on the Desert Tortoise Council Board of Directors since 2008, serving three terms as Chairperson focusing on establishing operating procedures to guide consistent decision making by the Board, and the development of a strategic plan to establish direction and priority for Board and Council actions. Bruce has always been fascinated by turtles, and attended his first Desert Tortoise Council symposium in the mid-1980s. Following graduation from Elmhurst College, Illinois, and graduate studies at Northern Arizona University, in Flagstaff, Bruce worked for the

Arizona Game and Fish Department as the first Nongame Habitat Specialist. At AGFD he participated in numerous tortoise surveys and demographic monitoring studies, and developed a state-wide tortoise distribution map. In 1992, Bruce joined the US Fish and Wildlife Service in Phoenix, first as an ecologist working with Arizona's rare and endangered plants, and then as supervisor of the USFWS Bird and Mammal consultation and recovery program for Arizona. Bruce prepared Endangered Species Act listing rules, recovery plans, and biological opinions for a variety of listed spe-

cies, and lead conservation programs for some of the rarest species in the Southwest. As coordinator of the USFWS California Condor Recovery Program (2000-2004) Bruce directed this high profile, multi-million dollar international conservation program that included captive breeding and releases to the wild in California, Arizona, and Mexico. For the last 10 years Bruce has been working in the private sector, currently at Jacobs Engineering in Phoenix, applying his knowledge of ESA and other environmental regulations to assist clients in efficiently meeting their environ-



mental compliance obligations and to advance responsible land and natural resource management.

Ken MacDonald

Ken MacDonald is the current Chair of the Board of Directors. He specializes in the National Environmental Policy Act, Endangered Species Act, and US Army Corps of Engineers permitting, and is Senior Environmental Manager and Partner with NewFields, a multinational consulting company. Working as an environmental professional in the western United States for more than two decades, Ken has led numerous projects, including the Hoover Dam Bypass, the Colorado River Management Plan for the Grand Canyon National Park, and the Clark County Regional Flood Control District. He holds a Bachelor's Degree in Biological Sciences and a Master's Degree in Business Administration from Stanislaus.

Ken formerly served as a Board Supervisor with the Conservation District of Southern Nevada. The Conservation District of Southern Nevada, who in conjunction with the Nevada Department of Conservation and Natural Resources conserves, protects, manages, and enhances Clark County's natural resources.

He is the founder and Chair of Grow Nevada!, a School and Community Garden Steering Committee because community gardening improves people's quality of life by providing a catalyst for neighborhood and community development, stimulating social interaction, encouraging self-reliance, beautifies neighborhoods, produces nutritious food, reduces family food budgets, conserving resources and creating opportunities for recreation, exercise,

therapy and education. In schools with gardens, kids eat better and learn better!

Ken served on the Consortium Committee as part of Southern Nevada's Sustainable Communities Initiative. As part of this committee, Ken and several other community leaders (e.g. elected officials, community leaders, agency directors, subject experts, etc.) oversaw a \$3.5 million grant from the U.S. Department of Housing and Urban Development to help the communities/region improve their economic competitiveness by connecting reliable transportation, safe and affordable housing, and job opportunities throughout Southern Nevada. He was also active on the Healthy Communities subcommittee.

Ken was active with Team in Training and completed three



26.2 mile marathons and a 100-mile bike ride as a fundraising participant or as a Team Mentor. The objective was raising money to fight leukemia and other blood cancers and to support the patients and their families.

Award Announcement

David J. Morafka 2016 Memorial Research Award

In honor and memory of Dr. David J. Morafka, distinguished herpetologist and authority on North American gopher tortoises, the Desert Tortoise Council, with the aid of several donors, has established a monetary award to help support research that contributes to the understanding, management and conservation of tortoises of the genus *Gopherus* in the southwestern United States and Mexico: *G. agassizii*, *G. morafkai*, *G. berlandieri*, and *G. flavomarginatus*.

Award Amount: \$2,000 to be awarded at the Desert Tortoise Council's Annual Symposium, depending on the availability of funding and an appropriate recipient.

Eligibility: Applicants must be associated with a recognized institution (e.g., university, museum, government agency, non-governmental organization) and may be graduate students, post-doctoral students, or other researchers. They

must agree to present a report on the results of the research in which award funds were used at a future symposium of the Desert Tortoise Council.

Evaluation Criteria: Applications will be evaluated on the basis of the potential of the research to contribute to the biological knowledge of one or more of the above gopher tortoise species, and to their management and conservation. Important considerations are the significance and originality of the research problem, design of sampling and analysis, preliminary data supporting the feasibility of the research, and the likelihood of successful completion and publication.

Application Procedure:

1. Download and open an application form from the Desert Tortoise Council's website www.deserttortoise.org. The form is electronically interactive.

2. Provide all information requested on the application, including a description of the research project in no more than 1,200 words.

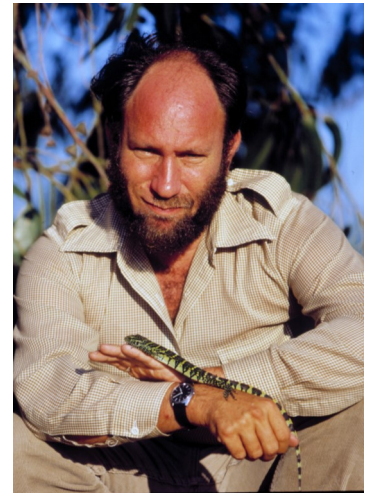
3. Submit the completed application to grstewart@cpp.edu as a pdf document.

4. Applications must be supported by the applicant's CV and three letters of recommendation, one of which must be from the applicant's research advisor, supervisor, or a knowledgeable colleague. Instruct the recommenders to submit their letters to grstewart@cpp.edu as pdf documents.

5. All application materials and letters of recommendation must be received by December 1, 2015. They will be evaluated by a committee of gopher tortoise biologists appointed by the Desert Tortoise Council Board of Directors.

6. The research award recipient will be notified of his/her

selection by January 19, 2016 and the award will be presented at the 2016 Desert Tortoise Council Symposium, February 19-21, 2016.



*David J. Morafka was a graduate of the University of Southern California and a professor at California State University, Dominguez Hills. His research interests included evolutionary biology, biogeography, and herpetology. He was an expert in the biology of the bolsón tortoise (*Gopherus flavomarginatus*) and Agassiz's desert tortoise (*Gopherus agassizii*), as well as the ecogeography of the Chihuahuan Desert and neonatology of tortoises.*

Tortoise Interrupts Construction Workers to Use New Wildlife Underpass

By Jessica Lamberton-Moreno

This tortoise is the first animal to use the Oracle Road wildlife crossing – and they haven't even finished building it yet.

Jesse Espinoza watched this Morafka's desert tortoise (*Gopherus morafkai*) make its way through the new wildlife underpass, traveling west, before it ran into Granite Con-

struction employees working on the underpass structure on the western end. Espinoza carefully helped the tortoise complete his journey a safe distance from the construction before taking this photo. Morafka's desert tortoise was recently removed from consideration for protection

continued on Page 14



This Morafka's desert tortoise is the first animal to have used the new Oracle Road wildlife underpass. Photo by Jesse Espinoza and Granite Construction.

BLM Reveals Little as Bundy Failure Lingers; Desert Tortoise Populations Remain at Risk

By Dan Patterson

LAS VEGAS—Internal government records released by the U.S. Bureau of Land Management concerning the armed stand-off with Nevada rancher Cliven Bundy give little clue of what led up to the confrontation and even less of what changed as a result. After a long delay, the records were finally turned over to Public Employees for Environmental Responsibility (PEER) as a result of its Freedom of Information Act (FOIA) lawsuit against BLM.

In the year following a failed attempt by BLM to seize Bundy's cattle, which had been illegally grazing on 160,000 BLM and National Park Service acres for more than a decade, the agency has

been largely silent and had not responded to a PEER FOIA request for explanatory documents. In a reply dated March 27, 2015, Theresa Coleman, Chief of BLM's Information Resources Management Division, declared that the agency possessed no records responsive to three of five categories of materials sought by PEER, namely:

- What became of the hundreds of Bundy's cattle collected by BLM before the round-up of trespassing cattle was called off;
- Any requests for prosecution BLM made to the U.S. Department of Justice; and
- Directives issued after April 1, 2014 within BLM concerning protocols or

advisories for handling similar incidents of armed resistance or other livestock trespass situations.

"In the aftermath of this incident, BLM apparently did not analyze either its effects or what to do if it happened again," stated PEER Executive Director Jeff Ruch, noting that his lawyers are working to verify that this is BLM's final answer and there are not more unreleased documents.

"Despite operating in what is self-described as 'the most transparent administration in history,' this exercise has been as productive as squeezing blood from a turnip."

In response to the rest of the PEER request, BLM turned over a total of 44 pages of material. As for what led to

the decision to end the Bundy round-up, BLM claims it has only a one-page press statement saying:

"Based on information about conditions on the ground, and in consultation with law enforcement, we have made a decision to conclude the cattle gather because of our serious concern about the safety of employees and members of the public."

This statement describes a decision that BLM claims was not reduced to writing. Nor apparently, was anything else written about what BLM was doing after the incident.

The other 43 pages are, in some cases, highly redacted communications about "extra safety measures" BLM employees should take, such as this from an unidentified BLM employee advising:

"At this time I recommend keeping a low profile, and not to wear anything that says you work for BLM...If possible try to double up when going to the field."

"When the history of this episode is written, BLM seems determined to contribute as little as possible," Ruch added. "So, what lessons were learned from this fiasco? Darned if I know."

As the feds allow the Bundy debacle to drag on, Interior managers have reportedly declared the Gold Butte area 'no go' for all agency employees, jeopardizing management, monitoring, enforcement and research.



A group of Cliven Bundy's cattle released by the BLM on April 12, 2014 after federal law enforcement agents stand down to Bundy supporters protesting the actions of the BLM in rounding up Bundy's cattle for removal from public lands that support desert tortoise populations and habitat. Photo by Jim Urquhart. / Reuters.

New Wildlife Film Stars Desert Tortoise, Scientists

By Dan Patterson

BOULDER CITY, Nev. – The Dam Short Film Festival entertains and informs people every February in this scenic, historic Mojave Desert town near the Colorado River. In 2015, Dam Short featured a cool new film on the desert tortoise, '60 Million Years'.

Dallas-based filmmakers Allan & Patty Thompson of One:Eight Productions and composer Ellen Seldin collaborated on the 60 Million Years project.

Filming occurred at sites in Clark County, Nevada, near Boulder City and Coyote Springs, in the northeastern Mojave Desert. 60 Million

Years unveils great footage of tortoises, desert habitat and interviews with respected scientists Todd Esque and Lesley DeFalco of USGS. Great aerial coverage from biologist and ultra-light pilot Ken Nussear provides a unique, stimulating raven's-eye view.

The film helps people learn about desert tortoises and makes an "emotional connection" with viewers, explains DeFalco.

After public showings in Las Vegas, Boulder City and Mesquite, Nevada, people have been 'really positive' about the film, reports Esque.

60 Million Years touches on the growing issue of how in-



creased wildfire is effecting tortoise populations, a research focus of USGS. Research suggests adult tortoises may be adapting somewhat to one-time fires, but lands burned repeatedly, especially when invaded post-fire by brome grasses, become significantly compromised habitat, especially for young tortoises.

"It's hard out there" for desert tortoises, says Esque. This film helps show that and helps people, especially kids, understand and respect what desert tortoises go through to survive.

60 Million Years "stirs enthusiasm and wonder" for desert tortoises, wildlife and the desert, which is needed in our techno-virtual reality world,

says DeFalco.

Film composer Seldin hopes the film and its wonderful music leads to "improved awareness of both the ecology of the desert and the desert tortoise."

I think it will. After taking it in at the historic Boulder Theatre, my family and I found the film touching and informative. This film is well done to effectively connect with people and spark human interest in conservation and recovery of the desert tortoise.

60 Million Years reportedly will be used in educational programs at the Dallas Zoo, and Red Rock Canyon Visitor Center in Las Vegas.

Watch the 60 Million Years trailer: vimeo.com/100119638



Dr. Lesley DeFalco is one of the USGS biologists featured in the new film.

Tortoise Interrupts Workers (continued)

under the Endangered Species Act, but Arizona law still prohibits the removal of desert tortoises from the wild. Captive bred tortoises are available for adoption.

The wildlife crossing structures, one underpass and one bridge, will link the Tortolita mountains and the Santa Catalina mountains, allow wildlife to safely travel across Oracle Road and reduce wildlife-vehicle collisions. The project

has brought together several partners including Sky Island Alliance, Coalition for Sonoran Desert Protection, Tucson Audubon Society, Pima County Regional Transportation Authority (RTA), the Arizona Department of Transportation, Granite Construction, and the Arizona Game and Fish Department.

Learn more about the wildlife crossing project on the Coalition for Sonoran Desert Protection website.



Oracle Road Wildlife Underpass under construction in September 2015. Photo by Coalition for Sonoran Desert Protection.

Photo Gallery



Students participating in the DTC's desert tortoise Health Assessment Techniques workshop in Phoenix, Arizona. Photo by Bruce Palmer.



Rachel Woodard and Peter Woodman demonstrate techniques to students of the DTC's desert tortoise Health Assessment Techniques workshop in Las Vegas, Nevada. Photo by Michael Tuma.



Morafka's desert tortoise (Sonoran type) site at Punto Tepopa, looking toward Isla Tiburón, 05 August, 2010. Photo by Taylor Edwards.



Students attending a lecture at the DTC's desert tortoise Health Assessment



Roy C. Averill-Murray and Bruce Palmer on the DTC Symposium field trip to Trout Canyon Translocation Site on February 19, 2015. Photo by Peter Woodman.



USGS biologists Todd Esque and Kristina Drake tracking desert tortoises in a screen shot from the One:Eight Productions film "60 Million Years."

Back Page Announcements

Sponsors Sought for DTC Newsletter

Interested in getting more exposure for your organization by sponsoring a non-profit? Consider advertising in the next issue of the Desert Tortoise Council Newsletter! The Council is currently seeking sponsors for upcoming issues

of the Newsletter, which is published quarterly, distributed via email to more than 500 of our members and past members, and available for free download from our website (www.deserttortoise.org/newsletter.html).

We are offering the following sponsorship levels:

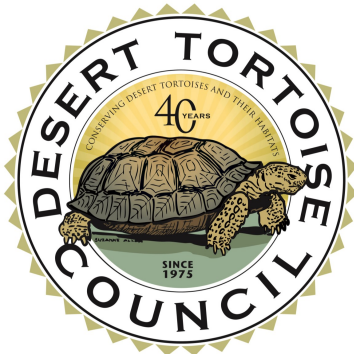
Silver: Your organization's name mentioned in the sponsorship section of the Newsletter for 4 issues (\$100).

Gold: Your organization's logo

presented in the sponsorship section of the Newsletter for 4 issues (\$250).

For more information on becoming a sponsor of the Desert Tortoise Council Newsletter, please contact Michael Tuma at mtuma@west-inc.com.

Follow the Desert Tortoise Council on Social Media



Council Mission

The Desert Tortoise Council was established in 1975 to promote conservation of the desert tortoise in the deserts of the southwestern United States and Mexico. The Council is a private, non-profit organization comprised of hundreds of professionals and laypersons who share a common concern for desert tortoises in the wild and a commitment to advancing the public's understanding of the species. For the purposes of the Council, desert tortoise includes the species complex in the southwestern United States and in Mexico, currently referred to as *Gopherus agassizii* and *Gopherus morafkai*.

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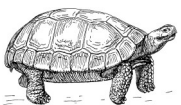
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