

RESPONSIBLE HERPETOCULTURE JOURNAL

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- MARINE CONSERVATION: PROTECTING SEA TURTLES
- IN SEARCH OF THE PALM VIPERS OF GUATEMALA
- BEHIND THE SCENES AT "REPTILE TALKS"
- INTERVIEW: GALAPAGOS CONSERVANCY
- AN INTRODUCTION TO HERPETOLOGY AT SINGAPORE ZOO
- HUSBANDRY AND CAPTIVE BREEDING OF: THE EMPEROR FLAT ROCK LIZARD, MALAYAN LEAF FROG AND AMUR RAT SNAKE
- MONITOR LIZARDS IN A SPOT OF TROUBLE – VETERINARY CASE STUDY

Picture credit by Turtle Foundation.



When the Conservation of Nature is not Enough...

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At the end of my presentation at The Reptile Talks in Anaheim California, I spoke about herpetoculture as a third place. In sociology a third place is a place that is not work and not

home where one socially engages with others. Third places are considered important for mental health, giving one a sense of relevance, connection, and community.

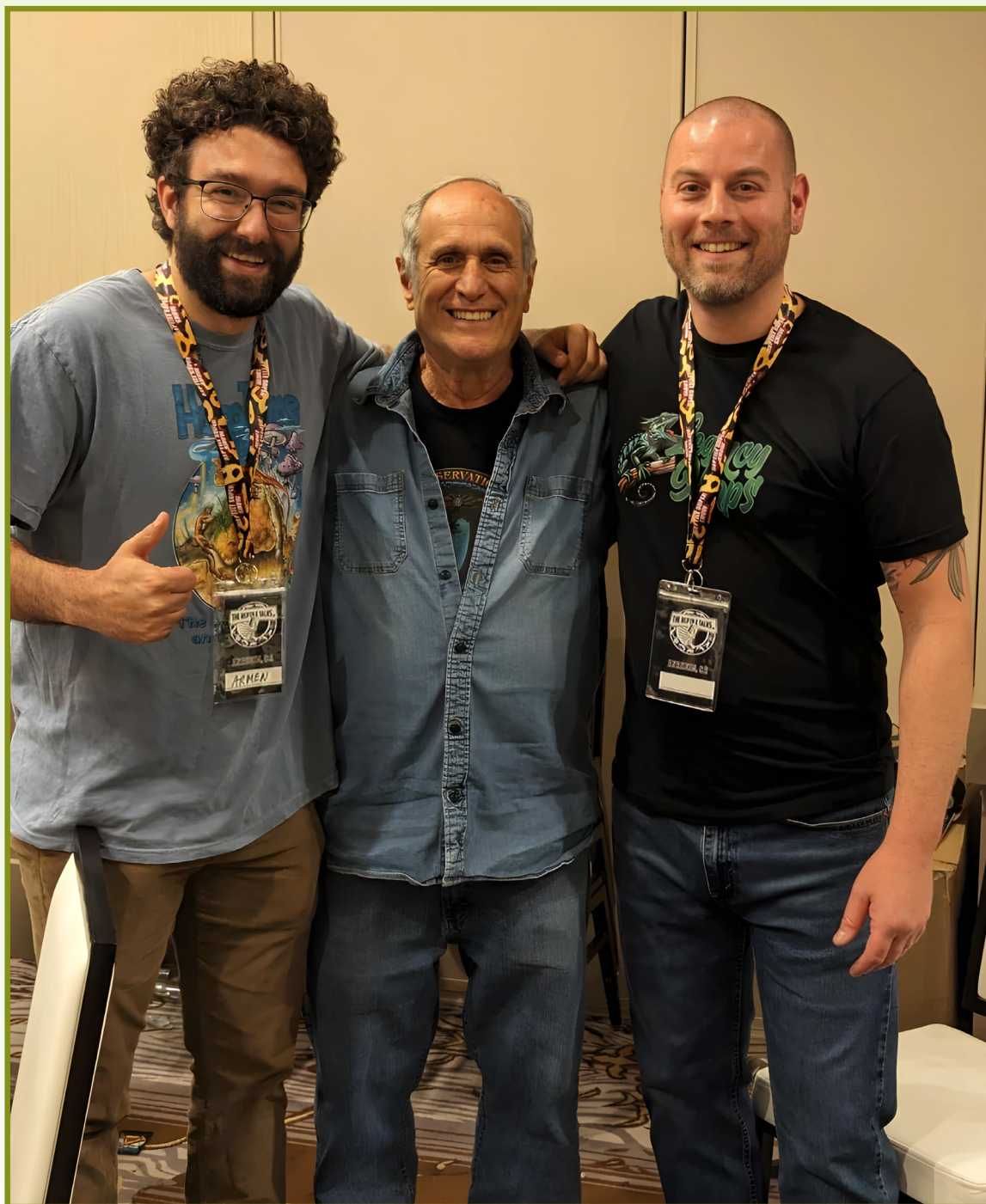


Figure 1. With some friends (Armen Keyulian and Justin Munsterman) on the conference.

Like Herpeton in 2019, which was attended by my friend Dmitri Tkachev and several members of BION, the Reptile Talks was a gathering where I met friends and colleagues I had not seen in a long time and where I also formed new friendships, notably with people in lateral fields like conservation, and with members of the younger generation who are at the forefront of some of the cutting-edge work in herpetoculture today.

I find that at these conferences some of the most valuable insights are discovered in the course of conversations during breaks, lunches, dinners or, more often, at the hotel bar in the evening hours. For example, I gathered valuable information from snake keepers about a pattern I see with Baron's racers where availability seems to have peaks followed by troughs. Why are blue Baron's racers which rank among the most beautiful and best displays snakes in the world still so difficult to find and not widespread? I also bounced the idea that in some species of snakes (e.g., rhino rat snakes) sex may be influenced by incubation temperature. Talking to my friend, the veterinarian Scott Stahl, I learned more about nidovirus (the proper term is now serpentovirus and there are two strains with significantly different effects) a disease I had to deal with in trying to establish a healthy carpet python colony as a research manager for Snake Pharm, and about *Stongyloides* (nematode thread worms), parasites which are being seen more frequently in collections. I had lunch with Ty Park, who I hadn't talked to since he founded and built Iguanaland, a facility which is at the cutting edge of captive rare iguana propagation, where he shared with me their work with the Anegada rock iguana, *Cyclura pinguis* Barbour, 1917. I met Justin Munsterman, whose work with uncommon lizard species I had been admiring for a long time and we were able to share our interests in lizards of the genus *Lophosaurus*. And it goes on....

One conclusion I and many others have come to is that online communities, forums, and social media have their place, but they are a pseudo-third place. You don't really begin to know someone until you've actually met them in person and engaged with them. There is so much more than the narrow band of online exchanges. Face-to-face conversations which start as general eventually become more personal and often enough connections and bonds are formed.

And as a third place, a conference like the Reptile Talks also allows me and others to present and test ideas for which there are few outlets. Where else could I have shared my thoughts on topics like "Are snakes in our DNA?" and "The Ouroboros as symbol of existence". At the end of these events, I always feel reinvigorated and excited about the discipline we call herpetoculture. The organizers, of the reptile talks Ramy Guirguis, Jay Sommers, and Armen Keuylian have already told me that there will be another Reptile Talks next year, same place and about the same time. I plan to be there.

Philippe de Vosjoli,

*Honorable President,
The Responsible Herpetoculture
Foundation (RHF)*





AN OVERVIEW OF THE REPTILE TALKS IN ANAHEIM



Author(s): **Sam Bacchini**, *Herpetologist, USA.*

The Reptile Talks first conference was held at the Anaheim Hilton on May 17-19, 2024. Organized by Ramy Guirguis (Reptile Super Shows), Jay Sommers (gecko and amphibian breeder) and Armen Keuylian (Herp Time), among others, and sponsored by a variety of major supporters of the herpetoculture field including Reptile Super Show, Zoo Med, Morph Market, Timberline and Ship Your Reptiles alongside many other smaller supporters. The conference was held to provide an in-person opportunity to share information among amateur and professional herpetoculturists and herp enthusiasts alike. It was also a benefit for the United States Association of Reptile Keepers (USARK) to help them with all they do to ensure that we can continue to participate in and enjoy the discipline of Herpetoculture. Conferences such as this are always a great opportunity to learn and meet like minded enthusiasts in person, and are always a joy to attend.

Friday, May 17

5pm - Ice Breaker - Hilton Lobby

Saturday, May 18

9AM -Talks Begin- Avalon Room

Jay Sommers - *Jay Sommer's Reptiles* - "Where'd They All Go?"

Bill Stegall - *Phoenix Reptiles* - "Husbandry and Reproduction of Captive Bred and Born Green Tree Pythons"

Mike Ready - *Mike Ready Photography* - "Tree-hole to Treetop: Captive Care and Reproduction of the Fringed Leaf Frog (*Cruziohyla craspedopus*)"

Scott Stahl - *DVM* - "Hot Topics in Herpetological Medicine and Surgery"

Crystal Mandica - *Director of Education at Amphibian Foundation* - "Critters in Our Future"

Lunch Break

Jordan Russell - *California Breeders Union* - "From Scales to Jails"

Mark Chen - *TMK Aquarist* - "Paludariums; Best of Both Worlds"

Chad Brown - *All Pro Shipping* - "Methods for Correctly Shipping Reptiles"

Socratis Christoforou - *Ari Elli Max Arboreals* - "Thriving Unconventionally: A Journey into Green Tree Pythons, Amazon Basins, and Lifelong Vitality"

6PM - **USARK Auction** - **Avalon Room** (with statement from USARK president - **Phil Goss**)

7pm - **Memorial for Bob Maillioux**

Sunday, May 19

9:30AM -Talks Begin- Avalon Room

Philippe de Vosjoli - *Author* - "The Further Reaches of Herpetoculture"

John Adragna - *SIM Container* - "Water Monitors Distribution, Color Patterns and Captive Care"

Mark Mandica - *Executive Director of Amphibian Foundation* - "Advancing the conservation of the slimy underdogs and foul and loathsome creatures of the Southeastern United States"

Armen Keuylian - *HerpTime* - "The Joy of Anolis: A Delightful Experience for Reptile Keepers of All Levels"

Lunch Break

James Badman - *Associate Director for the Department of Animal Care and Technologies at Arizona State University* - "Raising Tortoises In The Valley Of The Sun: Can A Private Breeder Contribute To Conservation?"

Justin Munsterman - *Legacy Herps* - "Embracing the Mystique: A Comprehensive Guide to Keeping Sri Lankan Cloud Forest Lizards"

Jeff Galewood jr. - *JMG Reptiles* - "For the Love of Hog".



Figure 1. Schedule of the talks on the conference.

Day One Talks

Hot Topics in Herpetological Medicine and Surgery by Dr. Scott Stahl, owner of Stahl Exotic Animal Veterinary Services in Fairfax, Virginia, USA



Figure 2. Dr. Scott Stahl during his veterinary-related talk.

The conference began with Dr. Scott Stahl DVM discussing the current status of diseases and other ailments of captive reptiles and amphibians. His talk included a personal tribute to the late herpetocultural pioneer Bob Mailloux, but otherwise focused on the common issues with captive reptile and amphibian health, what the current methods of treatment are, and what we can do to help prevent the spread of these conditions.

An Introduction to Captive Bred and Born Green Tree Pythons by Dr. Bill Stegall, owner of Phoenix Reptiles in Phoenix, Arizona, USA

Dr. Bill Stegall discussed some of the natural and herpetocultural history of the southern green tree pythons (*Morelia viridis* (Schlegel, 1872)) and northern green tree python (*Morelia azurea* (Meyer, 1874)) along with methods for the long-term husbandry and reproduction of these beautiful species.

Tree-Hole to Tree Top: Notes on The Captive Care and Reproduction of the Fringed Leaf Frog (*Cruziohyala craspedopus* (Funkhouser, 1957)) by Michael J. Ready, USA

Accomplished amphibian breeder Michael Ready discussed the natural history, husbandry and captive reproduction of one

of the most beautiful amphibians in the world, the fringed leaf frog (*C. craspedopus*). Mr. Ready took us through the history of the species in captivity, and the methods he used to successfully raise and reproduce this unique species.

Critters in Our Future by Crystal Mandica, Co-Founder and Director of Education at the Amphibian Foundation in Atlanta, Georgia, USA

Crystal Mandica of the Amphibian Foundation (AF) discussed her history going from pursuit of

a law degree to discovering her true calling and becoming a biologist. Ms. Mandica focused her talk on her role and the Director of Education for the AF and all of the programs that the AF provides to teach people of all ages about reptiles and amphibians, their importance in our ecosystem and to train future biologists and conservationists to carry on with the work of preserving these species.

Methods for Correctly Shipping Reptiles by Chad Brown, Owner and CEO for All Pro Shipping in Lone Tree, Colorado, USA

Chad Brown discussed the history of shipping animals in the reptile trade, highlighting how difficult it was in the early days, and describing the enormous efforts he and his colleagues went through to build the often very fragile relationships with various shipping companies that allow for the current ease of shipping reptiles and amphibians across the country for the herpetoculture trade.

The Paludarium: Best of Both Worlds by Mark Chen, TKM Aquarist, Los Angeles, California, USA

Mark Chen discussed his methods for creating Paludariums, enclosures that

incorporate fully terrestrial and fully aquatic zones, to create vivariums that not only support a variety of terrestrial and aquatic species, but are beautiful and fascinating to watch.

A Beginners Guide to Federal and International Regulations by Jordan Russell, California Breeders Union, California, USA

Jordan Russell discussed the various federal and international regulations that affect the Herpetoculture discipline. The goal of his talk was to dispel some of the many misconceptions about the often-confusing wildlife regulations that affect herpetoculture. Additionally, Mr. Russell provided references to the abundant resources that are available to individuals to research these regulations and help ensure that we, as herpetoculturists are easily able to stay in compliance with them.

Thriving Unconventionally: A Journey into Green Tree Pythons, Amazon Basins and Lifelong Vitality by Socratis Christoforou, Ari Elli Max Arboreals in Fort Lauderdale, FL, USA

Mr. Christoforou discussed the development of his passion for working with reptiles, and specifically with arboreal species. Focusing on his current favorite, Amazon Basin emerald tree boas, Mr. Christoforou described the philosophy behind his approach that resulted in his success with this beautiful species among many others.

The evening of the first day began with a word from USARK president, Phil Goss who discussed the current status of efforts by USARK on behalf of herpetoculturists. This was followed by an auction of items donated

by the conference sponsors and many of the speakers to benefit USARK and their work.

The final event of the evening before dispersing for dinner was a Memorial Tribute for Bob Mailloux of Sandfire Dragon Ranch. This event was an informal opportunity for those close to Bob, who is widely recognized as one of the early pioneers of herpetoculture, having introduced species such as bearded dragons and White's tree frogs among many others to herpetoculture. The common theme from each of the people who got up and spoke about their experiences with Bob, was to describe a person of incredible kindness and generosity, as well as someone having a great passion for reptiles and amphibians and their care and reproduction in captivity. Bob's recent passing was a great loss to all of us in the herpetocultural community.

Day One Talks

The Further Reaches of Herpetoculture by Philippe de Vosjoli, Herpetoculturist and Author in Vista, CA, USA

Day two of the conference began with another of the great pioneers in herpetoculture, Philippe de Vosjoli. Philippe's talk was of a more philosophical nature and



Figure 3. Philippe de Vosjoli talking about the place of herpetoculture in the global cultural sphere of humankind.



Figure 4. James Badman explaining how the private breeders can contribute to the conservation projects and save species.

Raising Tortoises in the Valley of the Sun: Can a Private Breeder Contribute to Conservation by James Badman, Associate Director for the Department of Animal Care and Technologies at Arizona State University in Arizona, USA

James Badman discussed his decade's long work with turtles and tortoises, among many other species. Highlighting particular species or groups of species (e.g., *Testudo* sp. radiated tortoises, star tortoises, *Pyxis* sp. and particularly Galapagos tortoises among many others) James discussed the successes and failures he has had over the years with each of these groups. He then went on to discuss the possibility of how the private herpetoculturist could meaningfully contribute to the conservation of these species that we all love. While he said it is a challenging road to follow, it is possible.

discussed the importance of reptiles and amphibians throughout human history, their cultural significance over the centuries up to the modern day, and how the DISCIPLINE of herpetoculture can be a model for future human cultural growth.

Advancing the Conservation of the Slimy Underdogs and Foul and Loathsome Creatures of the Southeastern United States by Mark Mandica, Executive Director of Amphibian Foundation in Atlanta, Georgia, USA



Figure 5. Promoting the breeding project dedicated to breeding of Frosted flatwoods salamander.



Figure 6. Armen Keuylian sharing aspects of work with different *Anolis* species.

Mark Mandica followed up on his wife's talk from day one by going into great depth on several of the projects the Amphibian Foundation is involved with that are attempting to conserve various species of critically endangered amphibian species in the Southeastern United States. His talk focused on three species, the frosted flatwoods salamander (*Ambystoma cingulatum* Cope, 1868), the Carolina gopher frog (*Lithobates capito* (LeConte, 1855)), and the striped newt (*Notophthalmus perstriatus* (Bishop, 1941)), but covered a few other less threatened species as well. The efforts the AF has employed include a combination of captive reproduction, headstarting, public education and habitat preservation/restoration. Please visit their website <https://amphibianfoundation.org/> for more information.

The Joy of Anolis: A Delightful Experience for the Reptile Keepers of All Levels by Armen Keuylian, owner of Herp Time in California, USA

Armen Keuylian, owner of Herp Time discussed his passion for working with the

smaller species of *Anolis* and other similar species such as the "micro geckos" in the genus *Sphaerodactylus*. Armen owns a large facility in Southern California with approximately 3,000 square feet of space dedicated to working with this somewhat underrated but often very beautiful group of lizards. Armen discussed his methods for creating naturalistic/bioactive vivaria that allow for the long-term successful maintenance and reproduction of these fascinating lizards. He brought several examples of the species he is working with for people to see in person.

The World of Varanids: A Guide to Mike's Monitors Socialization Caging Systems (MMSCS), and How to Provide Thorough Husbandry to Breed Varanids by Nick Lillis, Unlimited Exotics, Milford, PA, USA

Nick Lillis discussed methods for socialization in monitor lizards using a system developed by Mike's monitors, along with methods for the maintenance of monitor species in such a way as to promote captive reproduction. Working primarily with larger species in the *Varanus salvator* complex,

Mr. Lillis described how socialization of these animals is a great aid to reduction in stress to both he and the animals and is of great aid in their successful husbandry and reproduction.

Embracing the Mystique: A Comprehensive Guide to Keeping Sri Lankan Cloud Forest Lizards by Justin Munsterman, Legacy Herps in Dutchess County, NY, USA

Justin Munsterman discussed his work with *Cophotis ceylanica* Peters, 1861, *Cophotis dumbara* Samarawickrama, Ranawana, Rajapaksha, Ananjeva, Orlov, Ranasinghe & Samarawickrama, 2006, *Ceratophora tennentii* Günther, 1861, and *Calotes pethiyagodai* Amarasinghe, Karunaratna & Hallermann, 2014 from the cloud forests of Sri Lanka. These small but beautiful and fascinating lizards all have a reputation for being delicate, but Mr. Munsterman described how his methods have allowed great success with not only maintaining these species long term, but reproducing them in abundance. Care of the species is very similar and all do well in naturalistic vivaria when set up properly.

For the Love of Hog by Jeff Galewood, Jr., JMG Reptiles in Cleveland, OH, USA

The final talk of the conference was by Jeff Galewood, Jr. who specializes in western or plains hognose snakes. While not generally considered difficult to maintain or reproduce, there are lots of misconceptions on the difficulty of getting young hognose snakes feeding properly. The



Figure 7. Sharing experience on proper monitors' husbandry approaches.



Figure 8. Talking about husbandry of Sri Lankan cloud forest lizards.

focus of Mr. Galewood's talk described the use of field data on the diets of this species in the wild to give clues on how to provide a varied diet in captivity that will contribute to the individual's longevity, and described several techniques to induce problem feeders to eat.



Figure 9. The materials of the conference are published for everyone interested in them.

Considering that the conference was the first for the organizers, it went extremely well. It was well attended and informative, and I and everyone I spoke with really enjoyed the event. A magazine with select abstracts and summary articles was provided to all attendees. A limited number of these magazines are available for purchase through USARK for those who may be interested.

Year two of The Reptile Talks is already in the works for the same weekend in 2025. Some speakers are already lined up with plenty of time to attract more. As I stated above at the beginning of this article, these conferences are extremely valuable opportunities to share information, and to meet fellow herpetoculturists face to face. It is my hope that the popularity of this event will grow, allowing it to continue for many years to come.

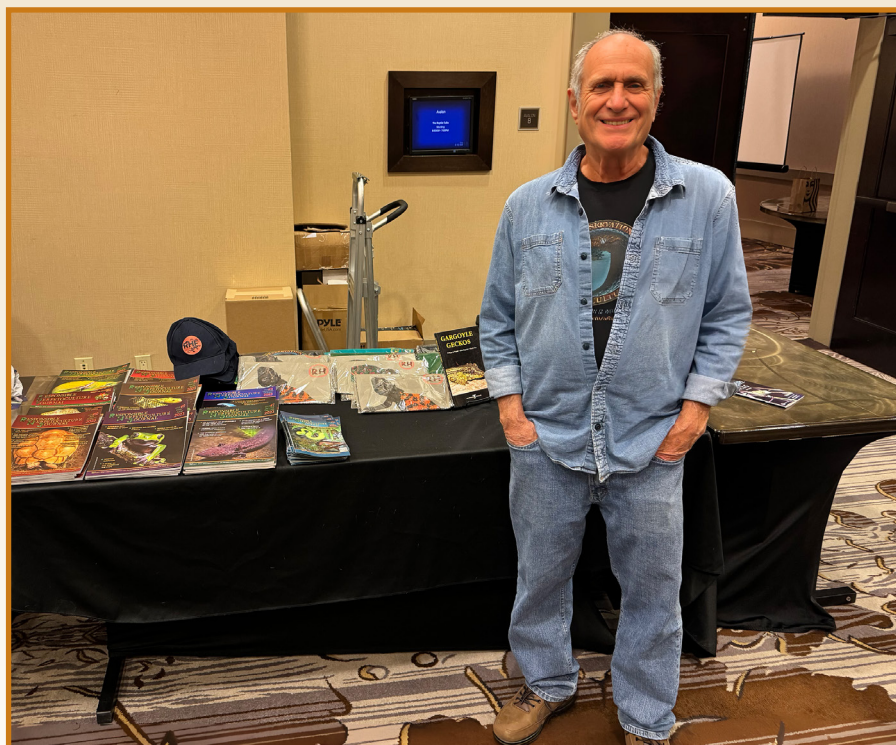


Figure 10. Philippe de Vosjoli at the RHF booth before the conference.



RESPONSIBLE HERPETOCULTURE FOUNDATION

WWW.RESPONSIBLEHERPETOCULTURE.FOUNDATION

The Responsible Herpetoculture Foundation (RHF) is a professional organization promoting herpetoculture as a discipline, business, and wildlife conservation tool.

RHF has over 5000 MEMBERS, including hobbyists, experienced herpetoculturists, professional breeders, herpetologists and biologists, zookeepers, owners of pet stores and herp-related businesses, representatives of well-known similar missions organisations (like DGHT, BHS, HF, TTPG), and specialists on wildlife conservation from 50 countries.

RHF is focused on promoting the body of knowledge associated with the husbandry

and breeding of amphibians and reptiles as a tool for preserving species in captive collections, for teaching biology and related subjects (ecology, animal behavior, soil science etc.), for conservation, and for publicizing Responsible Herpetoculture as a beneficial economic enterprise and philosophy.

The idea to create RHF emerged five years ago and was first presented at the Herpeton-2019 Conference in San Diego (US), where it

received an enthusiastic response from the professional audience.

It was released in March 2022 in the Ukraine, at the start of the Russian invasion and acted as an outlet for updated information on amphibians and reptiles, their husbandry, breeding, and conservation by recognised experts in their fields. An immense herpetological community came together to support the RHF, and the RHJ soon amassed a large following

<https://responsibleherpetoculture.foundation/about-us/>

For more information pls contact: responsibleherpetoculture@gmail.com.

Our partners:

HERPETOFAUNA



60th Annual Meeting of the German Society for Herpetology and Terrarium Science (DGHT):

The annual conference originally planned in Frankfurt had to be canceled at short notice and will now take place at the Zoological Research Museum Alexander Koenig in Bonn. All members are cordially invited to attend from September 18 to 22, 2024.

The program includes various highlights:

- On Wednesday, September 18.09.24, there will be a welcome evening at Brauhaus Bönnsch in Bonn.
- DGHT members Prof. Dr. Thomas Ziegler and Prof. Dr. Dietrich Mebs will be speaking on the evenings.
- A workshop on the adder will be led by Tim Lüddecke.
- The general meeting with new elections of the presidium will take place on September 20, 2024.
- Guided tours of the scientific collection and animal husbandry at the Museum Alexander Koenig are planned.
- The traditional colorful evening on Saturday will also take place at the Museum Alexander Koenig.
- Excursions to Cologne Zoo and the Wahner Heide, the most species-rich nature reserve in North Rhine-Westphalia, are planned for Sunday.

In addition to herpetological interests, Bonn, as the former federal capital, offers many other sights, including the old Bundestag, the Villa Hammerschmidt and various museums. Further information will be published on the DGHT website at a later date.



Photo: Cologne Zoo

New online portal for species protection

On February 5, 2024, the online portal for "Registration and Certification in Species Protection" (MelBA-online) was launched in Baden-Württemberg (<https://melba-bw.de>) and Rhineland-Palatinate (<https://melba-anmeldung.naturschutz.rlp.de>). The



Photo: Susanne Edele

portal records the keeping and sale of protected species. This reduces bureaucracy for citizens and makes it easier for authorities to trace the whereabouts of protected species. "MelBA-online relieves the burden on citizens, supports the work of the authorities and strengthens international species protection, as it can be used to precisely determine whether the keeping and sale of protected species is legal. At the same time, it makes it easier to submit notifiable information to the authorities," says Rhineland-Palatinate Environment Minister Katrin Eder. Thekla Walkker, Minister of the Environment in Baden-Württemberg, added: "The portal provides a good overview of the protected species kept in the state, simplifies communication between the administration and the population and helps to reduce bureaucracy." Anyone wishing to keep a protected species such as a chameleon, a Greek tortoise or a gray parrot must register this. A permit is required for the sale and purchase of protected animal and plant species or parts thereof, such as wood, skins or corals. Previously, numerous forms had to be submitted for this purpose. This can now be done via MelBA-online.



Photo: Tim Vickers (Wikipedia)

Special symposium on snake venom and venomous snakes

Hardly any other group of animals exerts such a fascination on us humans as venomous snakes. They have always been revered and feared in equal measure. Consequently, many terrarium keepers successfully and safely keep venomous snakes in their care. Nevertheless, many species are capable of causing catastrophic damage with their venoms. It is estimated that up to three million snake bites occur worldwide every year. These lead to around 150,000 deaths and several hundred thousand permanently injured victims, particularly in the poorest regions of the world (e.g. South-East Asia and Sub-Saharan Africa). In response, the World Health Organisation classified snakebite envenomations as a priority 1 neglected tropical disease in 2017 and set a strategic goal of reducing snakebite deaths by 50% by 2030.

In view of the importance of snakebite envenomations on the one hand and their position as important suppliers of active substances and terrarium animals on the other, a special symposium on snake venoms, snakebites and venomous snakes will be held on the Science Day of this year's Annual Meeting. In a series of selected expert lectures from the German research and terrarium landscape, these important topics will be considered and discussed from different perspectives. Conference participants will thus have the opportunity to gain an initial insight into this topic and enter into a dialogue with proven experts from science and the terrarium hobby. A separate schedule will be published shortly; separate registration for this event is not necessary as it will take place in a separate lecture room in the Museum Koenig in parallel to the other scientific lectures.

Green toads at the wildlife centre

The Sachsenhagen Wildlife and Species Conservation Centre has been involved in supporting the population of the green toad in the district of Wolfenbüttel, Lower Saxony, since 2019. The wildlife centre is responsible for ex-situ measures in the rearing of young toads from spawn in order to bridge the lossy stages from egg to metamorphosis.

In 2023, there were several positive developments in the efforts to support the population of the green toad in Lower Saxony: The Ecological NABU Station Aller/Oker (ÖNSA) of NABU Niedersachsen e. V. started the project 'Creation of habitats for the endangered green toad' in 2023 and is thus also carrying out measures in the district of Helmstedt. Alongside the district of Wolfenbüttel, this is the only district with remaining populations of the green toad in Lower Saxony. While in the first few years the wildlife centre only supported the population of green toads in the district of Wolfenbüttel with the young toads reared at the centre, it has now expanded its rearing facility and has also been rearing green toads for release into the wild in the district of Helmstedt on behalf of ÖNSA since last year.

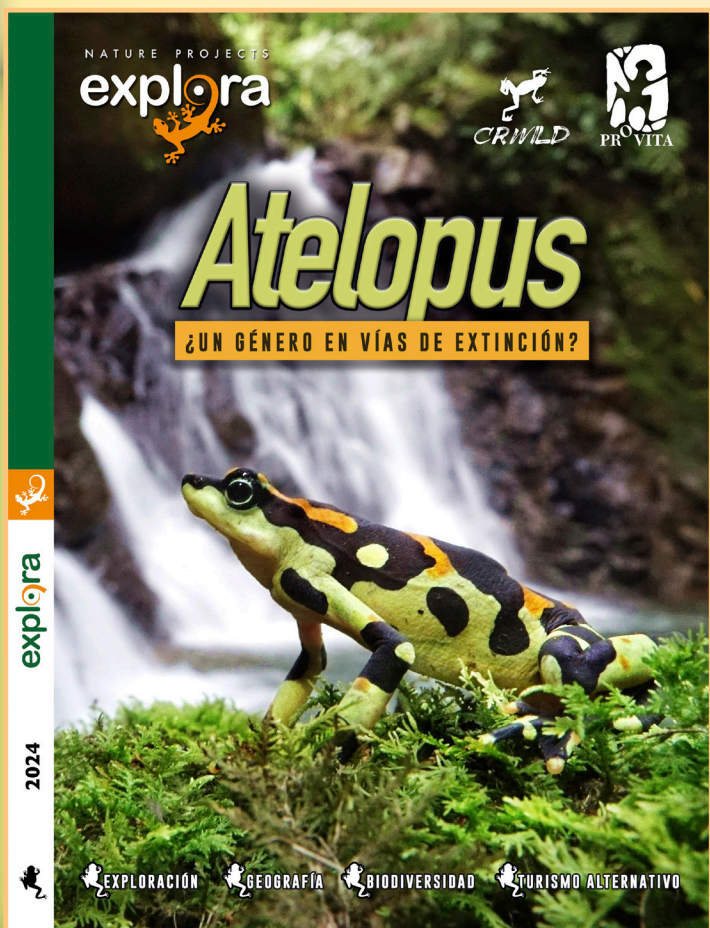
Spawning began early in 2023, and the wildlife station was able to receive the first spawn for rearing from the district of Wolfenbüttel on 28 April 2023. The search for spawn in the district of Helmstedt proved to be more

difficult, with burbot not being brought to the wildlife centre for rearing until the beginning of June. With the enlarged facility, it was then possible to provide a total of 1,409 reared young toads for release into the wild.

Another positive development was that in June 2023, the centre was able to breed its own offspring for the first time. On 13 June 2023, a spawning line that had been released the evening before was recovered from the outdoor terrarium completed in 2022. If it proves possible to regularly breed green toads in the coming years, it may not be necessary to remove spawn from the outdoor enclosure.



Figure 1. Green toad (photo credit: O. Kukshyn).



EXPLORA magazine

A special edition of the Venezuelan magazine, EXPLORA has launched with a focus on the endangered harlequin toads of the genus *Atelopus*. It gathers articles by eminent specialists from several Latin American Countries: Costa Rica, Panama, Colombia, Venezuela, Ecuador, Peru, Bolivia and Suriname. It is the first comprehensive work dedicated to such a imperiled genus. In it is possible to understand the current situation of many species, the real problem, to see efforts in the conservation of several species, to see the last pictures ever taken or *Atelopus chiriquiensis* in Panama, or the last surviving *Atelopus carbonerensis* from Venezuela. A great must if you like to be informed about frogs in general, and to enjoy new and very old pictures of some of the most spectacular anurans in the world.

Here is the link to download for free, https://www.crwild.com/_files/ugd/ea5bc6_32d8ff8b3f9649fc8c39a4e451877198.pdf?index=true

And if you want to see it online: <https://www.yumpu.com/es/document/read/68717865/atelopus-sapitos-arlequines>

Road salts cause rapid evolution in US frog species

Researchers in New York state have discovered rapid evolution in a species of frog in response to salt used to de-ice roads.

A study of wood frogs has shown that the accumulation of salt in the water contained in its wetland habitats has caused incredible fast changes in the amphibian species. The team studied the salt content in a wetland next to a car park that had existed for 25 years and found it to be nearly 100 times higher than that of pristine wetland.

Over just 10 generations, the population of wood frogs living in the car park-adjacent wetland had developed a higher tolerance to salt than other populations. This response is a remarkable adaptation considering the wide range of dangers posed to wildlife from salt draining into fresh water bodies.

The researchers focused on the wetlands due to the small pockets of water found there containing much higher concentrations of salt than larger bodies of water. Eggs were collected from nine populations, with the tadpoles later being exposed to salt. The results showed that the individuals from the areas with a



Figure 2. A wood frog (*Lythobates sylvaticus* Le Conte, 1825). Image: shutterstock 794274316 Photo Contributor Viktor Loki

higher salt content survived significantly longer than those that originated from less contaminated areas.

While the findings show some tolerance to higher salt levels, there is no guarantee that even the most resilient individuals would survive should levels rise even higher. The team hopes that the study will encourage local governments to continue to consider how salt is applied to roads and what efforts can be taken to ensure road safety without jeopardising frog populations.



Figure 3. A Mozambique spitting cobra (*Naja mossambica*) Image: shutterstock 97045964 Photo Contributor Stu Porter

Breakthrough in search for spitting cobra snakebite treatment

An effective snakebite treatment for African spitting cobra venom has been discovered, offering new hope for a previously devastating issue.

Professor Nicholas Casewell and Dr Steven Hall were part of the team from Liverpool School of Tropical Medicine who made the discovery that using a small amount of varespladib, a repurposed small molecule drug, could prevent the damage caused by a spitting cobra bite. The drug works by blocking one of the two toxins that causes irreversible skin and muscle tissue damage, which can lead to permanent injury and sometimes loss of limbs.

The approach offers new hope of treating local envenoming, for which there has been no previous treatment. Existing antivenoms are effective for bites from other species of snake, but cannot target localised damage around the bite site.

Professor Casewell said: "Our findings hold much promise to improve the treatment of tropical snakebite. Current treatments for spitting cobra bites are widely regarded as

being ineffective, meaning that rates of disability and amputation have remained high across much of Africa. Our data shows that blocking just one of the main toxin families in spitting cobra venom will likely prevent the debilitating tissue damage seen in thousands of snakebite patients each year."

Lungless frog species not so lungless after all...

Tiny pairs of lungs have been found within a species of frog previously considered to be lungless by researchers from the National University of Singapore.

The Bornean flat-headed frog (*Barbourula kalimantanensis* Iskandar, 1978)) has long been considered unique in the amphibian world due to its apparent lack of lungs, however new findings have revealed that there is more to the species' anatomy than first thought.

The latest research focused on specimens studied by the first research team to declare the frogs lungless in 2008, using a high-resolution scanner to detect a tiny set of thin lungs barely visible to the human eye.

Bornean flat-headed frogs inhabit cold, fast-flowing streams and never leave the water, leading scientists to conclude that they had developed the ability to breathe entirely through their skin as an adaptation to their surroundings. Lungless animals are not unheard of but remain rare, with only one species of caecilian and a handful of salamander species known to breath without a typical respiratory system.

With more advanced technology, researchers have been able to gain a clearer understanding of how these aquatic amphibians intake enough oxygen to survive in their intense habitats. It is hoped that the study will lead to a greater understanding of how other species of amphibians living in similar conditions function and survive.



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Figure 5. This year's turtle month comes soon after the TSA's 20th anniversary

Annual Turtle Month Celebrated in USA

The Turtle Survival Alliance celebrated their annual "Turtle Month" event last month. Each year from Earth Day to World Turtle Day (May 23rd) the TSA puts on events and initiatives to raise awareness for turtle conservation around the world.

Although most events took place in the US, the outreach drew global attention to the diversity, beauty and preservation of the 350+ extant turtle species. Amongst the events is the understandably popular "Drink Beer. Save Turtles" event where the TSA's own craft beer was featured in breweries in Charleston, Jacksonville and Albuquerque. Alongside the fun

and novel initiatives were apparel sales and more.

The month concluded with more educational livestreams from Mexico and the Turtle Survival Centre in South Carolina. More information on the event will be available in the next issue of the Responsible Herpetoculture Journal.

Eastern Indigo Snakes Released into Wild

Forty-one Eastern indigo snakes, bred in captivity, found their new home in the Nature Conservancy's Apalachicola Bluffs and Ravines Preserve (ABRP) last month, marking the eighth consecutive year of releases aimed at bolstering wild populations. The group comprised 20 females and 21 males, hatched at the Central Florida Zoo & Botanical Gardens' Orianne Center for Indigo Conservation (OCIC) and raised at the Welaka National Fish Hatchery before their release at around 2 years of age.

The success of the program is evident from the sighting of two wild-born hatchlings in 2023, offspring of previously released Eastern indigo snakes. Additionally, one female released in 2019 and 13 others released between 2020 and 2023 have been spotted in the preserve, as reported by the Nature Conservancy.

Over eight years ago, a collaborative effort was initiated by the Nature Conservancy, in partnership with various organizations including the Central Florida Zoo & Botanical Gardens' Orianne Center for Indigo Conservation, the Florida Fish and Wildlife Conservation Commission (FWC), U.S. Fish and Wildlife Service (USFWS), Welaka National Fish Hatchery, The

Figure 6. Eastern indigo snake (*Drymarchon couperi*). Image: shutterstock 129768641 Patrick K. Campbell



Orianne Society, Joseph W. Jones Ecological Research Center, Southern Company through the National Fish and Wildlife Foundation (NFWF), and the Fish & Wildlife Foundation of Florida. Their joint mission: to repopulate Eastern indigo snakes in the Apalachicola Bluffs and Ravines Preserve. To date, a total of 167 Eastern indigo snakes have been reintroduced into the preserve.

Successful Mojave Desert Tortoise Hatching

On April 15, the San Diego Zoo Wildlife Alliance and The Living Desert Zoo and Gardens announced the successful emergence of 70 critically endangered Mojave desert tortoises (*Gopherus agassizii*) from their winter burrows on Edwards Air Force Base in Southern California. These tortoises are part of a headstart program aimed at bolstering their survival in the wild.

In collaboration with the military at Edwards Air Force Base, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey, the alliance implemented headstart techniques to support the tortoises' adaptation to their natural habitat. This involved one to two years of indoor captive care at The Living Desert, allowing the tortoises to grow three to five times their original size, enhancing their ability to fend off predators. Following this care, they were reintroduced into their native habitat on the base.

Emergency excavation of the eggs was necessary more than a year ago due to a heat wave that threatened the tortoises' survival. The staff at The Living Desert provided early care to

the tortoises and assisted during various stages of hatching. A second emergency excavation occurred in September 2023 when predatory ants and fly larvae posed a threat to the eggs and hatchlings as they emerged from their shells. This situation was likely exacerbated by Hurricane Hillary, a rare event in Southern California, which created favorable conditions for rapid insect proliferation.



Figure 7. A wild Mojave desert tortoise (*Gopherus agassizii*). Image: shutterstock 1718658274 clayton harrison

London Zoo Celebrates Breeding of Critically Endangered Mountain Chicken Frogs

London Zoo is celebrating the arrival of six precious froglets from one of the planet's most imperiled amphibian species. The newborns, descendants of a breeding pair of mountain chicken frogs (*Leptodactylus fallax*), mark a milestone in the zoo's efforts to conserve these remarkable creatures as part of its new Secret Life of Reptiles and Amphibians exhibit.

Known for their imposing size, mountain chicken frogs can tip the scales at a hefty one kilogram and stretch up to 20 centimeters in length, making them one of the largest frog species worldwide.

Male mountain chicken frogs employ an intricate courtship ritual, fashioning a bowl-like structure to entice their female counterparts into mating. This culminates in the creation of a foam nest where the female deposits her eggs.



Figure 8. A mountain chicken frog (*Leptodactylus fallax*) shutterstock 1989838601 Derek D. Galon

Once native to 11 Caribbean islands, including Montserrat and Dominica, mountain chicken frogs faced a devastating decline due to the introduction of the chytrid fungus in the early 2000s. Combined with relentless hunting for sustenance, the species saw up to 90% of its population decimated. Today, only a scant 21 individuals are believed to survive in the wild on Dominica.

The precarious state of the species underscores the significance of breeding success at London Zoo, offering a glimmer of hope for the survival of these dwindling populations.

Scientists Unveil New Dwarf Gecko Species Thriving in Venezuelan Mountains

In the rugged terrain of Cordillera de Mérida, nestled within the Venezuelan Andes of western Venezuela, researchers have stumbled upon a newfound treasure: a species of dwarf gecko previously unknown to science.

Dubbed *Pseudogonatodes quihuai*, this diminutive creature shares traits with its relatives in the *Pseudogonatodes* genus, including its diurnal nature and preference for leaf litter habitats. However, what sets it apart as a distinct species is its singular postnasal scale, a distinguishing feature noted by experts.



The unveiling of this gecko, detailed in a paper authored by Fernando J. M. Rojas-Runjaic, Claudia Koch, Santiago Castroviejo-Fisher, and Ana L.C. Prudente, illuminates the often overlooked diversity within Neotropical dwarf geckos. It also underscores the pressing need for further exploration into the systematics and taxonomy of this fascinating group.

Pseudogonatodes quihuai makes its home in semideciduous montane forests within the state of Barinas, thriving at elevations ranging from 1120 to 1319 meters above sea level. A fitting tribute to José Daniel Quihua Ramírez, a dedicated wildlife photographer and naturalist renowned for his expertise in Venezuelan reptiles and amphibians, the species bears his name in honor of his contributions to the field.

Adorned in a coat of dark brown with delicate white spots, these geckos exhibit slight sexual dimorphism, with females boasting a marginally longer length from snout to vent, measuring between 31.3cm to 33.6cm.



A terrarium exhibition was held in Kyiv for the first time in the past few years

On May 4, 2024 a Terrarium Expo (covering invertebrates, amphibians and reptiles) took place in the House of Nature (Kyiv, the capital of Ukraine). This event was dedicated to the development of terrariumistics and ethical approach to herpeto- and entomofauna keeping and breeding. A total of about 30 participants from Kyiv, Kharkiv, Dnipro and other Ukrainian cities took part in this expo, which also served as a so-called mini-market place for various merch, souvenirs and terrarium equipment. And of course, the visitors had an opportunity to adopt a healthy, captive bred reptile. The Expo was visited by about 1000 people, which is an undoubted success. This was the first expo of this kind during the war time.

Lectures by Volodymyr Noskov on the ethical aspects of animal's

husbandry and the importance of UV for their well-being were an excellent addition to the event.

Oleksander Kurylenko (zoologist and experienced breeder) was one of the main initiators of the exhibition. Venue – House of Nature (<https://kyiv.dityvmisti.ua/kiyivskij-miskij-budynok-prirodi/>), Rognedinskaya str. 3, Kyiv

The organizers are planning a second Terrarium Expo and would appreciate any proposals regarding this matter. Information partner of this event was BION Terrarium Center.





I INTERVIEW: GALAPAGOS CONSERVANCY WITH WASHINGTON (WACHO) TAPIA

Author(s): The interview was conducted by **César Barrio Amorós**, Contributing Editor, **RHJ**, Costa Rica; the questions were answered by **Washington Wacho Tapia**, General Director of Galápagos Conservancy, Ecuador (**WT**).

The interview was organized and supported by Leandro Bergmann (Contributing Editor, **RHJ**, Germany) and Xavier Castro (Outreach Coordinator of Galápagos Conservancy, Ecuador).

Photos: Galápagos Conservancy (GC)

RHJ: First of all, who is Wacho Tapia, and what is your role inside the Galapagos Conservancy?

WT: Well, thanks for this interview. I am Washington Tapia, General Director of the Galapagos Conservancy.

My role is to ensure that the mission and vision of the Galapagos Conservancy are implemented in the territory. I am based on Santa Cruz Island, as is the entire conservation team. That's another

peculiarity of our organization, as only the fundraising team and the president are based in the U.S. The year 2014, when I met you (César) in Santa Cruz, it was a transition year, I worked 15 years for the National Park System. I resigned in February 2014 with the intention of going into independent consulting and completing my PhD, but I was immediately invited to Galapagos Conservancy and then I started in April of the same year leading the initiative.



Figure 1. Washington Wacho Tapia.



Figure 2. Pink iguana on the Galapagos islands.

RHJ: So, now, what is The Galapagos Conservancy, what are the main goals? What is the vision for the Galápagos Islands?

WT: As the introduction in our website states: Galápagos Conservancy is the only U.S.-based nonprofit dedicated exclusively to the protection and restoration of the Galápagos Islands and its brilliant mosaic of life, including more than 2,000 species found nowhere else on Earth. Part of our mission is to save imperiled species, build a more sustainable society, and rewild the complex ecosystems of the Archipelago.

RHJ: Is the Galapagos Conservancy a public government entity or is it private?

WT: The Galapagos Conservancy is a private non-profit organization, based in the United States and for the last two years with its operating arm in Ecuador, called the "Conservando Galapagos" Foundation. Just today we are celebrating our anniversary, 39 years since the creation of the Galapagos Conservancy and the mission is basically to contribute to the conservation and sustainability of the Galapagos unique habitats and species.

RHJ: And being a private entity, do you have any support from the government of Ecuador or the local government of Galapagos?

WT: In financial terms, no governmental aid either at the state level or at the local level. What we do is work very closely with the Galapagos National Park System, which as you know is the administrator of almost all the territory in Galapagos and as such, our natural partner. So, our main program, which we call it Galapagos Initiative, with which we work with ecologically essential species, mainly reptiles, we work it as a joint program. We provide the financial resources and the National Park provides the rangers and then we execute the expeditions jointly.

RHJ: And what are the main objectives of the Galapagos Conservancy? What is the vision and the work in the Galapagos Islands of the Galapagos Conservancy?

WT: The vision basically is to achieve a sustainable Galapagos in the long term. The main objectives are to contribute to the conservation of endangered species, the second to the restoration of ecosystems of even entire islands and the third to sustainability, because in Galapagos we have a human population and if we don't work with them there is no conservation possible.

RHJ: Could you tell us a little bit about the history of the Galapagos Conservancy? How was it founded and what has changed since its inception?

WT: Well, Galapagos Conservancy was originally born as one of the first partners with the Charles Darwin Foundation in order to help raising funds in different countries. Then, for reasons that are not relevant here, this network was dissolved, but then the directors decided to continue independently and since 1992 we basically work independently as Galapagos Conservancy. Initially the focus was to raise funds and allocate resources by invitation, having as main partners the Charles Darwin Foundation and the Galapagos National Park, but evidently things in Galapagos have evolved. The Darwin Foundation is no longer the only organization that does science and that made that since 2015 Galapagos Conservancy through an agreement with the government of Ecuador decided to start directly running programs and then established two programs, one what was called Giant Tortoise Restoration Initiative, basically focused on working with

all species of tortoises in the archipelago and the other Education for Sustainability with a focus on teacher training, because the education system in Galapagos needs to be improved and the best way to do this is to provide training opportunities for teachers. As time went on, since 2021, the giant tortoise restoration initiative became a Galapagos initiative incorporating other ecologically essential species such as land iguanas, marine iguanas, sea lions, seals, seahorses, albatrosses, cacti and some other species that were a priority for the national park and the education for sustainability program was maintained with teacher training, in addition to incorporating some environmental education actions with local groups. We also incorporated in 2021 a third program that we do not execute directly, but those donations that were made by donation we converted them into a large program, with competitive funds, basically what we do is a public call with three lines of intervention, one that we call Mayor Grants, which are funds of up to 200,000 dollars that are focused on priorities that we select by the national park and are



Figure 3. A wide view over the landscape.

conservation or research projects directly, that individual researchers can apply for, but also any institution, and two other lines that are smaller funds of up to 10,000 dollars, we call them Small Grants, which are focused on two conditions, one, to be a resident of Galapagos and two, to have good ideas that contribute directly or indirectly to conservation.

And the third line we call WISE, Women of Entrepreneurship, which is basically focused on women who also reside in Galapagos and have an enterprise that can be sustainable. So, basically that's what we are, we have two programs, one focused on conservation, the other one on education, and the third one is a big one, that we contribute funds directly to the local community. The idea is not only to try to stimulate the local economy with sustainable activities, but also to support local young people who want to get involved in conservation and who are doing their thesis, for example, or are recent graduates and have a research project that they want to develop. We try to provide experience to local people who want to make their career in conservation.

RHJ: Tell us about the Galapagos Conservancy's current projects devoted to native species. What specific measures is GC taking to protect the species and what are the threats to these?

WT: Currently, through the Galapagos initiative, an important component is the optimization of the captive breeding program for giant tortoises. Something that is not new in Galapagos, the National Park has been managing it for 60 years, but in recent years what we have done is improve or incorporate scientific knowledge at all levels, from changing the incubation system to make it more efficient, to the whole process of care and maintenance, to the repatriation and subsequent follow-up when they are released on the islands. Why is this tool still necessary? Because while there have been some success, as in the case of the Española island where the program was already closed, there are other islands where there are still threats on the species. We must remember that giant tortoises are probably the saddest story in Galapagos, because they were the most



Figure 4. A part of the team while work.

exploited species by humans in past centuries, mainly whalers, who collected hundreds of thousands of tortoises in the Galapagos especially in the 19th century, driving three species to extinction and reducing almost all populations. The recovery of those species is still a priority because these animals are the real engineers of the natural ecosystems, but also, they are the only large herbivores on many islands and so they play a fundamental role.

The three extinct species are the Santa Fe island Giant tortoise (*Chelonoidis sp. new.* extinct; in process to be described), The Pinta giant tortoise (*Chelonoidis abingdonii* (Günther, 1877)) and the Floreana giant tortoise (*Chelonoidis niger* (Quoy & Gaimard, 1824)). In the case of Santa Fe, what we have done is, after assessing the state of the island, since 2015 with the National Park we have introduced tortoises from Española Island (*Chelonoidis hoodensis* (Van Denburgh, 1907)) to Santa Fe to restore their role in the ecosystem and in seven years it's interesting the changes that we started to find. For example, there is already cactus regeneration.

Even though Santa Fe is the island that has the largest cactus forest, what we found is that there are adults and sub-adults and almost no juveniles. Now we have an important recruitment of juveniles already 5 to 7 years old that coincides with the presence of the tortoises.

In the case of Floreana it is also interesting because in all the bad that the whaling pirates did by extracting the tortoises and extinguishing them, they threw into the water in front of Isabela Island, some live tortoises managed to arrive on land and genetics showed us that we had hybrid tortoises with genes from that species. Then, since 2017 we set up a captive breeding program of those hybrid tortoises and we are ready to repopulate Floreana with non-purebred but hybrid tortoises with genes of that species. Once the eradication of the cats and rats happens and there are good environmental conditions especially in terms of food availability, we have 319 tortoises ready to start the release in Floreana. Almost all species are in some level of threat, except in some way those of Alcedo volcano in Isabela



Figure 5. A couple of Giant tortoises in wildlife.



Figure 6. Transporting giant tortoises in a truck.

(*Chelonoidis vandenburghi* (Desola, 1930)), where we estimate a population of between 15 and 20,000 tortoises, which is very good, a result of the eradication of the goats in 2006. In the south of Isabela we have just completed comprehensive censuses of all the existing populations (*Chelonoidis guntheri* (Baur, 1889)) and definitely the situation is worrisome, especially in Sierra Negra volcano, our estimate is around 700 tortoises distributed in five population patches and with a huge presence of invasive species, especially pigs, ants, wild cattle, donkeys, blackberries, guava, so there is much to be done. And the situation in Cerro Azul (*Chelonoidis vicina* (Günther, 1874)) is quite similar in terms of threats, but anyway our population estimate is around 5,000 tortoises distributed throughout the volcano in five different

populations. Pinzón Island giant tortoises (*Chelonoidis duncanensis* (Garman, 1996)) show an interesting case because for more than 100 years the black rats prevented the reproduction of the tortoises, the National Park eradicated the rats in 2012 and currently we did a census almost two years ago and found that about 30% of the population are tortoises already born on the island, are growing and are about 5 to 6 years old, just coinciding with the eradication of the rats.

The Española case (with *C. hoodensis*) is perhaps the most successful where from only 15 individuals out of 60 were repatriated over 2,000 tortoises to the island. Our last estimation was a little over 3,000, but overall our modeling showed that it was the same if we kept repatriating annually approximately the 80 tortoises that were capable of producing

those 15 breeding adults, than if we didn't. In 100 years, there was no significant difference and so the recommendation was to close that program to put effort into other species.

In the case of San Cristobal, the population (*Chelonoidis chathamensis* (Van Denburgh, 1907)) is in pretty good shape even though there are goats breeding in the living area, but also recently thanks to genetics in collaboration with Yale University and Newcastle University we found that based on bones basically collated in one area of San Cristobal by the California Academy of Science it appears that San Cristobal had two different lineages. We are planning a mega expedition to the eastern area of the island which we haven't explored and according to some of the farmers have seen some tortoises out there and depending on what we find then it will be the decision on how to orient the management of tortoises on San Cristóbal going forward. Fernandina Island (*Chelonoidis phantasticus* (Van Denburgh, 1907)) is a particular case, after more than a century of

declaring them endangered, if not extinct. In 2019 we found a female; we have made several expeditions from there unfortunately we failed to find new individuals. My theory is that the few that remained died in the eruption of 2020 if I'm not mistaken because in addition to the eruption, we found that there was a big fire right in the area where we found those old beds, a series of marks that tell us here were living tortoises since not long ago.

In Santiago, despite the fact that the goats, pigs and donkeys are eradicated, they still have a problem of a very small tortoises' population, dominated by males especially because the nesting areas are at altitudes where we have colder temperatures. So, we collect eggs in the wild, incubate them at a different temperature to get more females and thus try to help the recovery of that population.

In these last two years we've been fortunate to use a helicopter and that has made a big difference because when we brought the eggs loading them ourselves



Figure 7. Measurement of giant tortoises by the team.

from the nest area to the shore, then the boat and all the logistics that it involves we had a success of 40–45%. Bringing them in helicopters the rate rose to 99.9% which makes a great difference, so we hope to have resources to continue with this practice.

RHJ: Excellent work Wacho! Now, tell us about the work on *Conolophus marthae* Gentile & Snell, 2009, the famous and extremely endangered Pink land iguana.

WT: Well, as you know this iguana is unique of Volcano Wolf and not from the entire volcano, it is only found in the northern area. We still have many questions to solve, but precisely in the last two years we have funding a project to two Park rangers that did their degree thesis about the subject, that is when, how and where the pink iguanas nest, finding for the first time newborns, confirming that cats are a major threat. On this information we are working we with did ecological part, and a foundation called Jocotoco, specialized in invasive species control, is working on control of cats and rats, and Gabriel Gentile and his

team are working with the genetic part and how this can help the conservation of the species. There is a plan approved by the IUCN, and we are in the process of implementing it. We have established a small research station in the life area of the pink iguana, that makes us much easier to be able to develop more intensive studies, because in the past a limiting was to have to be only in tents, to load the water from the shore of the summit of the volcano, which is not an easy task, now we have water collected from the rain and a place to stay, and that makes a big difference.

RHJ: What is the status of the pink iguana today? What's the density? Is there an estimate? What problem are the iguanas facing?

WT: Justly, Gabriel Gentile has just published an article based on his last 15 years of research suggesting that in terms of variability, despite the threats and all, it is not as bad as someone would expect and suggests that it might be in danger and not in critical danger. Personally, from experience on the site, I



Figure 8. The famous pink iguana.

disagree very much with these conclusions because definitely almost all the population are old adults, there are very low recruitment, and despite efforts to control cats and rats the predation continues. In addition, they share the nursing zone with the yellow land iguana (*Conolophus subcristatus* (Gray, 1831)) and at different seasons, which also implies a threat because yellow iguanas destroy the nests of the pinks. According to Gabriel's studies, both iguana species do not hybridize, or at least, never have found individuals with obvious signs of hybridization. We estimate the population to be between 200 and 300 individuals.

We either cannot afford to bring adult individuals into captive breeding programs, and that they die in the process of experimenting. We already have the experience of yellow iguanas that are not easy to reproduce in captivity; the process of adaptation is very complicated. The behavior of the iguanas is very territorial, very aggressive, so that the animals must be kept in separate cages for females and males and only put them together at the specific time of breeding.

RHJ: There will be a lot of non-resident people who will wonder if it is possible in any way to be as a volunteer or as a visiting scientist, etc., to contribute something to both the projects that are already being carried out by Galapagos Conservancy. Is it possible to volunteer and work there for a while? How people can contribute with these Galapagos Conservancy Projects?

WT: Definitely yes, we accept volunteers. Obviously, the requirement is that you have at least two months because for us just takes a week to train then people and then for the volunteer also a period of at least two months allows them to learn not only on the desk but directly in the expeditions, have the opportunity of to do real conservation. We also have our conservation center that basically provides information about the conservation efforts we do.

We also accept volunteers there focused a little more on people who want to contribute but who physically do not like to go out to

the field. Then we also have that option and obviously in the environmental education program we also accept volunteers who like environmental learning above all and in our communication department also we welcome volunteer with photography, video and that kind of skills because we produce a lot of informative material both for the local community and for our donors in the United States. Another way of contributing even without coming to Galapagos is through our program adopt a tortoise that is basically a virtual adoption.

The person has the opportunity to adopt a tortoise, give it his name and during the five years he stays in the nursing center receive reports of how he is growing, the changes he is making, etc. Another way to contribute is by becoming a member of Galapagos Conservancy. We have a fairly wide network of members about 12,000 members who are people who contribute from 10 dollars to several thousand dollars and become members of our community constantly receiving privileged information as members of our organization. In our web, there is all this information: www.galapagos.org.

RHJ: What kind of dangers can happen on an expedition to the Galapagos?

WT: The dangers in an expedition are the difficult topography, you can easily stumble, fall into a lava well, and be severely wounded. The other is dehydration, especially from December to May, with very high temperatures and very intense sun, dehydration is a real danger. If you do not know the site or do not have a GPS, it can be very easy to get lost and it is very dangerous because there is no water anywhere.

RHJ: What special social conservation successes have you already experienced and what are you proud of?

WT: In terms of conservation, we can list a lot of things, from the description of a new giant turtle species, to having found the last live tortoise in Fernandina, to returning tortoises to Santa Fe, having found for the first-time newborns of Iguana Rosada, there is a long list... Also, in social terms I think the fact that



Figure 9. Some team members while the measurement of giant tortoises.



Figure 10. Even some smaller tortoises get measured by the team.



Figure 11. Team member with some little giant tortoises.

the local community sees us as an ally organization, that it doesn't see us as the enemy to flee, that says a lot about how we focus our work.

RHJ: To what extent would you say that social media influences the work of Galapagos Conservancy?

WT: We use all social networks, currently they are an important tool not only in terms of disseminating the work that we do, but in terms to reach especially to young people. Generally, our members are older adults, but through the networks we try to

reach a young audience also who is much more aware and much more interested in conservation and above all is a way to reach the local population. We also have a radio program every two weeks, which is a very useful tool to reach the local population, but social networks help a lot in this regard.

RHJ: And finally, what are the long-term plans of Galapagos Conservancy? How do you plan to ensure the sustainability and protection of the islands and their projects?

WT: Justly we are a very dynamic organization, annually for almost a week we do an institutional retreat where we all gather, we evaluate where we are, we look at what the reality of Galapagos is and where we want to go, how we could optimize the impact we generate on the conservation and sustainability of the archipelago, but also, we develop our operational planning jointly. We try to be a completely horizontal organization where there are no hierarchies, but we are all a working team and our vision, as I said at the beginning, is to contribute to having a sustainable Galapagos in the long term. I personally firmly believe that Galapagos is still one of the few places where we can show that a harmonious coexistence between man and nature is possible.



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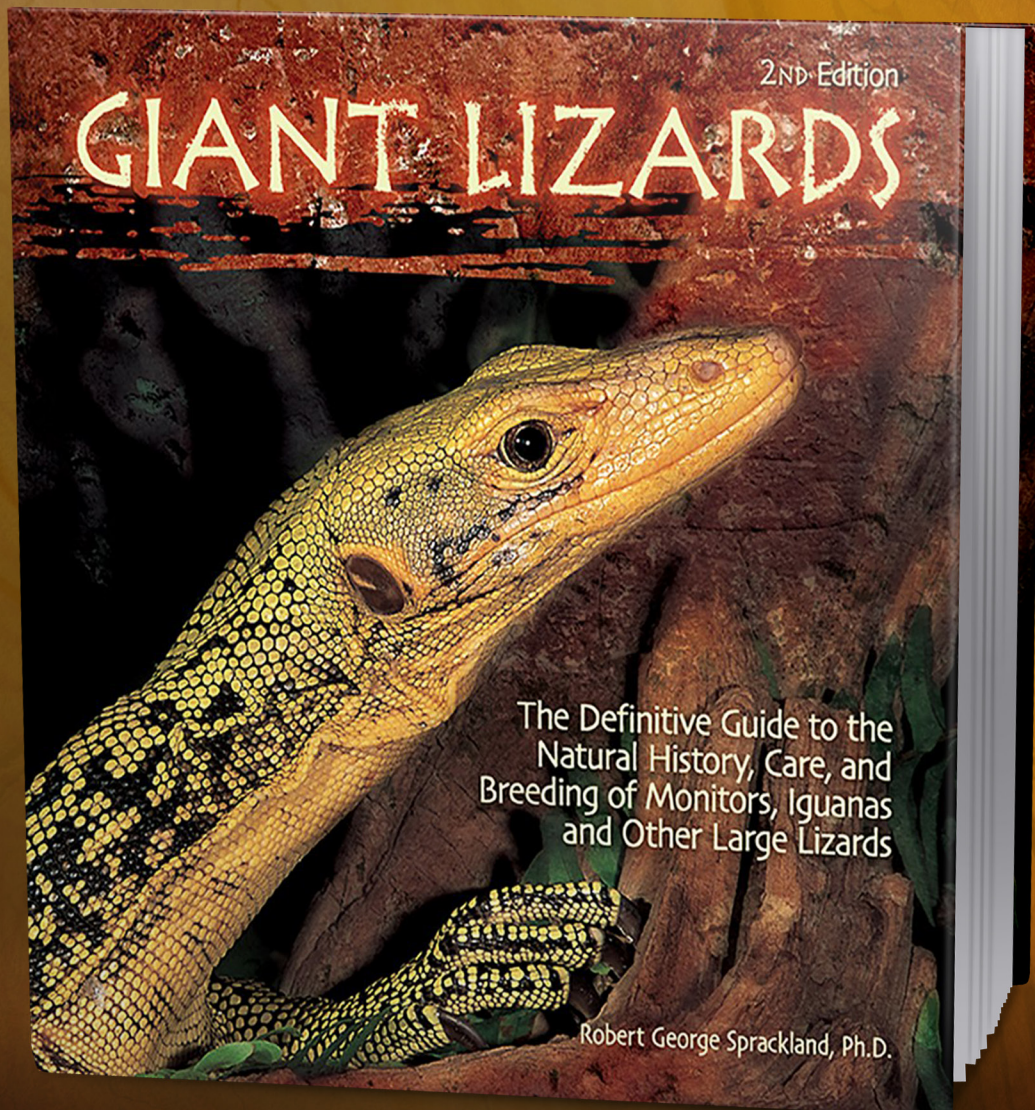


BOOK REVIEW

• GIANT LIZARDS

by Robert George Sprackland, Ph.D

2nd Edition



The Definitive Guide to the Natural History, Care and Breeding of Monitors, Iguanas and other Large Lizards!

“Giant Lizards. The Definitive Guide to the Natural History, Care and Breeding of Monitors, Iguanas and other Large Lizards. 2nd Edition” offers comprehensive coverage of essential topics about the life of big-sized reptiles, such as feeding, housing, breeding, and health care. For readers interested in scientific details, it includes sections on lizard biology, evolution, and several identification keys, along with conservation and natural history information. The book features full-color photos, lavish illustrations, and new sidebars and tip boxes by expert breeders, highlighting key points throughout the text. Many grateful readers praise Dr. Sprackland for creating a splendid volume that provides herpetologists and herpetoculturists with a wealth of up-to-date information in one book, photos of exceptional quality, the updated information regarding species designations and care, and the engaging and accessible text. This is an outstanding follow-up to his first book on giant lizards.

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THE NATURAL HISTORY AND CAPTIVE CARE OF THE AMUR AND KOREAN RAT SNAKES

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Synonyms

Elaphe schrenckii (Strauch, 1873) – *Elaphis Schrencki* Strauch, 1873; *Coluber schrenckii* Boulenger, 1894; *Coluber virgatus* Boettger, 1898. *Elaphe anomala* (Boulenger, 1916)) – *Coluber anomalus* Boulenger, 1916; *Elaphe schrenckii anomala* Pope, 1935; *Elaphe maculata* Ma & Zong, 1984.

A Quick Note on Names

This article will deal with both *Elaphe schrenckii* (Strauch, 1873) and *Elaphe anomala* (Boulenger, 1916). The Amur rat snake has several other vernacular names across its range; for example, the Amur rat snake, the Siberian rat snake, Manchurian rat snake, the Great Black rat snake, Schrenck's rat



Figure 1. Female Korean rat snake (*E. anomala*).

snake (after the Amur naturalist Leopold von Schrenck) and the Black water snake. It has also been referred to as the Korean rat snake in literature. When it comes to the “Korean” rat snake (that is to say, *E. anomala*), things get really confusing: Korean rat snakes (as named in the pet trade) do not actually occur in Korea, the animals there are actually genetically indistinguishable from Amur rat snakes (*E. schrenckii*), although the Amur rat snakes in Korea tend to look like the brown and tan Korean rat snakes rather than the black and yellow animals of Russia. See? Confusing. As such, ‘Korean rat snake’ is something of a misnomer but will be used here for familiarity’s sake. The taxonomic status of the two species, whether they are indeed two separate species or whether *E. anomala* is in fact a subspecies of *E. schrenckii*, has become muddled and is beyond the scope of this husbandry article. For the purposes of this article, they are treated as two separate species, and the names used are those currently in common use in the pet hobby; therefore, where the Korean rat snake is mentioned, it is in reference to *E. anomala*, rather than the *E. schrenckii* which is actually the form found in Korea.

Introduction

The Amur rat snake (*E. schrenckii*) is a snake that holds a special place in the hearts of many keepers. This eminently suitable pet snake has garnered a low key but passionate cult of fanciers in the hobby thanks to a combination of stately size, a placid but curious nature and impressive black and yellow coloration in adults.

This is a fantastic species of snake that has a lot to offer for both the beginner and experienced snake keeper if they can provide it with the space it deserves. Captive bred examples have to rank as one of the most

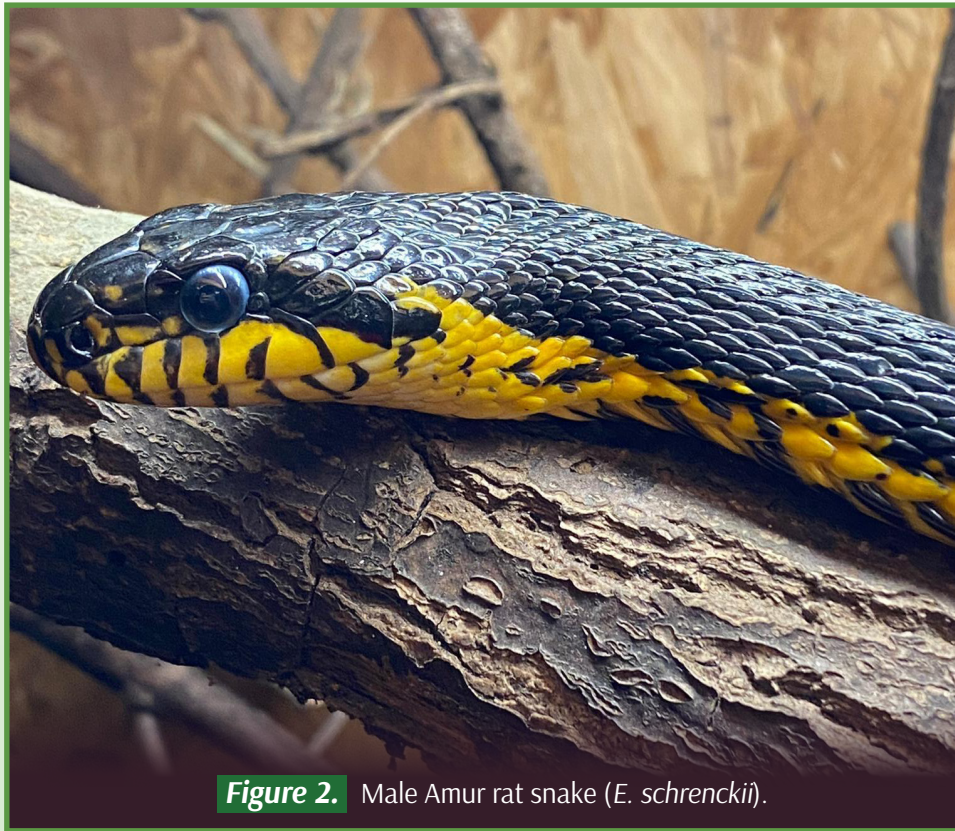


Figure 2. Male Amur rat snake (*E. schrenckii*).

hardy and durable reptiles out there; among species commonly kept in the hobby, they are rivalled in their tolerance of cold environments only by a few species such as the Dione’s rat snake (*Elaphe dione* Pallas, 1773) – which overlaps their range – the Black rat snake (*Pantherophis obsoletus* Say & James, 1823) and some of the more northern Garter snakes (*Thamnophis* spp). It is a species that has been a cornerstone for my snake keeping passion; my oldest specimens were acquired around 1998 and are currently in their twenties and still going strong.

They have no problematic requirements other than space for them to move and will live for many years and breed easily. Further, they are also noted to be extremely docile and laid back when handled, rarely if ever striking in self-defence and safe to allow to crawl up onto the handler’s shoulders and head (which they inevitably will try to do if not restrained). This is an ideal species for the first-time snake keeper that wants something a little larger than the typical Corn snake or Royal Python but does not want to invest in something as large as a Boa or larger Python. The Korean rat snake (*E. anomala*) is a very closely related

species that indeed was once regarded as a subspecies of *E. schrenckii* (and is still considered so by some), although the two populations are mostly separated geographically. They are less commonly offered for sale than the Amur rat snake and are not quite as striking in colour but are almost identical in care requirements and so the two species will be handled together in this article.

Distribution

The Amur rat snake occurs primarily the Amur basin of Siberia, from the Nömrög River in the Ikh Hyangan Mountain Range of Mongolia (where it is known from only one specimen) to the Khabarovsk region in eastern Russia and the more southerly parts of the Ussuri basin in the Primorsky Territory. Further south it occurs throughout North and South Korea, and in the northern parts of Manchuria, China (Jilin, Heilongjiang and Liaoning). The type specimen was taken at the Hinggan Mountains, Russia.

In some areas the Amur rat snake is considered quite common and may be one of the most common snakes in its habitat; in other regions (such as in Korea, where it has declined greatly) it is considered a category I endangered species. In Mongolia it has only been recorded at elevations over 500m above sea level and there it is only thought to occur to the extreme east of the country. The Korean rat snake on the other hand occurs solely in China (Hebei, Beijing, Shangdong, Shaanxi, Jiangsu and Nei Mongol) and, ironically, not Korea. The type specimen was taken at Chifeng (Zhihli Province, China). I have personally encountered this species north of Beijing, in the Labagoumen Primeval Forest, and also further south on the outskirts of Jinan. In the Labagoumen Primeval Forest, two adult



Figure 3. This animal was given to the author by Florence Butler in 2019 and may be a hybrid between Amur and Korean rat snakes (*Elaphe schrenckii* x *anomala*).

specimens were found close to one another on the 15 th and 16 th May 2019, just before and during mild rain. A juvenile specimen was seen near Jinan in June 2017, again just prior to rainfall.

There are old records dating back to the 1950s (Pope) of a Korean rat snake being found near Pyongyang, however no researchers have found them there again and this record is considered erroneous by some researchers. There is a feral population of *E. schrenckii* in the Netherlands, originating near Eelde airport in the municipality of Tynaarlo. These are said to have originally been released on purpose into an ornamental garden and are assumed to have spread from there. Animals from this population show traits from both species, with some showing patternation more like *E. schrenckii*, and others looking like *E. anomala*, and some in between. It has been suggested that examples of both species were introduced (since they were regarded as one and the same species at the time) and have hybridised.



Figure 4. Comparison between a newly-hatched Korean rat snake (*E. anomala*) - circled in red - and Amur rat snake (*E. schrenckii*) beneath it.

Habitat and Ecology

Both the Amur and the Korean rat snakes are among the largest snakes within their respective ranges. The Amur rat snake may be sympatric with the Chinese Beauty snake (*Elaphe taeniura subsp. taeniura* Cope, 1861) in the more southern parts of its range in China and Korea, which may reach similar lengths but less mass, but otherwise is the largest and certainly the girthiest snake found within its distribution. The Korean rat snake may be sympatric with other large snakes aside from the Chinese Beauty snake, notably the King rat snake (*Elaphe carinata* Gunther, 1864) and the Big-Eyed racer (*Ptyas dhumnades* Cantor, 1842) both of which may reach similar lengths. As might be expected of snakes living in such a cool climate, these species prefer

bright and sunny localities, often over 250m above sea level; towards the very south of the range Korean rat snake has been recorded above 1820m. They are usually found close to streams, rivers or other water bodies and seem to prefer coniferous and mixed forests, although they are also happy to colonise agricultural land, scrubby areas, rocky slopes and grassy upland meadows. They also are well able to withstand anthropogenic change and indeed often shift their habitats to farmed areas to take advantage of hyper-abundance of rodent prey.

Several naturalists have commented that the Amur rat snake in particular is quite willing to enter water, and presumably it is from this that it gets its common name Black water snake. Although they may be considered mostly terrestrial, these snakes are not strictly confined to ground level and will climb readily on walls, the eaves of houses, rock piles and up trees, where they have been found 20 feet above the ground in the Amur region. Additionally, males and females seem to show preferences for slightly different habitats, with males preferring high vegetation cover (such as grasslands, rock piles and even human-made structures) whereas non-breeding females remain closer to water and the banks of streams and gravid females prefer paved roads (which may offer better opportunities to thermoregulate on the sun-warmed asphalt).

Both species have typical rat snake diets, taking rodents up to the size of rats, small birds (Tree sparrows, *Passer montanus* (Linnaeus, 1758), which are the most common passerine throughout most of their range, form a significant part of their diet), bird's eggs and frogs. They have also been recorded to take bats. As with most of the Asian *Elaphe*, Amur and Korean rat snakes possess modified vertebral hypapophyses beginning at the 8th and ending at the 45th vertebrae, to assist them breaking the shells of eggs.

E. anomala, and the more southerly distributed examples of *E. schrenckii* in Korea

and China, may enter the hibernacula as late as mid to late November and emerge mid-April. Further north, where the climate is far less comfortable, *E. schrenckii* may hibernate for up to six months of the year. In the south of the range, egg laying occurs from June to July, but further north and in colder regions this may be delayed until mid-August. On the Korean Peninsula, this snake was often venerated as a household spirit and treated with great respect, unfortunately it is also used in local remedies and medicines which probably helps account for why it has diminished so drastically in abundance.

Handling

Young specimens of both species may be quite shy and resistant to handling. They may rattle their tails threateningly, bluff strike and musk over the keeper. This is particularly true of the Korean rat snake although young Amur rat snakes also can remain quite shy until they reach about 30" in length, at which point they usually start to calm down and display the placidness adults are known for.

Adults are easy to handle snakes, in over twenty years of keeping a number of specimens I have not once been bitten by an adult of either species, and even wild specimens I have encountered have been remarkably docile and calm. They do not like to be restrained and prefer to be allowed to go their own way, but if handled gently and well supported with the arms and hands, they are easy snakes to manipulate and will climb up onto the keeper readily (usually ending up draped over the shoulders or perched on the head!).

I consider it a good habit to sanitise one's hands in between handling each snake, especially in larger collections or where there are freshly purchased snakes present in the same house as established animals. I use F10 hand sanitiser gel, but any hand sanitiser should do.

Enclosure Design

The first thing one must consider when deciding on how to house one of these snakes is whether they can cater to its large size and

activity. Adult Amur rat snakes can exceed six feet (I have one specimen that is closer to seven) and as such require correspondingly large enclosures with space for them to explore, climb and move around. Rat snakes are one of the snake groups that have been most extensively studied when it comes to the effects of enrichment and richer, more complex and stimulating environments have been shown to improve their cognition and expression of more natural behaviours. They are also known as curious snakes. As such, I would recommend not less than 72x24x24 in (183x61x61 cm) for a single adult of this species, and if possible something more like 72x36x36 in (183x91x91 cm) or even larger.

Wooden terraria are perhaps the most cost-efficient way to cater for this species as they can be cheaply custom-built yourself to whatever specifications you want, are durable and, if properly sealed, will resist a certain amount of humidity. However it is also possible to house these snakes in fiberglass, plastic and even glass enclosures if you prefer; all can make great snake cages, provided they are large enough for the animal and can easily accommodate the required equipment.

Other than size of enclosure, Amur and Korean rat snakes present no special problems for the prospective keeper; in fact due to their preference for cooler temperatures than the average pet snake they can be more cost efficient to keep in terms of electricity bills.

Heating

The first thing to consider when housing any reptile is heat. As poikilotherms, reptiles rely on heat to warm their bodies up enough for vital processes to function. Both Amur and Korean rat snakes are hardy snakes that do not require much in the way of heat, although Amur rat snakes are notably more hardy and cold-tolerant than Korean rat snakes. However, they will still need a certain amount of heat to warm themselves to their optimal temperatures, whilst still allowing them to escape the heat and cool off when they want to. This is achieved by means of a thermal gradient. What this means is, one side of the enclosure will be warm to allow them to bask, and the other side of the enclosure

must be cool, so they can move between the warm and cool areas as they wish. This is particularly important for these cold-tolerant snakes as they will actively seek to escape heat once it gets too hot, becoming lethargic or spending much of their time in the water bowl, buried deep in the substrate or pressed against the far side of the terrarium from the heat source. An ambient temperature of around +22 °C (71.6 °F) (in other words, room temperature) is fine at the cool side for both species. A heat source will also be required that will create a localized basking surface temperature of around +28 – +30 °C (82.4–86.0 °F) although that word must be used again – localized. It should not be so hot that it ruins the thermal gradient. The basking surface should be large enough that the snake can curl its entire body onto it, but not so large that it renders a thermal gradient impossible. I have found the best way to achieve this is with a low wattage overhead spot lamp, preferably a halogen lamp. I use either a 35 W halogen or a couple of 20 W halogens directed at a flat stone or slab. This will warm up the stone nicely, creating a place the snake can curl up and absorb the overhead heat, and at the same time provide “belly heat” (in other words, allow the snake to thermoregulate thigmotactically, by absorbing the heat from the stone itself). Using halogen spot bulbs, it is possible to create a surface temperature on the stone itself of over +30 °C (86.2 °F) whilst not upsetting the thermal gradient or making the ambient temperature too high, and this is perfect for this type of snake. This means the overall temperature of the enclosure can remain low, whilst providing a warm area for the snakes to warm up on. Whilst there are of course many ways to heat up a terrarium, I find halogen bulbs to be the best (preferable to heat mats or ceramic heat emitters, for example) for several reasons. The reason halogen bulbs are now being recommended so highly is because of the type of heat they put out, what is called ‘near infra-red’ which is different from the ‘far infra-red’ heat put out by ceramics. This is important because of the way it warms the basking surface and does not warm the air around it as much as a ceramic heat emitter. A ceramic

heater, while certainly serviceable, is nowhere near as efficient at delivering penetrating heat as a halogen bulb, and will warm the air around it more. So, while it does warm up the vivarium, it is less efficient at providing heat on a specific surface – the basking surface – and better at raising ambient temperatures. This is not what we want for this kind of snake. If we imagine a sunny day in the Primorsky Krai, or even on a cool but sunny day in the UK, you would expect low ambient temperatures, maybe no more than +15 °C (59.0 °F). However even on a fairly cold day, if you put your hand on a dark stone that the sun has been shining on for a few hours, it will feel warmer to the touch than the surrounding atmosphere, and this is how cold-tolerant reptiles gain their heat – not just by exposing themselves to the sun, but by sitting on sun-warmed rocks and isolated areas where they can actually warm themselves more than the surrounding air temperature. Reptiles are masters of doing this.

An enclosure for an Amur rat snake should be at least as long as the snake is and provide UV lighting, under which the snakes will spend much time basking.

The key point here is that the air temperature may be low but the surface temperature of the sun-warmed rocks might be as high as +30 °C (86.0 °F)! What we really want in the terrarium is the same thing – a low ambient temperature, but a warm surface temperature at the basking zone... and ceramics are not ideal to provide this, especially in a small, enclosed space like a terrarium. The reason for this is because they give out mostly far infra-red light, it is near infra-red that provides a more penetrating, efficient heat. The beauty of halogen bulbs and the near infra-red part of the spectrum is that you can direct them at a surface – say a flat piece of rock, which is ideal – and then they heat that surface so efficiently that the reptile can lie on that and benefit from ‘belly heat’ from underneath as well as overhead heating. Not only that, the overhead heating penetrates deeper, quicker and warms the animal’s body up more evenly and more quickly. They can do this without overly heating the air temperatures so much that it overpowers the thermal gradient. In fact,

at the end of the day after the light is off, that flat rock will still be warm for a while and the animal can sit on it after dark if it wants to, which is exactly the same as if they were sitting on the sun-warmed tarmac of a road in the evening.

Another benefit of this style of heating is that the 'by the numbers' method of keeping ceases to apply. You can provide a basking surface temperature beneath the halogen that may exceed that commonly prescribed by common hobby care sheets, and the snake can move onto and off it as they wish and be safe from overheating. One other benefit of near infra-red heat is that it actually confers a therapeutic effect. This is why it is so pleasant to feel sunlight on your bare skin or the heat from embers on the back of your hand, and why near infra-red lights are used to help heal wounds and treat cancer; this wavelength can have photostimulation and photobiomodulation effects (in short, it feels more pleasant) that can encourage basking in reptiles. At night, all heating equipment is turned off, these snakes require no supplementary heating at night. The average room temperature of a house (around +20 - +21 °C (68.0-69.8 °F)) and possibly even more in a reptile room where other enclosures are being heated) will be much higher than the night temperatures throughout their range, which may dip into the single digits even outside the winter months.

Lighting

Whilst both species in snakes come from relatively temperature to cool regions, both actually favor well insulated basking sites and are actually sun-worshippers. They really do enjoy bright light and UV and this is another important aspect of their care. Rat snakes are probably the most well studied snakes when it comes to their preferences for UV light and their behavioral responses to it, and whilst these studies historically have tended to focus on their North American relatives, the same is certainly true of the Amur and Korean rat snakes.

As such, we also should provide them light including UV as there are a number of health and behavioural benefits in doing so, however

this is not always as simple as just whacking in a bright light to the enclosure and expecting everything to be hunky-dory. In general, I provide a UV light that covers not more than half of the length of the terrarium, on the same side and partially overlapping the basking spot. A UV Index of 1-2 is fine for these species on the brightest side of the enclosure, tapering to no UV on the shaded side.

It is important to position the UV light according to the manufacturer's instructions. In larger enclosures I use Arcadia t5 fluorescents and aim for a UVI of 1 on the ground throughout most of its length, but I will also provide a branch or two a bit closer to the bulb so that the snake can expose itself to a slightly higher UVI of 2 if it wishes to (which is quite often in these species). In smaller or lower terraria, I instead use t8 bulbs such as the Arcadia D3 bulb. It is essential to understand that most reptiles don't live at one constant temperature or at one level of light. Just as with thermal gradients, reptiles move along photogradients as and when they need to, whether that be moving into a warm space to top themselves up with heat so they can function optimally, moving away from the heat to cool down, or moving into or out of light to regulate their UV exposure. So, it is just as important to provide the means to allow a reptile to regulate its exposure to UV as it is to heat. Herein lies the problem; you are now attempting to manipulate two stimuli within the terrarium - heat and light/ UV. Now light is often a trigger for basking and many lizards (primarily those with parietal eyes such as Lacertids, Agamids and Iguanids) rely on light intensity to tell them when to bask. So, it is recommended that the hot spot also have the light directly above it. But what happens when a more secretive animal like a snake wants to warm itself up without exposing itself to light? Or when it feels like exposing itself to light to top up its D3 levels but is already warm enough and doesn't want more heat? The trick is allowing the animal to choose when it wants to utilize one stimulus without the other. This may seem like common sense (and it is) but many fall down at this conundrum. Simply put, the answer is to ensure the animal has lots of cover and to pay attention to where



Figure 5. Amur and Korean rat snakes are active animals and should have an enclosure at least as long as they are. Juveniles and subadults can be started off in 48 in (122 cm) vivaria but ideally should be upgraded into something larger as they reach full size.

that cover IS in relation to the equipment. Hiding spots at the warm end, hiding spots at the cold end, and cover in the middle. That way, the animal does not need to sacrifice one desire in order to get another – it does not have to expose itself to bright light if it wants to warm up. It does not have to warm up if it just wants to sit under UV. The important thing is offering the animal choice. Only then will you see it enact a greater range of behaviors and activity.

Decor

Cage furnishings serve a variety of purposes for the snake, from providing places to hide, perches to climb over and explore, a means to bask and enact natural behaviors, and an aid to shedding skin. The first choice a keeper will make is substrate. Here there are many choices and different keepers can argue endlessly over which is the best, most efficient, and easiest to clean and so on. For my part, I am not particularly fussed about what type of substrate is used as long as the snake can burrow into it (for this reason amongst others I dislike newspaper or similar). But aubiose, bark mulch, orchid bark, aspen and chippings all have their pros and cons, and can all be used effectively. However, in recent years I have veered into using mixes of sand, soil, coco coir and similar to the exclusion of all else. This is a personal choice though and any of the above

substrates will perform the job adequately. In general, I start off with a mix of play sand and potting soil in about equal ratios. I may then add coco coir to this mix as well as fine grit or fine orchid bark, to taste. As long as the mixture retains a hole when you poke your finger into it, it will retain a burrow and is ideal for a snake. In the first day or two after a fresh lot of substrate is added to the enclosure, you may notice the humidity will rise, this will not harm either of these snake species at all. After a few hours of heat and light running inside the enclosure, the humidity will dissipate. Neither the Amur nor the Korean rat snakes have any special humidity requirements. I also add a layer of leaf litter on top of the substrate. Not only is this aesthetically appealing, it allows the snakes to burrow and it lets them feel secure beneath the leaves. They can bask cryptically by sitting under the basking lamp or UV and exposing only a few of their coils but otherwise feeling hidden, and it is just another way of giving them some tactile and olfactory enrichment (more complex environments are more stimulating than less complex ones). It can even result in areas of localized humidity beneath the leaves, particularly if you spray a particular area periodically. The only drawback of adding leaf litter is that the snakes will be much noisier as they move through the dead leaves, so this can be an issue if the snake is being kept in a bedroom,



Figure 6. Korean rat snake (*E. anomala*).

as you will be listening to rustling noises all night (I find this pleasant but others may not!) and as they are so active, these snakes will be moving about a lot.

Once the substrate has been decided on, the actual cage furnishings can be added. Amur and Korean rat snakes are active, curious snakes that love to rove and explore over cage furnishings. Piles of rocks, large trunks and branches (both horizontal and vertical) will all be utilized and climbed over. I prefer to align at least one horizontal branch beneath the fluorescent lights so the snake can stretch out under the UV, which they do regularly (and often spend longer beneath the UV lights than the heater).

These snakes love to climb so should have at least some branches above ground level, or perhaps some flat stones or large slabs of bark placed against the back for them to move over and curl up on if they wish. Hides are of paramount importance to a snake. All snakes are by their nature secretive animals, and they all will spend a certain amount of time hiding. Whilst adult Amur and Korean rat snakes are not particularly shy and will usually be visible somewhere in the enclosure, youngsters are far more reticent and

appreciate a lot of hiding places. If you are using a deep substrate and dead leaves on top, they already will have plenty of scope to conceal themselves, but some tight hides such as curved cork bark, flat stones or synthetic containers with access holes cut in should also be provided.

I prefer to ensure the snakes have at least one hiding spot at the warm end (which if you are using a flat stone or pile of stones beneath the heater will usually be this), one at the cool end, and one somewhere around the middle of the thermal gradient. This ensures the snake does not have to choose between hiding and exposing itself to its desired temperature, which can cause stress. It is an old truism that the more hiding places you provide your snake, the more secure it will feel and the more you will see it out and about. One other thing I now always provide to my snakes is a humid hide. This can be one particular slab of bark under which damp sphagnum is placed, which is lifted and sprayed regularly, or it can be a plastic box big enough for the snake to enter and curl up in, with an access hole cut into the side or top and half filled with moist earth and sphagnum. If you provide this kind of humid hide, you should never see your snakes have

an incomplete shed again. Of course, a water bowl is necessary, I always prefer to provide one at least large enough for the snake to fully submerge itself in if it should so desire, as the adults are rather large this may be something along the lines of a plastic wash tub or similar, although ceramic dog bowls are adequate for smaller specimens.

Brumation

A very important aspect of care for these species is brumation. These are snakes that often inhabit very inhospitable climates that experience drastic drops in temperature in the winter. As an example, in the Primorsky the average summer temperature falls between +15 °C (59.0 °F) and +20 °C (68.0 °F), with winter lows to below -16 °C (3.2 °F). Other than some of the more northerly distributed garter snakes, the Black rat snake and the Dione's rat snake, the Amur rat snake is one of the commonly kept reptile species that experiences the harshest environmental conditions. The Korean rat snake endures slightly milder conditions with winter lows in China of -5 °C (23.0 °F) but spring and summer highs in the +30s °C (80.6s °F). Nevertheless, a long period of brumation is required for the best fertility for breeding both species; without it I have experienced rather mixed breeding success, with it the snakes come out in spring like locomotives and fertility is notably improved. The method I use is based on that presented in a wonderful article by Kim Caldwell in an old copy of Reptilian magazine (Issue 4 volume 7 from May 1997) – in fact this feature had a major impact on the way I keep my snakes, I recommend anybody keeping temperate colubrids to try and look for this issue, it's the one with a *Boiga irregularis* (Merrem, 1802) on the front. I use the following method for cycling my Amur and Korean rat snakes that involves not only manipulating temperatures, but manipulating lighting as well. During the spring and summer, the lights are on for 14–16 hours a day. At the beginning of October, I start reducing the photoperiod by an hour in the morning and an hour in the evening each week (it really helps to have the lights on a timer!) so that by the beginning of November the lights are on for about 8 hours a day. At the same time, the heating

is gradually reduced as well. Snakes kept on heat mats or with spot bulbs and so on should have the thermostats gradually turned down a few degrees each week down to room temps. It is important that the snakes are not fed towards the end of this period to avoid the risk of the food not digesting properly in the cooler temperatures; the last meals are offered at around the middle of October, and at least two weeks left between this and the snakes being put under for brumation. It goes without saying that the whole cooling/brumation process should only be attempted with perfectly healthy, well-fed snakes. At around the middle of November, after several additional weeks at room temperature, the snakes are taken from their enclosures and put into individual tubs with sphagnum and a small water bowl and placed into a fridge set to the required temps (about +8 – +10 °C (46.4–50.0 °F) is fine for Korean rat snakes, although some specimens may remain active even at this temperature and can easily survive temperatures even lower. Amur rat snakes will easily endure +5 °C (41.0 °F) temperatures or lower). My largest animals are too big for the fridge and with these I resort to putting them into 84L tubs half full of soil, with some bark slabs in them. These are then placed in a frost-free shed outside; while UK winter temperatures are nowhere near as harsh as those from these species' habitat, they are cold enough to allow them to brumate. After three or four months of brumation (depending on the species in question; Amur rat snakes are brumated for longer than Korean rat snakes), the snakes are returned to their enclosures and the process is reversed, gradually increasing photoperiod and temperatures over several weeks. During this time the snakes should be fed a very small meal e.g., a single adult mouse, and allowed to defecate before another tentative feeding, and then their normal feeding can begin again. (It is a good idea to make sure any females that you intend to breed are fed a lot to ensure they are healthy during and after egg-laying!). You will notice that the snakes soon shed a few weeks after brumation, which is a good sign that breeding is about to begin. Many keepers seem to prefer to do away with



Figure 7. A pair of Amur rat snakes about to mate; the male (on top) tries to initiate mating by rubbing along the females flank and head with regular tongue flicks.

brumation altogether, especially those that are not interested in breeding their snakes, but I find that not only is there often a huge increase in breeding drive and fertility rates for both Amur and Korean rat snakes after brumation – I seldom had good luck hatching healthy offspring from this species without a decent period of brumation – but also there is mounting evidence that snakes which would normally brumate tend to live longer lifespans when they are allowed to do so. Indeed, it has been found that rat snakes which brumate in the wild live longer lives, mature at older ages and breed later than those that do not brumate. Furthermore, personally I believe it only makes sense to let the animals fulfil a life process they have adapted to do, especially given that doing so seems to have so many physiological effects on their life rhythms. Many keepers have reported their Amur rat snakes become possessed of an odd wanderlust and stop feeding around the time that winter begins, this is because the snake's biological rhythms are telling it to brumate, regardless of whether we are preparing for it or not.

Feeding

Both the Amur and the Korean rat snakes present no problems with feeding and, like most other rat snakes will readily take a variety of suitably-sized frozen-and-thawed prey items. Adults can and will take anything up to the size of an adult rat, although I have noted they seem to prefer several smaller prey items to one large one. I try to vary what I feed my snakes as much as possible, and as there is such a wide variety of readily available commercial frozen prey items, this is no problem. So of course, the most common prey will be rats and mice of all ages and sizes; these can be supplemented with multimammate mice; hamsters and gerbils; day old chicks; quail chicks; quail and hens' eggs; and newborn rabbits or small guinea pigs. These snakes are quite ravenous feeders during the active season and metabolise food relatively quickly, defaecating 24 to 48 hours after eating. They will eat a lot and have a tendency to become quite fat if allowed to do so, one way to combat this is to rotate the size and type of meals; a handful of small mice one

week, a rat the next, a chick the week after, and so on. As long as the feedings are kept on the small side these snakes can easily take a feed a week during the active season. Smaller specimens will of course require smaller prey, but one of the nice things about these species is that hatchlings are relatively chunky and large so come out of the egg easily able to consume pinky and fuzzy mice from day one.

Breeding

Both the Amur and Korean rat snakes are unproblematic to breed and will do so readily in captivity if they have been properly cycled and brumated. I have found that snakes of either species that have not been brumated tend not to produce as many eggs, produce smaller eggs or infertile eggs. Females of this species are slow to mature and should not be bred before their fourth year, in the wild in the colder parts of their range they may not breed until their seventh year. Whilst captivity offers more gentle and ideal conditions without the rigours of the Siberian climate for the snakes to contend with, I personally am of the opinion that female snakes should not

be bred until they are at least four-year-old and have put on a good size and weight.

Breeding occurs in Spring a few weeks after emerging from brumation, and eggs are laid by early August. In the wild, Amur rat snakes seem to prefer piles of decomposing vegetation, compost or dead leaves, often in the vicinity of farms, however southerly individuals of the Amur species seem to prefer oviposition sites on stream banks. Korean rat snakes may prefer rocky crevices and holes in man-made walls. All these types of egg laying sites may offer constant temperatures and a ready chance to thermoregulate for the female. Schulz (1996) offered anecdotal evidence that the females may incubate their own eggs, although I have not witnessed this. It would certainly be an interesting behavior and not unwarranted given the harsh climatic extremes in parts of these species' range. They lay seven to thirty eggs, although about ten to thirteen is average among my animals, each around 50 by 25 mm (1.96 by 0.98 in), although I have also seen specimens lay a second clutch of smaller eggs only 30 mm (1.18 in) long. These are incubated at +26 °C to +28 °C (78.8–82.4 °F) for 45 to 70 days, and all being well the babies hatch out



Figure 8. Mating of Korean rat snakes (*E. anomala*).



Figure 9. Female rat snakes should be provided a lay box half full of moist, damp sphagnum where they can deposit their eggs; here a female Korean rat snake (*E. anomala*) is close to laying.



Figure 10. Part of a nice clutch of Amur rat snake eggs laid April 2023.





Figure 11. Hatchlings of Amur rat snakes.

between 280 and 450 mm (11.02-17.71 in). These babies hatch out relatively chunky and well able to wolf down pink and fuzzy mice as their first meal.

It is up to the keeper how to raise the babies, usually this will be done simply in minimalistic enclosures (for example they can be started off in 5 liter or 9 liter plastic tubs) to ensure they are eating and growing well for the first few months, however these are active snakes and an absolute joy to watch, so it is perfectly possible to grow them on in small vivaria such as Exo Terra, or smaller wooden

enclosures that can be lit and furnished attractively. The young snakes, kept individually, will often be seen climbing, exploring and basking and soon become tame enough to accept food from tongs and ignore the presence of the keeper whilst they go about their business.

Conclusion

Either of these two rat snakes make a fantastic introduction to snake keeping for amateur keepers that want something a little larger and more impressive than many of the more common fare, and rank as some of the most engaging and easy to keep snake captives out there. This is definitely a snake for the larger enclosure that offers it room to move, climb and explore to its heart content. If kept this way they are very charismatic and long-lived animals that will provide many years of enjoyment and engagement for the keeper. Amur rat snakes in particular, with their stunning black and yellow colouration and diurnal habits, make great display animals that are usually in view.

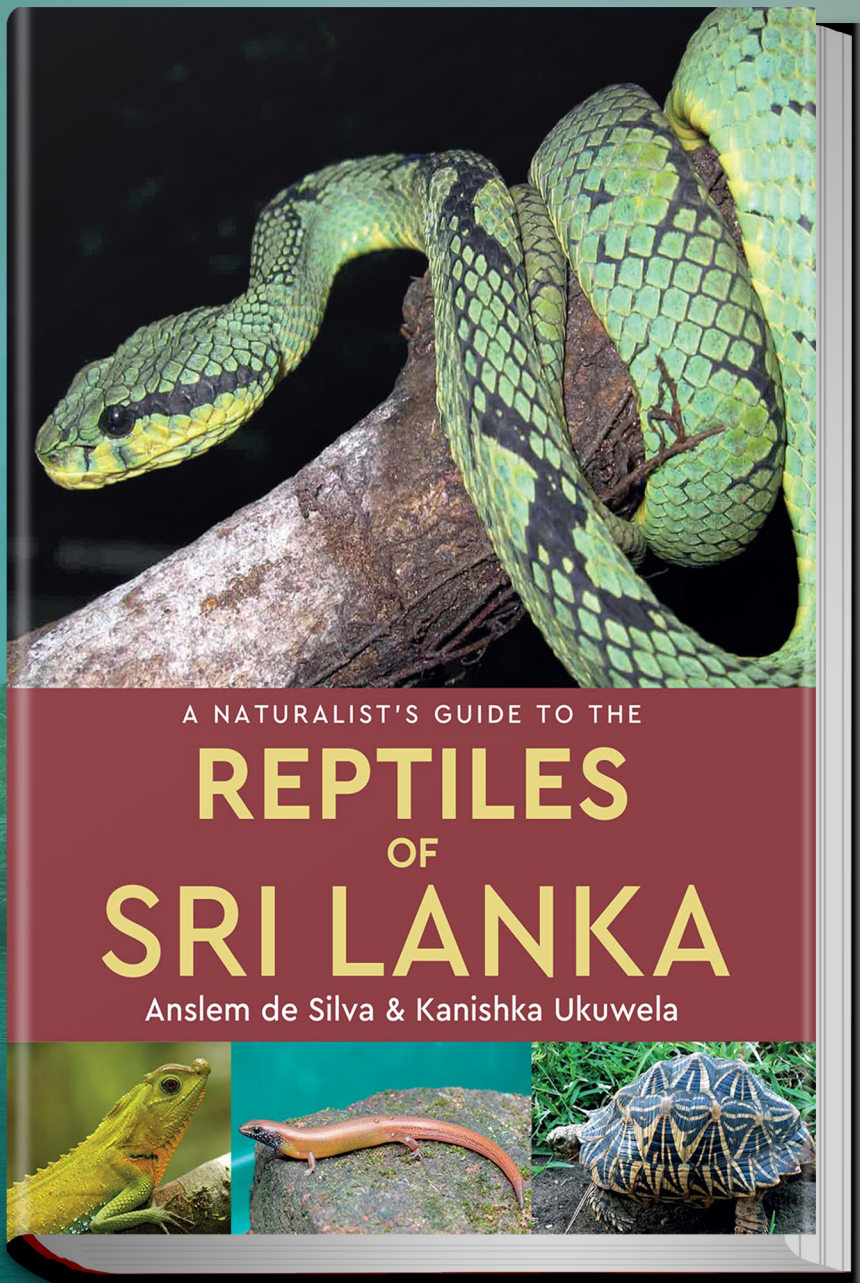




BOOK REVIEW

• A Naturalist's Guide to the Reptiles of Sri Lanka

*by Anslem De Silva
and Kanishka Ukuwela*



***“As someone who has herped in Sri Lanka,
I would personally recommend acquiring this
book ahead of a trip”***

A Naturalist's Guide to the Reptiles of Sri Lanka (2nd Edition) by Anslem De Silva and Kanishka Ukuwela is an indispensable resource for any herpetology enthusiast planning on visiting this wonderful country. Sri Lanka is home to over 200 species of reptile, three quarters of which are endemic to the island nation. The country is split into three distinct biotopes, the "dry zone", the "wet zone" and the central highlands. Amongst the montane regions of Sri Lanka, various genera have adapted to highly specific habitats and have remarkably small ranges. "A Naturalists Guide to the Reptiles of Sri Lanka" helps the reader unpick these differences and gain a contextualized knowledge of the country's herpetofauna.

As someone who has herped in Sri Lanka, I would personally recommend acquiring this book ahead of a trip. The biodiversity and extent of endemism, alongside reasonably inaccessible areas and a requirement for permits, means the average herper should have a robust idea of exactly what species they wish to target before visiting Sri Lanka. This books helps do that perfectly and approaching a guide knowing exactly which areas you wish to visit will make the entire trip more productive.

150 reptile species are featured in this book over 176 pages. As well as habitat and distribution information, the guide also provides a thorough species description and excellent photography. This makes the publication as visually interesting as it is comprehensive. Its small size is also perfect to slip into a backpack whilst out in the field.

A significant aspect of the second edition (2020) is its emphasis on conservation. The authors highlight the threats facing Sri Lanka's reptile populations, from habitat loss to climate change, and lists each species' IUCN status. The book not only serves as an identification guide but also as a call to action for conservation efforts, making it a valuable tool for environmental education and advocacy.

ISBN 1909612928, 978-1909612921, Published: 2017, Pages: 176.



THE HISTORY OF PEREGRINE LIVEFOODS



Author(s): **Chris Jones**, *Managing Director (Peregrine Livefoods), UK*

Introduction

Peregrine Livefoods was founded in 1988 as a humble insect farm catering to a quickly growing clientele of reptile keepers in the UK. Established by Tim Green and David Perry, the Epping-based farm soon grew into a wholesale business that supplied the UK with important products to keep and maintain reptiles and amphibians in captivity. Over three decades, the operation grew in scale and now Peregrine Livefoods is Europe's largest wholesaler of reptile supplies. The business sells hardware, live foods and live animals to over 1,500 pet stores, zoological institutions and agricultural colleges across the UK. Over 50,000 orders leave Peregrine

HQ each month and the business holds an important position in the heart of the herpetoculture industry and community in the United Kingdom.

History

David Perry and Tim Green, two passionate herpetoculturists, established their insect farm in the 1980s. Taking "Perry" and "Green" and turning it into "Peregrine", the duo began breeding brown house crickets (*Acheta domesticus* (Linnaeus, 1758)), followed by desert locusts (*Schistocerca gregaria* (Forskål, 1775)), mealworms (*Tenebrio molitor* Linnaeus, 1758) and more until their offerings facilitated the growth of an emerging hobby



Figure 1. From left to right; Peter Morgan, Tim Green & David Perry.

known today as “herpetoculture”. With more and more food offerings, both live and frozen, keepers in the UK and Europe were able to keep more diverse and unique species. Today, Peregrine Livefoods has the widest range of live food species available in the UK.

In addition to livefood, Peregrine Livefoods distributes well-known brands including ZooMed, Exo Terra, Reptile Systems, MistKing, Lucky Reptile, Microclimate and also has its own brands ProRep, WhitePython, Blue River Diets and Fish Science.

In 2016, Peregrine Livefoods purchased WhitePython, with its founder Chris Jones then taking on a role as Sales & Marketing Director at Peregrine Livefoods. Several years later, Chris became the company’s sole Managing Director and still runs the company today.

Later in 2018 (completing in 2021), Tim & Dave sold their business to a newly formed Trust company, “Peregrine Livefoods Trustee Ltd”. The trust is majority-owned by all the employees. This allowed the company to pay Tim & Dave for their valuation from the profits over several years, whilst also enabling all employees to share in a tax-free annual bonus scheme.

David Perry remains a significant representative of the herpetoculture industry as a lobbyist for the Companion Animal Sector Council, whilst Chris Jones is also one of 3 directors of REPTA, the Reptile and Exotic Pet Trade Association. The two lobbyist groups are important organisations for the global fight for the perpetuation of herpetoculture as a hobby and discipline.

In recent years, Peregrine Livefoods has invested in its Rolls Farm Barns facility. From implementing automated machinery to assist in producing pre-made tubs for the live insects, to over 1,200 solar panels mounted across 45,000 square feet of roof space. Today, Peregrine Livefoods employs 170 members of staff and has a revenue approximately 25 million euros.

Insect Rooms

Peregrine Livefoods produces over 100,000 packs of insects every week. However, their devotion to providing an eclectic mix of food options, to help preserve the diversity of viable animals in captivity means that over 25 different species of invertebrates can be

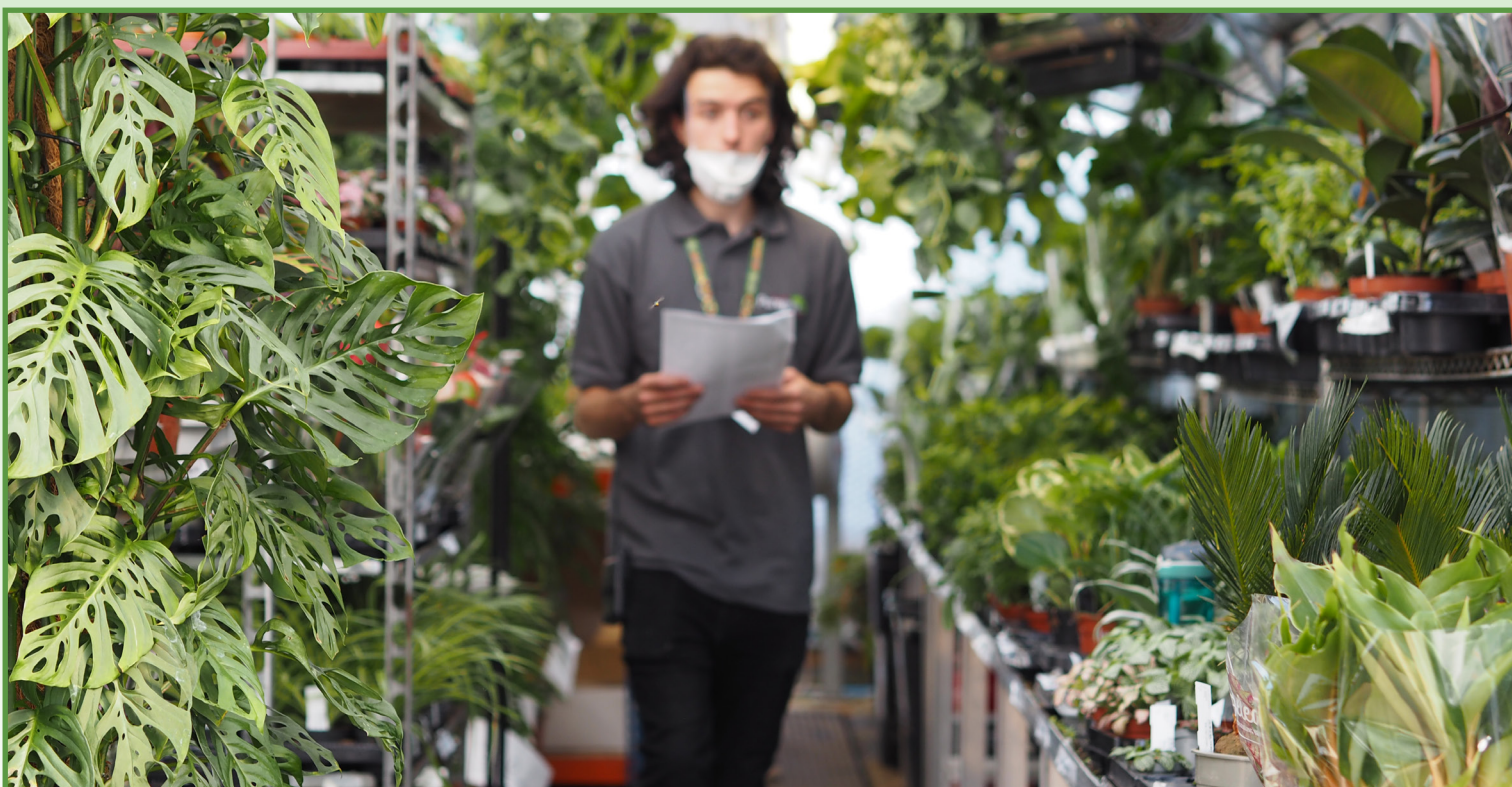


Figure 2. Inside the ProRep Greenhouse at Peregrine Livefoods’ Headquarters.

purchased as live food options from Peregrine.

Amongst Peregrine Livefoods' insect prey offerings are house brown crickets, field crickets, black crickets, desert locusts, dubia roaches, mealworms, morios, silkworms, soldier fly larvae, curly wing flies, golden fruit flies, flightless fruit flies, waxworms, earthworms, springtails, isopods, snails and weevils. Most groups contain multiple species, multiple sizes and multiple quantities to help keep the UK's reptiles, amphibians, birds, mammals and inverts fed. Aquatic livefood is also available. These include river shrimp, bloodworms, copepods, daphnia, mysis shrimp, tubifex and brine shrimp. Whilst the aquatic live foods may be most frequently purchased by aquatics retailers, the wide variety of species means that specialist reptile and amphibian keepers can ensure that their aquatic species are well fed. These foods provide a valuable food option for growing or developing newts, salamanders and more.

Peregrine Livefoods also owns the frozen food brand, PLT Rodents. The eclectic mix of species includes mice, rats, chicks, rabbits, quails, guinea pigs, multimammates, gerbils and hamsters. By offering a wide range of vertebrate prey, keepers can provide a varied or naturalistic diet for even the fussiest of snakes. Varied sizes also ensure that every carnivorous species in a UK collection can be fed appropriately, from the hatchling corn snakes (*Pantherophis guttatus* (Linnaeus, 1766)) to the adult reticulated pythons (*Malayopython reticulatus* (Schneider, 1801)).

Animal Department

Over the years, the Animal Department at Peregrine Livefoods has imported, bred and sold hundreds of species of reptiles, amphibians and invertebrates. At every step of the way, reflection and sustainability have been a consideration. As a business with over 1,500 customers, Peregrine Livefoods plays an enormous role in the propagation and availability of Britain's exotic pets. This is why certain progressive measures have been imposed over time to ensure that the company is only selling the most suitable animals for their scale of business. For example, on noticing that red-eared sliders

(*Trachemys scripta subsp. elegans* (Wied, 1838)) were posing a potential risk as an invasive species, the business halted the sale of the species several years before it was listed under the Invasive Species Act. Peregrine Livefoods has also historically avoided the sale of large constrictors, green iguanas and other reptiles on the view that large-scale importation or propagation may compromise animal welfare.

The business, which historically imported a wide variety of wild-caught animals, now operates a points-based assessment criteria to assess whether the species is suitable for import. If the species scores too low on the assessment, it will not be imported. The criteria is as follows:

1. Population: Is this species considered threatened according to the IUCN?
2. Sustainability: Has the collection and trade of this species shown to be sustainable or beneficial to the local population of both animals and humans?
3. Invasive: Is this species considered 'non-native' from the country of export?
4. Stress and hardiness: does this species show high tolerance for shipping and introduction into captive care?
5. CB availability: Is this species already available as captive-bred in reasonable quantities?
6. Reproduction: Do historical records demonstrate this species is likely to be reproduced in captivity?
7. Breeding programme: Is this species being imported specifically for re-sale to experienced breeders on the basis that new bloodlines will assist in the growth of captive-bred animals?

Of all reptiles and amphibians sold by Peregrine Livefoods, wild-caught individuals made up 19.8% in 2020. After pledging to reduce this percentage in 2021, the number dropped to 9.6% (including animals which were kept from the previous period). Now, large-scale shipments have completely halted since 2021 and wild-caught animals make up less than 2% of the total animals sold by Peregrine Livefoods.

Whilst the business is not opposed to the sale of wild-caught specimens, a national shortage of good-quality, healthy captive-bred representatives of the most popular pet species has prompted Peregrine Livefoods to reflect on their position in the industry and ensure that the most suitable species are kept by the widest number of keepers.

Brands and Products

Throughout its history, Peregrine Livefoods has launched and acquired several revolutionary brands. It is also the sole distributor of Reptile Systems, Lucky Reptile, MistKing, Taurus Mites and Psittacus Foods in the UK. However, the flagship brands in the company's roster include the following:

The business' most well-known brand is ProRep. Currently, ProRep produces numerous hardware items such as glass terrariums, lighting, heating and artificial décor. However, the brand is probably most famous for its award-winning "Life" series of substrates. Whilst "BioLife" and "DesertLife" are considered

universal options for a whole spectrum of species, it is the tailor-made species-specific products that have gained national and international recognition. TortoiseLife was voted the UK's favourite reptile product in 2023 and BeardieLife remains constantly in the heart of herpetocultural discussions. Both products combine practicality and natural ingredients to formulate a substrate that mimics the wild habitats of Mediterranean tortoises and Central bearded dragons (*Pogona vitticeps* (Ahl, 1926)). ProRep also produces a LeoLife for leopard gecko (*Eublepharis macularius subsp. macularius* Blyth, 1854) keepers, a PythonLife for royal python (*Python regius* (Shaw, 1802)) keepers and CrestieLife for crested gecko (*Correlophus ciliatus* Guichenot, 1866) keepers.

Most recently, in 2023, Peregrine Livefoods launched Blue River Diets. The all-natural, super fragrant, complete crested gecko formulas are already taking the herpetoculture world by storm. With six distinct flavours available and an instantly recognizable



Figure 3. Customers purchasing ProRep products from ProRep Product Development Specialist, Jamie Girling.



Figure 4. Left to right; Dr David Pool (Founder of FishScience) and Chris Jones (Managing Director of Peregrine Livefoods).

aesthetic, the brand is well on its way to being the UK leader and is set to take the US and Europe by storm throughout 2024 and 2025. Blue River Diets has funded a joint expedition with Exotics Keeper Magazine to New Caledonia to formulate in-situ research on the wild habitats of crested geckos, gargoyle geckos (*Rhacodactylus auriculatus* (Bavay, 1869)) and giant geckos (*Rhacodactylus leachianus* (Cuvier, 1829)). This content is being used to improve the captive husbandry of some of the most popular species of lizard, whilst also helping the brand make informed decisions on new product development. Currently, Peregrine Livefoods is searching for distributors and stockists for the new brand. Those wishing to explore this opportunity should email dsarkadi@peregrine-livefoods.co.uk.

Peregrine Livefoods also perfectly combined its expertise in livefoods with a new venture into the world of aquatics in 2022

with the acquisition of the FishScience brand. FishScience was founded by Dr David Pool in October 2013. After a 25-year career at Tetra, as well as several years studying Freshwater Fisheries at the University of Liverpool, David began building unique fish foods using black soldier fly larvae (*Hermetia illucens* (Linnaeus, 1758)) as a key ingredient. By swapping the industry standard protein of fish meal, for a more sustainable insect meal, the brand gained wide praise from fish keepers. Not only do insects provide a far more naturalistic diet for aquarium fish, but they are also farmed in more sustainable ways. Farming insects typically produce ten times less CO₂ than that of other commercial livestock. Black soldier fly larvae can be raised on organic waste and the entire supply chain can be more closely managed by suppliers, leaving less room for environmental damage whilst still producing vast amounts of protein. Using insect meal in the foods also means the foods are more



Figure 5. Customers viewing Zen Habitats for the first time in the UK.

easily digestible and therefore, produce less waste when eaten by the fish.

The formulas have long been a hit with aquatics businesses, but now Peregrine Livefoods, with the help of their expert Marketing Department has rebranded and modernized the products. Peregrine Livefoods has also launched several new lines of blister-pack foods. These frozen aquatic foods are ideal for semi-aquatic reptiles and amphibians such as turtles, newts and axolotls (*Ambystoma mexicanum* (Shaw & Nodder, 1798)).

The future

Peregrine Livefoods has played an integral role in the growth of exotic pet keeping in the

UK for decades. Whilst frequently trading with European companies, attending European shows and distributing European products has been a standard since the business was first founded, the coming years will introduce Europe to Peregrine. Now the business has a wealth of brands and new products to launch, Europe and the USA will act as major commercial targets for Peregrine Livefoods. As a company at the forefront of reptile care in Britain, we hope that we can bring our expertise and wide range of products to the rest of the world. Europe and the US can expect to see Blue River Diets, ProRep and more on their shelves as soon as 2024! Contact us for more information dsarkadi@peregrine-livefoods.co.uk.





Fig 1. Exotics Keeper Magazine: May 2024

EXOTICS KEEPER MAGAZINE – MAY 2024

The May issue of Exotics Keeper Magazine is perhaps one of the most celebrated in the publication's history. Feature an 8-page article on the brand's expedition to New Caledonia with Blue River Diets, it aims to give a huge percentage of first time reptile keepers expert insights into the wild habitats of crested geckos (*Correlophus ciliatus*). With environmental data readings, habitat photography, wild specimen observations and much more, it is a valuable contribution to herpetoculture.

Alongside the flagship article, the May issue of EK also looks at the wild habitats of Ackie monitors (*Varanus acanthurus*), plus husbandry features of red-footed tortoises (*Chelonoidis carbonaria*), sand geckos (*Tropicolotes* sp.) and more. Each issue also features a "Keeper Basics" section, of which this issue's is dedicated to natural substrates and impaction.

THE HERPETOLOGICAL JOURNAL: VOLUME 34, NUMBER 2

April saw the release of the British Herpetological Society's quarterly journal. This issue contains one open-access paper exploring the habitat suitability index for great crested newts (*Triturus cristatus*). As well as this headline piece, the journal also discusses various topics concerning the ecology and distribution of *Caretta caretta*, *Tarentola mauritanica*, *Palea steindachneri* and the herpetofauna of the Cerrado and Caatinga. There are also papers on the physiology of black kingsnakes, whipsnakes and *Lithobates* sp. The journal is available to download for members of the British Herpetological Society now.



Fig 2. Exotics Keeper Magazine June 2024

EXOTICS KEEPER MAGAZINE – JUNE 2024

The most recent issue of Exotics Keeper looks at a range of species in a captive setting, including invertebrates, contextualized with academic references and anecdotal observations. The magazine dives into the diversity of *Strophurus* geckos and tackles the problematic issues surrounding their introduction to the hobby whilst also celebrating the growing success of reproducing these charismatic lizards.

This issue also looks at the care and keeping of centipedes (*Scolopendra dehanni*), African fat tailed geckos (*Hemithelyconyx caudicinctus*), red eyed tree frogs (*Agalychnis callidryas*) and blueberry hermit crabs (*Coenobita purpureus*).



Fig 3. The Herpetological Journal: Volume 34, Number 2



Cover of REPTILES

REPTILES

The large REPTILES magazine also offers new content. The March/April issue features the following content:

Vet Report: Obesity in reptiles: Treating obesity in reptiles can be a very long process. The article looks at different approaches to weight reduction and health promotion in reptiles.

Japanese pond turtle: This article deals with the care and breeding of the Mauremys japonica, a Japanese pond turtle. Tips are given on species-appropriate keeping and successful breeding.

Reproductive behavior of the Blomberg's Tree Boa: This article examines the fascinating behavior of the tree-dwelling snake Blomberg's Tree Boa. Aspects such as mating behavior, brood care and reproductive cycles are highlighted.

Simple water changes for your aquatic turtle: This article gives practical advice on caring for aquatic turtles. In particular, it looks at how to ensure clean water for your turtle.

Zoo Med Terrarium Build: Learn how to build a bioactive terrarium for Starry Night cave geckos. The article includes instructions on designing the habitat and selecting suitable plants and substrates.

Herping in Canada's Desert: Field Herping in the South Okanagan: This article takes us on a journey to the Canadian desert in search of nocturnal geckos. Tips are given on how to observe and protect the natural environment.

Vitamins and supplements: Keep your reptiles healthy: This article provides information on the importance of vitamins and supplements for the health of reptiles. Various supplements and their use are discussed.



"elaphe" 3/2024 erscheint Ende Juni 2024

Topic: Reptile of the year 2024

They were once considered a plague. Bounties were placed on them by the highest state authorities. Today, they are highly endangered or threatened with extinction: adders have had a varied history in German-speaking countries over the last 200 years. They are not only beautiful, but also reptiles of superlatives. They have the largest range of all snakes and can even be found north of the Arctic Circle. In the cover story of the next "elaphe", we present the reptile of the year 2024 in detail.

In this Issue:

- Our traditional large, illustrated list of newly described reptile species 2023
- Keeping and breeding rail tortoises and *Peltocephalus dumerilianus*
- and much more

Photo: © DGHT

REPTILIA

The new issue of REPTILIA once again impresses with interesting topics. The new issue has a different style for once. Elmar and Ingrid Meier have been awarded the Federal Cross of Merit for their commitment to the International Center for Turtle Conservation (IZS) at the Allwetterzoo Münster. The International Center for Turtle Conservation will also be presented as an excellent model project for cooperation between private animal husbandry and zoos. There is a report on the keeping and breeding of the Vietnamese three-striped tortoise in human care. And an article discusses turtle conservation using the example of Cambodia and questions whether "species-appropriate" is only possible in the wild. A herpetological expedition in search of the false chameleon in the Caatinga region of Brazil is also described.

These topics reflect the diversity of the articles, which deal with various aspects of terraristics and species conservation. There are also travel reports, such as from the Everglades.

Photo: ms-verlag.de



SALAMANDRA

German Journal of Herpetology



Published by
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Salzhemmendorf, Germany

VOLUME 60 · NUMBER 2

15 MAY 2024

The latest issue of SALAMANDRA (60-2) was published online on 15 May 2024 /

Some interesting articles:

GIPPNER, S., N. STROWBRIDGE, E. ŠUNJE, M. CAPSTICK, F. AMAT, S. BOGAERTS, K. MERABET, K. PREISSLER, P. GALÁN, I. MARTÍNEZ-SOLANO, L. BONATO, S. STEINFARTZ, G. VELO-ANTÓN, C. DUFRESNES, K. R. ELMER & M. VENCES: The effect of hybrids on phylogenomics and subspecies delimitation in *Salamandra*, a highly diversified amphibian genus. pp. 105-128 plus supplementary material.

KOVAR, R., M. BRABEC, P. MORAVEC & T. HUSAK: Fire Salamander, *Salamandra salamandra*, niche selection in Central European conditions. pp. 129-146.

MOGALI, S. M., B. A. SHANBHAG & S. K. SAIDAPUR: Behavioural responses of predator-naïve, predator-experienced and wild-caught *Sphaerothera brevipeps* tadpoles to kairomones from the carnivorous tadpoles of *Hoplobatrachus tigerinus*. pp. 147-152. reproduction of the black-line forest skink, *Sphenomorphus nigrolineatus* (Squamata: Scincidae), from Papua New Guinea. All in all a great issue!



THE EMPEROR FLATROCK LIZARD: CAPTIVE HUSBANDRY & REPRODUCTION



Author(s): **Ryu Flagle**, Private breeder, Blackstone exotics; Senior reptile keeper at Reptilandia Zoo TX, USA

Introduction

With their magnificent colors, patterns and elaborate displays, lizards of the genus *Platysaurus* are extraordinary members of the Cordylidae family. There are currently 15 species and 13 subspecies of these small to medium sized rock specialists recognized. Generally, the males have elaborate colored throats and a dorsal surface covered with granular scales with bright colors and patterns. Osteoderms are limited to the large scales on the head, legs and the tail. *Platysaurus* are a highly social species forming large colonies with multiple territorial males in charge. These lizards are the only oviparous members of the family Cordylidae. They nest communally in deep cracks, producing one to two elongated eggs multiple times a year. *Platysaurus*, also aptly named flat rock

lizards, are found in specific habitats such as areas with large formations of exfoliated flakes of granite, gneiss, and sandstone rock ledges and walls. They are ed to this specific type of habitat. The genus *Platysaurus* taxa occur in the Mpumalanga, Limpopo and KwaZulu Natal provinces of South Africa, Swaziland, Zimbabwe, Malawi, Tanzania and Mozambique and two species occupying a much smaller range along the border of South Africa and Namibia. *Platysaurus imperator* Broadley, 1962 or the Emperor flat lizard, is the largest of the genus *Platysaurus*. Their range is northeastern Zimbabwe the adjacent part of Mozambique. Its habitat is mesic savanna. These lizards will often live on top of boulders on hills and display bright vivid coloration. In this paper I will be speaking more specifically on this species and my work with them in captivity.



Figure 1. Map of Africa showing location of the three studied areas in the 1960s indicated by the yellow dots for *P. imperator* located in north-east Mozambique, Southern Africa (GBIF.org (27 December 2023) GBIF Occurrence Download <https://doi.org/10.15468/dl.7evb5e>).

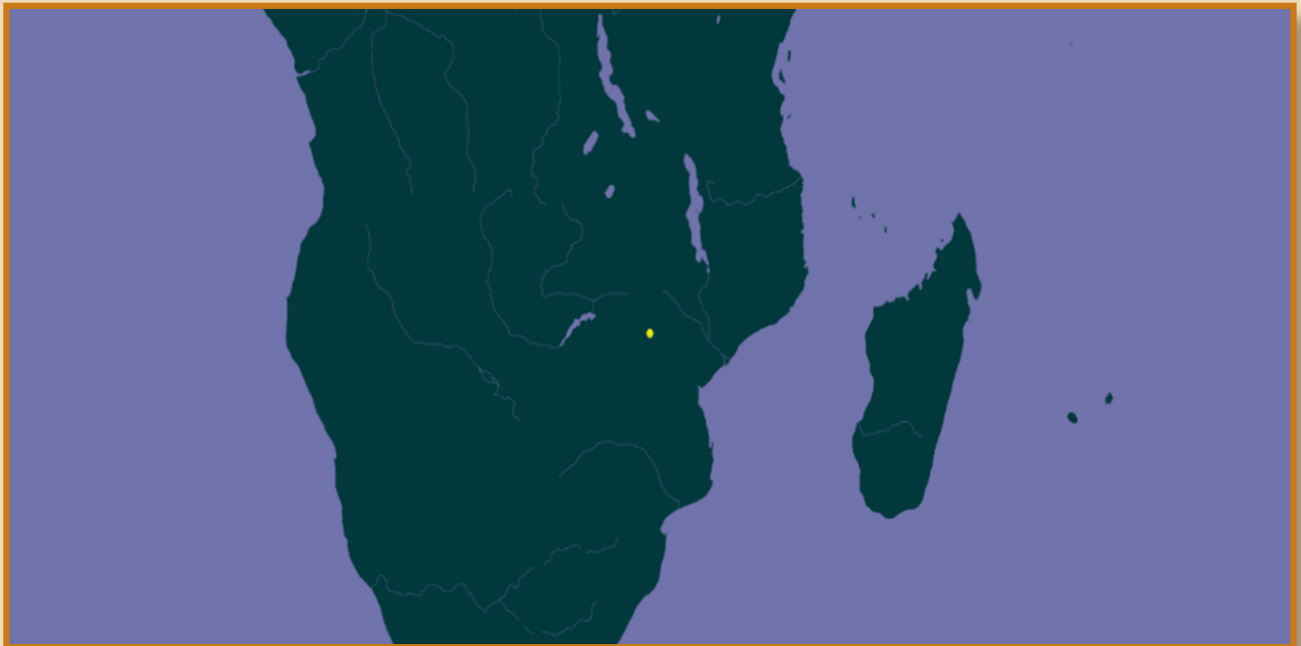


Figure 2. Updated map of Africa showing a lesser population of *P. imperator* occurring from 2014 – 2023, indicating the damage done from smuggling the species, causing their status to be “near threatened” (GBIF.org (27 December 2023) GBIF Occurrence Download <https://doi.org/10.15468/dl.7evb5e>).

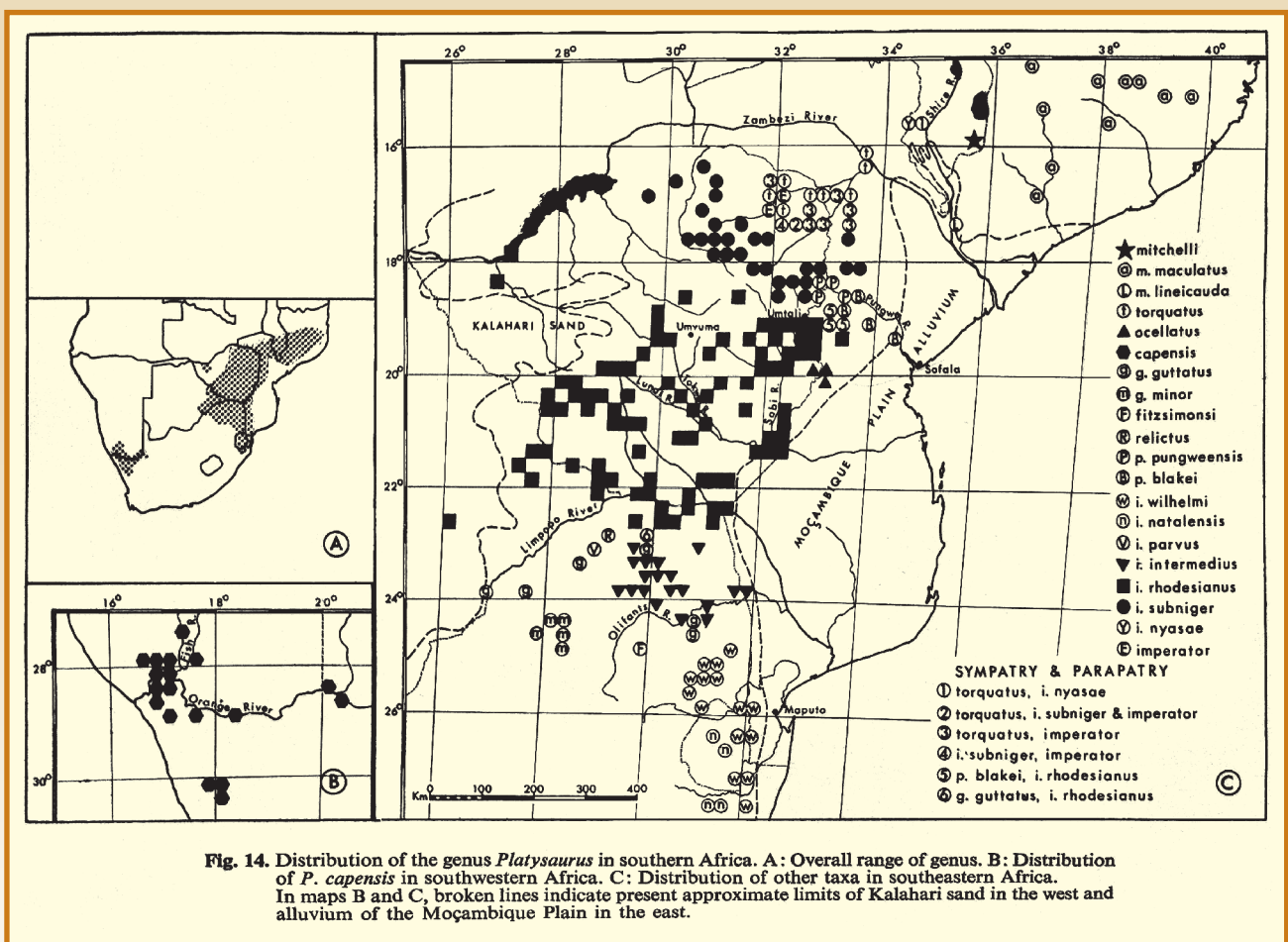


Figure 3. Map of Southern Africa showing the locations of several *Platysaurus* species (Broadley, 1978).



Figure 4. 74-gallon enclosure with adult group of 1.3.



Figure 5. Hidden entrance to nesting chamber.

Captive husbandry

Emperor flat lizards are kept on a 70% sand 30% peat moss mix with stacked flat rocks heavily secured with small separators in between to ensure safety. T5 Arcadia UVB is provided throughout the enclosure with a dramatic hot



Figure 6. Inside of nesting box.

and cool end. Hottest basking spot on the top of the rocks averages around 125.0 °F (+51,6 °C) with different levels for thermoregulation. The opposite end averages 78.0 °F – 83.0 °F (+25,5 – +28,3 °C) with a large water dish. In the center of the enclosure is a dark box filled halfway with damp soil for nesting with a hole just large enough for entry. I keep their enclosure naturalistic to encourage bioactivity and leave some excrements that they deposit on the rocks to retain a natural scent/familiarity for the animals. Babies all have similar setups for varying sizes. Some include rock backwalls for climbing to ensure healthy muscle development.

Feeding and prey items

As shown below, 60% of a *P. imperator*'s diet in the wild is Coleoptera (beetles), however it is difficult to find the right beetles to feed in captivity.

Here in captivity, they readily feed on an assortment of dusted crickets, zophobas (superworms), Dubia roaches, and soldier fly larvae. Every once in a while, I will feed both my adults and babies, fruits such as strawberries and



Figure 7. Hatchling enclosure.

Table 4. *Platysaurus*: percentages of full stomachs containing various food classes.

Class	<i>mitchelli</i>	<i>maculatus maculatus</i>	<i>maculatus lineicauda</i>	<i>torquatus</i>	<i>ocellatus</i>	<i>guttatus guttatus</i>	<i>pungweensis pungweensis</i>	<i>pungweensis blakei</i>	<i>intermedius wilhelmi</i>	<i>intermedius rhodesianus</i>	<i>intermedius subniger</i>	<i>intermedius nyasae</i>	<i>imperator</i>
Full stomachs examined	23	87	12	94	58	9	25	77	57	285	113	32	70
Orthoptera (Blattidae)	—	8	—	3	9	22	8	4	4	8	7	12	7
Orthoptera (Mantidae)	4	—	—	—	—	—	—	—	7	1	—	—	—
Orthoptera (Acrididae & Locustidae)	17	9	8	4	7	11	20	14	12	15	9	3	9
Dermoptera	—	—	—	—	—	—	—	4	4	—	—	3	—
Isoptera	—	30	—	3	2	33	4	5	4	4	12	—	10
Neuroptera	—	—	—	—	—	—	—	1	—	1	—	—	3
Hemiptera	4	1	—	5	3	—	4	4	25	5	4	3	4
Lepidoptera (adults)	4	—	—	1	7	—	—	—	4	—	—	3	1
Lepidoptera (larvae)	—	10	8	23	16	—	20	9	23	10	24	31	36
Coleoptera (adults)	43	36	—	38	40	67	52	49	39	33	49	44	60
Coleoptera (larvae)	35	3	—	4	—	22	4	5	7	4	3	3	4
Diptera (adults)	4	1	—	3	3	11	—	3	11	2	2	6	6
Diptera (larvae)	4	—	—	—	—	—	—	—	—	—	1	—	1
Hymenoptera (Ants)	65	63	83	67	10	89	52	42	58	35	35	53	27
Hymenoptera (Wasps, Bees)	13	14	17	7	7	78	28	10	25	10	7	3	10
Arachnida	52	11	8	5	10	11	—	13	23	4	8	6	3
Chilopoda	4	1	—	2	2	—	—	—	2	—	—	3	1
Diplopoda	4	2	—	3	5	—	4	6	—	3	4	6	7
Isopoda	—	—	—	—	—	—	—	—	2	—	1	—	—
Vertebrata	—	1a	—	—	—	—	—	1b	—	1c	1d	—	—
Vegetable matter	30	1	—	—	33	78	—	4	35	17	10	16	10

a = *Hemidactylus* tail. b = *Mabuya* tail tip. c. = *Typhlosaurus* juv. d = lizard mandible.

Figure 8. Results of the diet of various *Platysaurus* species based on the examining food items found inside their stomachs (Broadley, 1978).

raspberries which to my knowledge remains undocumented until now. Babies tend to go for fruits more than their elders.

Breeding and incubation

This species tends to breed almost year-round in captivity, but egg laying typically occurs between the months of late February to early September.

Females lay clutches of 2 eggs at a time that measure 24,8x12,5 (0.97-0.49 in). However, I have gotten 2 separate clutches of eggs that were much larger than usual, measuring 31,7x14,2 mm (1.24-0.56 in). The larger eggs

were unfortunately unsuccessful and only developed somewhat. The same female will lay several times a year and eggs take around 90 days to hatch when incubated on humid perlite at 82.0 °F (+28 °C). Hatchling *P. imperator* weigh 2 g and measure 5.1 in (129,54 mm) from snout to tip of tail. Hatchlings will readily feed on dusted 1/8 in (3,2 mm) crickets.

Sexual dimorphism and appearance

The typical adult male weighs 74.67 g and measures 5 in (127 mm) snout to vent and 10.2 in (259.08 mm) snout to tip of tail. Females weigh 73.23 g and measure 4.2 in (106.68 mm)



Figure 9. Female in nesting chamber laying unusually large eggs (31,7x14,2 mm).



Figure 10. Size comparison of a normal *P. imperator* egg versus a larger one.



Figure 11. Close up photo of one of my *P. imperator* taken by William Lamar.



Figure 12. Adult male (left); male in mid color transformation (middle); female (right).

snout to vent and 10.3 in (261.62 mm) snout to tip of tail. Offspring all resemble female colors and patterning and aren't sexable until they are much more sizeable. Emperor flat lizards are sexually dimorphic, with females presenting brownish black bodies with 3 yellow/white lateral stripes and orange tails, while males tend to be brightly colored with neon oranges and yellows. There is an exception though.

In the wild, and even in captivity, males will sometimes do whatever it takes to mate during breeding season and have more access to food. To surpass the larger more dominant males, lesser males will sometimes disguise themselves in female colors and find their way to females without being noticed. Below is a photo representation of their coloration and a male in mid transition.

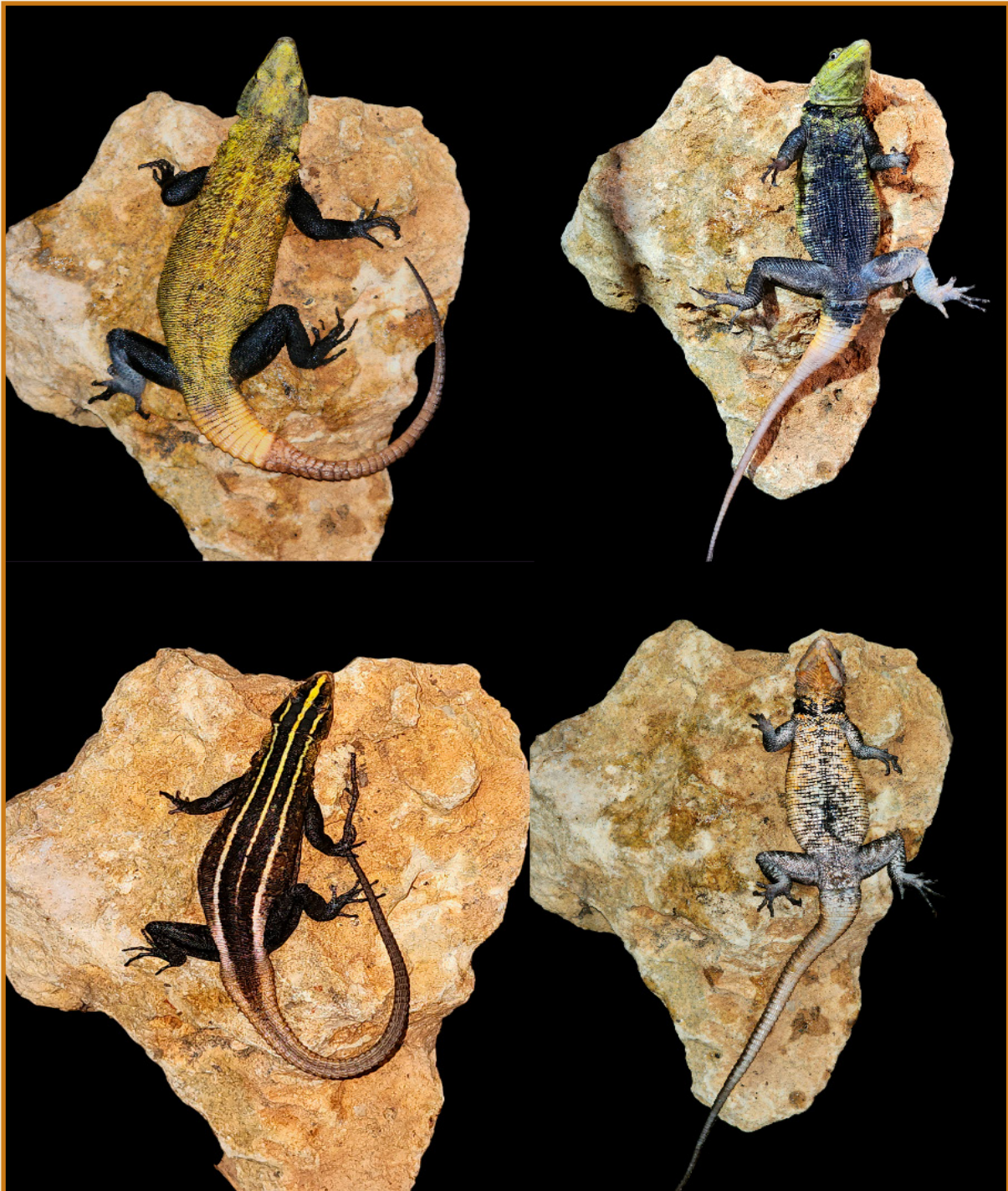


Figure 13. Top and dorsal view of a *P. imperator* male (top photos) and female (bottom photos).



Figure 14. Photo of one of my male *P. broadleyi* taken by William Lamar.

Number of individuals in my care

Two captive bred (cb) hatchlings, 6 cb subadults (2.4) 7 adults (2.5) and 4 cb babies that I had traded for 4 cb *Platysaurus torquatus* Peters, 1879. Current status of wild Emperor flat lizards is "Threatened" by over-collecting for the pet trade and due to South Africa's rapidly rising heat from climate change. This is why conservation of the species is so important.

Not the only flat rock lizards
I'm working with...

It's not just emperor that I'm passionate about. I am eager to work with as many species/subspecies as possible hoping to keep their populations thriving. I am also working with *Platysaurus broadleyi* Branch & Whiting, 1997 (Broadley's flat lizard), *P. torquatus* (striped flat lizard) and *Platysaurus pungweensis*



Figure 15. A pair of *P. torquatus* – male (left) and female (right).

Broadley, 1959 (Pungwe flat lizard). I am still pushing to successfully breed these species, and I've gotten eggs from both *P. broadleyi* and *P. torquatus* and the *P. broadleyi* eggs are looking to hatch soon. However, success in hatching *P. torquatus* I am still aiming for as I am rebuilding my group after a fire. This hasn't stopped my passion for these animals however and I will breed them as well in time.

In conclusion

I hope to produce more of this wonderful genus in captivity so that we can reassure that the population thrives. It doesn't stop there either. I'm working hard at producing other cordylids and South African species as well because their preservation and representation really matters to me.



Figure 16. Female of *P. pungweensis*.

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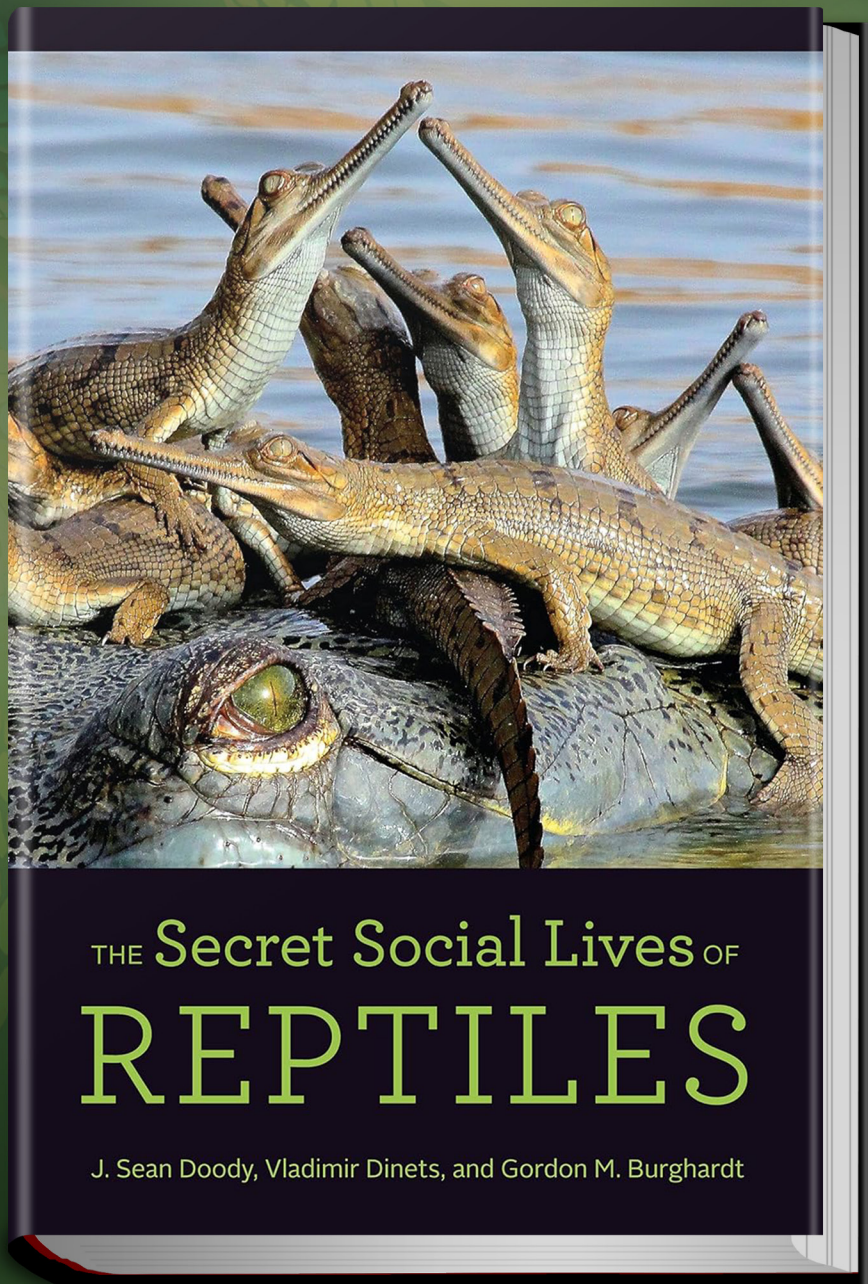
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BOOK REVIEW

• The Secret Social Lives of Reptiles

*by J Sean Doody, Vladimir Dinets
& Gordon M Burghardt*



*F*or a long time, people have overlooked the complex social dynamics of reptiles. They are too often dismissed as unintelligent and solitary creatures that may congregate simply out of necessity than a true biological drive to socialize. "The Secret Social Lives of Reptiles" addresses this topic head on, asking why the social lives of reptiles are misunderstood, how reptiles socialize and what we can learn from these relationships.

Written by J Sean Doody, Vladimir Dinets & Gordon M Burghardt and published in 2001, "The Secret Social Lives of Reptiles" presents a revolutionary outlook on the physiological, genetic and sensory factors affecting the social lives of reptiles whilst using key examples from all major groups of reptiles.

Published by John Hopkins University Press, the book fits nicely between an academic textbook and an introductory exploration of zoology. As each social dynamic is beautifully illustrated with photography and the authors present concise and easy-to-understand explanation, this piece of literature is just as well suited to the coffee table as it is the university library.

Some popular tales of socialization, such as the monogamy of shingleback lizards and the parental instincts of crocodilians are explored in depth. At the same time, new explorations into reptile socialization focusing on rare and endemic species from all over the world presents fascinating new research inspiration for both student and academic, as well as hobbyists with a keen interest for learning. Robust introductory chapters, an inspiring foreword and various other "bonus" elements create a comprehensive look at this misleadingly vast subject matter.

Rulon W. Clark best summarises the impact of The Secret Social Lives of Reptiles in his review as he writes, "Although anyone with an interest in reptiles or their natural history would benefit from reading this book, perhaps its greatest impact will be on the up-and-coming next generation of scientists. If you are still developing your own expertise or are casting about for an area of scientific inquiry in which to focus, this book is a treasure map—it highlights case after case of compelling (but often preliminary) observations that need further investigation."

This book is a source of inspiration to anyone looking to develop a better understanding of herpetology.

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WEEKEND AT MANDAI WILDLIFE RESERVE, SINGAPORE



Author(s): **Luke Harding**, *Curator of Herpetology, Mandai Wildlife Reserve, Singapore*;
Thomas Marriott, *RHJ Executive Editor, UK*.

Introduction

Mandai Wildlife Reserve is a collection of zoological attractions in the heart of Singapore. Comprised of Singapore Zoo, Bird Paradise, Night Safari, River Wonders and a new, soon-to-be-launched park,

Mandai plays a major role in conservation and education within this largely metropolitan country. Each of the current four collections exhibit reptile and amphibian species, with Singapore Zoo leading the charge through its dedicated “Reptopia”. This facility houses

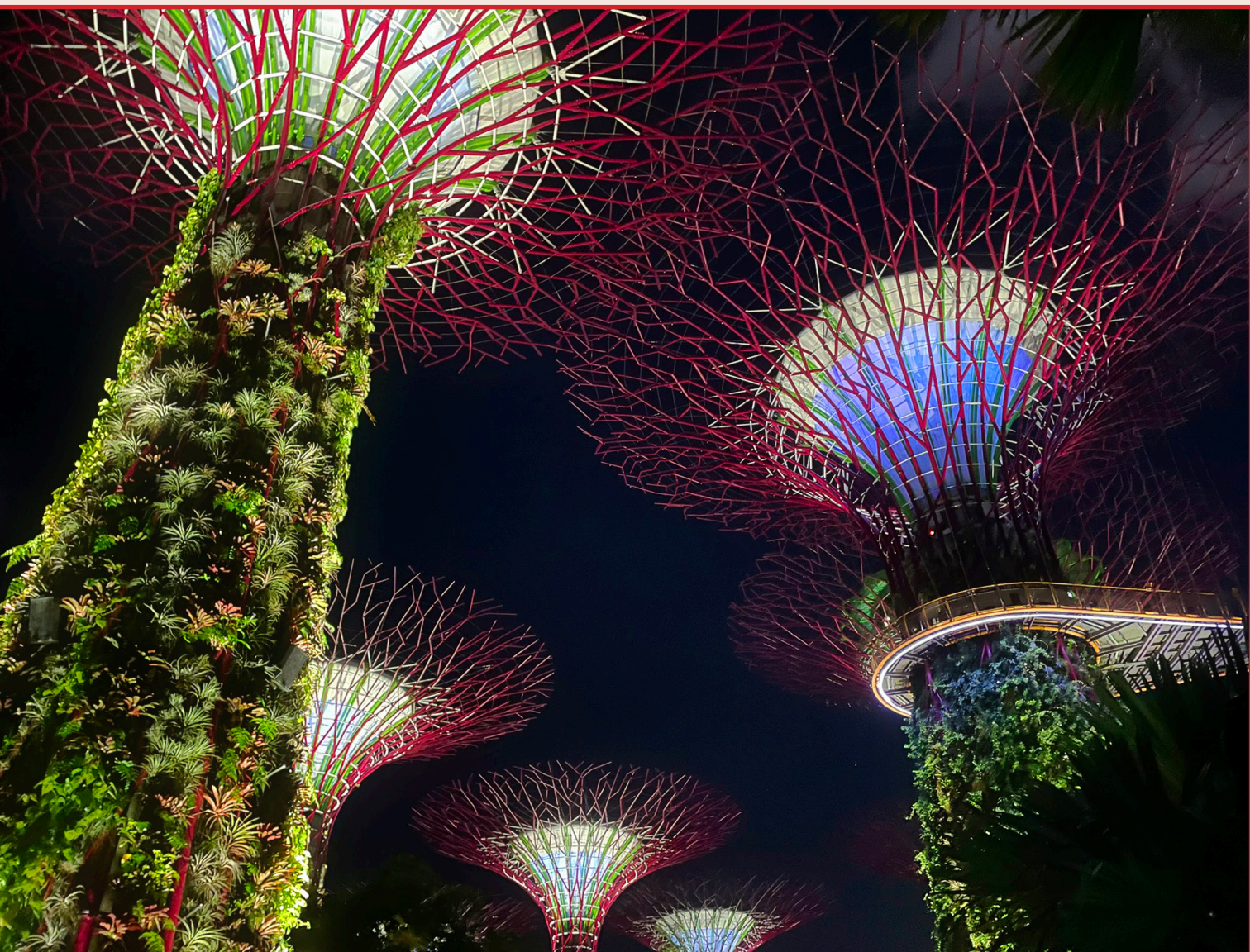


Figure 1. Gardens by the Bay, one of Singapore’s most iconic tourist attractions.

83 species of reptile and 20 species of amphibian (over half of these are on display to the public). Reptopia utilizes air-conditioned rooms for temperature-sensitive species, enormous outdoor enclosures for tropical species and operates as a training facility for both experts and interested visitors alike. It is even possible to find water monitors (*Varanus salvator* Laurenti, 1768), clouded monitors (*Varanus bengalensis* Daudin, 1802), wagler's pit vipers (*Tropidolaemus wagleri* Boei, 1827), reticulated pythons (*Malayopython reticulatus* Schneider, 1801), vine snakes (*Ahaetulla prasina* Boei, 1827) and more species on the Zoos grounds. I joined Luke Harding, Curator of Herpetology at Mandai Wildlife Reserves for a tour of their facilities.

Entering the Park

The very first exhibit that visitors to Singapore Zoo are greeted with, is a flagship reptile conservation project. Singapore Zoo has a large collection of 15 false gharials (*Tomistoma schlegelii* Muller, 1846), split into three groups. Seven of these animals were bred at the zoo. These enormous crocodylians from Borneo, Sumatra and the Malay Peninsula are considered Endangered. Luckily, they thrive in the optimal temperatures that Singapore experiences year-round, meaning that the institution can successfully maintain a healthy population and breed the species in the most naturalistic ways possible. Unfortunately, it also means that there are very few collections across the world with



Figure 2. A pair of *Tomistoma* viewed from the canopy walkway.

the resources to hold the species. Singapore Zoo has achieved successful breeding with fertile eggs every year for several years now and whilst these eggs are not currently being incubated, the research conducted has helped construct best practice guidelines for husbandry and breeding. With less than 10,000 mature individuals left in the wild, the transferable skills developed at Singapore Zoo may play a globally significant role in protecting the longevity of the species.

The climate in Singapore sits at almost the perfect temperature to keep a wide range of species (+22 – +28 °C (71.6–82.4 °F with

high humidity throughout the day). Sadly, this means that invasive species can very easily become established, resulting in a complete ban of reptiles and amphibians as pets with the exception of the already invasive red-eared slider (*Trachemys scripta subsp. elegans* Wied-Niuwied, 1839), the white's tree frog (*Litoria caerulea* White, 1790) and the native Malayan box turtle (*Cuora amboiensis* Daudin, 1802). This amplifies the need for positive herpetological education, outreach and exposure within Singapore.

Singapore is home to over 140 species of reptiles and amphibians, including several snakes that may pose a threat to human life. Whilst most of these are Elapids and Viperids, reticulated pythons can grow to such a size that they are considered dangerous. During my visit, Luke had a callout to remove a 30-foot python from a military base. Requiring 16 people to move the giant serpent (potentially the largest snake spotted in Singapore in 50+ years), the team at Mandai Wildlife Reserve operate a vital service in dealing with human animal conflict and also accepting specimens intercepted through trafficking routes.

Reptopia

Reptopia houses the main reptile and amphibian collection across Mandai Wildlife Reserve. Even though some of the zoos most remarkable reptile species, such as the turtles of the genus *Batagur*, the Chinese alligator (*Alligator sinensis*, Fauvel 1879) and the green anaconda (*Eunectes murinus*

Linnaeus, 1758) can be found in outdoor exhibits across the various collections, most of the reptile diversity of Mandai Wildlife Reserves are exhibited in Reptopia in Singapore Zoo.

The Reptopia exhibit is home to over 100 species of reptiles and amphibians. Amongst the most notable are the Roti Island snake-necked turtles (*Chelodina mccordi* Rhodin, 1994) which Singapore Zoo has successfully bred and repatriated to the wild. The institution is currently working with numerous organisations, as well as Indonesian government on an ongoing conservation



Figure 3. A poster of dangerously venomous snakes in Singapore.



Figure 4. Outdoor crocodile monitor exhibit.



Figure 5. Outdoor Chinese alligator exhibit.



Figure 6. The “frog room” in the offshow area of Reptopia.



Figure 7. Terrariums housing various species of reptiles commonly seen in captivity.



Figure 8. More terrariums in the off-show area of Reptopia.

strategy for these bizarre freshwater turtles. Endemic to Rote Island in Southeast Indonesia, *C. mccordi* underwent a controlled extinction in the wild as animals were removed and brought into the care of different zoological institutions to help increase numbers of animals with a focus on viability for release. Singapore Zoo has a pair on display and a hatchling turtle for educational purposes. More viable eggs will be incubated and hatched once the conservation project requests them.

Singapore Zoo is also known globally for its crocodile monitor (*Varanus salvadorii* Peters & Doria, 1878) breeding program. With the perfect conditions to house these enormous Papuan lizards comfortably outside, the zoo is reasonably successful at producing offspring each year which are then exported to other zoos across the world to improve awareness for these impressive reptiles. Although the crocodile monitor is not currently considered Threatened, they are becoming increasingly more popular in captivity and having zoological institutions leading the way with captive breeding practices may see a more sustainable trade of the species in the future.

Reptopia is also home to Mario and Taro the Komodo dragons (*Varanus komodoensis* Ouwens, 1912). Also benefitting from large outdoor enclosures, the two specimens may play an important role in the genetic diversity of dragons in captivity. Bima, Mario's father was thought to have been gifted to the zoo by the King of Indonesia at the time. Whilst the story is yet to be verified, if it is true, Mario may have purely "wild" blood and therefore, represent a new bloodline in captive collections. A truly spectacular animal, the white and cream colouration of Taro is typical of animals from Komodo that are said to have lighter colouration possibly as an adaptation to the exposed regions they inhabit in contrast to the smaller, darker animals found on Rinca that usually live in denser forests and hunt smaller prey.

As well as the on-show displays, Reptopia features a glass viewing window into the sizeable "off show" area. Three rooms harbour a few dozen glass terrariums housing a wide variety of species. From Yemen chameleons (*Chamaeleo calypttratus* Dumeril & Bibron, 1851), crested geckos (*Correlophus ciliatus*



Figure 9. One of the tortoises' exposition terrariums.

Guichenot, 1866) and royal pythons (*Python regius* Shaw, 1802) found as illegal pets, to golden mantella (*Mantella aurantiaca* Mocquard, 1900), ornate flying snakes (*Chrysopelea ornate* Shaw, 1802) and blue tree monitors (*Varanus macraei* Bohme & Jacobs, 2001) this room is an important facility for herpetology within Singapore. Groups or individual members of the public can arrange training courses within this very visible "off show" facility.

The tortoise facility

Once a small mammal house, the Tortoise Shelter ("shell"ter) offers windows into the natural habitats of some of the most imperilled tortoise species on Earth. Each exhibit is several meters long with arched glass that shows the otherwise quite drab desert habitats of extremely important Chelonia specimens. Ploughshare tortoises (*Astrochelys yniphora* Vaillant, 1885), Indian star tortoises (*Geochelone elegans* Schoepff, 1795), Burmese star tortoises (*Geochelone platynota* Blythe, 1863), hingeback tortoises (*Kinixys belliana* Gray, 1831), radiated tortoises (*Astrochelys radiata*

Shaw, 1802), Madagascan spider tortoises (*Pyxis arachnoides* Bell, 1827), Indochinese box turtles (*Cuora galbifrons* Bourret, 1939), elongated tortoises (*Indotestudo elongata* Blyth, 1853), and Chinese three-striped box turtles (*Cuora trifasciata* Bell, 1825) are all on exhibit here.

The collection is already beginning to breed ploughshare tortoises that were seized from the illegal wildlife trade. Each animal has etchings of a number on its carapace. This practice of "tattooing" tortoises helps protect animals from the illegal wildlife trade. Animals with a unique identifying number can be tracked back to the wild and therefore, become less desirable amongst smugglers. Over time, the tortoises will shed their scutes and the engravings become less visible, but they will always be known to have come from Madagascar.

Whilst I was visiting the zoo, Luke received a call from Singapore Changi Airport. They had seized two big-headed turtles (*Platysternon megacephalum*, Gray 1831) and a Chinese giant salamander (*Andrias davidianus* Blachard, 1871). As two Endangered species known for their high price within the

illegal pet trade, the new animals will now be maintained within the Mandai Wildlife Reserves captive collection and potentially contribute to valuable breeding projects.

Turtles and crocodilians

Singapore Zoo is the only institution outside of Myanmar to breed the Burmese roofed turtle (*Batagur trivittata* Dumeril & Bibron, 1835). These Critically Endangered freshwater turtles, endemic to Myanmar, were brought back from the brink of extinction after being rediscovered around 30 years ago. The species

was thought extinct until a dead animal was found in Myanmar in 2001 and a live specimen was found in a food market in China in 2007. Researchers went about rediscovering the species and found less than 10 mature individuals in the wild in 2018. Since then, the captive population totals around 1,000 individuals, most of which are maintained by various conservation initiatives in-situ and successful release of these animals have taken place frequently over recent years. Outside of Myanmar, a population of around 30 animals are on display and actively breeding at Singapore Zoo.



Figure 10. Enclosure for turtles (*Batagur*) and crocodilians.



Figure 11. “Together for Wildlife” stand.

Female Burmese roofed turtles grow much larger than their male counterparts. Singapore Zoo houses a 9:12 group of 21 animals. These impressive turtles are not only important for conservation but make excellent display species.

Mandai Wildlife Reserve maintains all six species of *Batagur* with many of them breeding. Every member of the genus is considered Critically Endangered, making it one of the most imperiled groups of reptiles on Earth. Most species face a similar cacophony of threats; habitat degradation reduces available waterways and microhabitats which reduces numbers and fragments populations, collection for food decimates already fragile populations and an increased demand for rare species spurs illegal harvesting of remaining animals. As *Batagur* species rely on specific, lowland rivers with an abundance of food, they are highly susceptible to environmental changes.

Native Herpetofauna

Singapore is home to the largest reptile on Earth, the saltwater crocodile (*Crocodylus porosus* Schneider, 1801). They are most frequently encountered in Sugei Buloh Wetland Reserve, where one of the healthiest populations on the Malay Peninsula is found. Unfortunately, crocodiles that exceed three meters in length are culled to protect public safety. Over years this may have impacted

the overall size of the crocodiles in Singapore and it is likely that similar selective dwarfism has impacted reticulated pythons in urban areas. Whilst this is a small price to pay for the sustainable protection of a species within city limits, it showcases the need for wild spaces. The 30-foot reticulated python that was found at an airbase during my visit is a prime example of nature working relentlessly when given the opportunity to flourish. The team at Mandai Wildlife Reserve caught, tagged and released the snake into a new area where it would not pose a threat to humans. Hopefully, ongoing research into the behaviour of this enormous snake will teach conservationists how reptiles are utilizing the wild spaces that are so carefully maintained within the metropolitan epicenter of Asia.

Mandai Wildlife Reserves protects thousands of hectares of natural space. The organization aims to protect and restore over 100,000 hectares of natural ecosystems by 2025. This allows a wide variety of species to flourish in such an anthropogenically important part of the world. By combining a vision for protecting wildlife alongside the broader zoological goals of educating, inspiring and conserving, Mandai Wildlife Reserves is one of the most important zoological facilities on the planet and a visionary for the 21st Century “zoo”.

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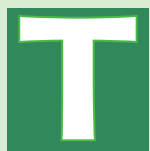
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THE MALAYSIAN LEAF FROG IN CAPTIVITY: HOW TO ACCLIMATIZE, HOUSE AND SEX A VERY MISUNDERSTOOD SPECIES



Author(s): **Daryl Lott**, Private Breeder, UK

Background history

Malaysian leaf frogs (*Megophrys nasuta* Schlegel, 1858) in the wild are widespread throughout Asia, and found in countries such as Brunei, Indonesia, Malaysia, Singapore and Thailand. They are also found on the island of Borneo.

M. nasuta are a terrestrial ambush predator and as such, are territorial. They are found in lowland and submontane rainforests where they camouflage within the leaf litter and tuck themselves into crevices between tree stumps and fallen logs.

During heavy rainfall and thunderstorms, they are found around fast-moving streams and waterfalls. It is here where they will mate, and lay spawn submerged and attached to bogwood.

In the industry

It is all but guaranteed that any Malaysian shipments that arrive into mainland Europe will contain *M. nasuta*. The species are highly desirable in the pet trade and are regularly seen in shops and at reptile expos. They are an impressive size, unusual in appearance and have comical personalities.

The vast majority within the hobby are sadly wild-caught specimens. They are a species that are always incredibly stressed when offered as wild-caught. Because of this, a significant percentage of imported individuals die on arrival or soon after due to starvation caused by shock.



Figure 1. Left to right: male, female and three month old froglet.



Figure 2. A pair of leaf frogs in amplexus in their breeding pool.

Wild caught to captive process

The species require much time and effort to settle them. This is something that isn't always considered by the prospective keeper. Many people presume that the key thing to do is to feed and water them as soon as possible. Perhaps surprisingly, this is not vital.

For over a decade I have worked with the species and have established a highly successful method in order to acclimatise as quickly and stress free as I possibly can.

Quarantine housing

On arrival the individual needs to be soaked in a blacked-out plastic box with just water, this will allow rehydration. I also add

a small amount of the product ReptiBoost. This is full of electrolytes such as sodium, potassium, calcium and magnesium, all of which really aid to the re-hydration process. The individual should stay overnight in these conditions.

After the initial 24 hours, the next stage is to place the frog in another much smaller blacked-out box, allowing the frog to only move a very small distance. The dark conditions create an area for the frog to calm down, minimizing the risk of injury. Within the box there should only be damp paper towel and half of a plastic plant pot. This will create a shelter for added security.

Paper substrate should be changed daily, but careful consideration should be given to avoid contact with the individual

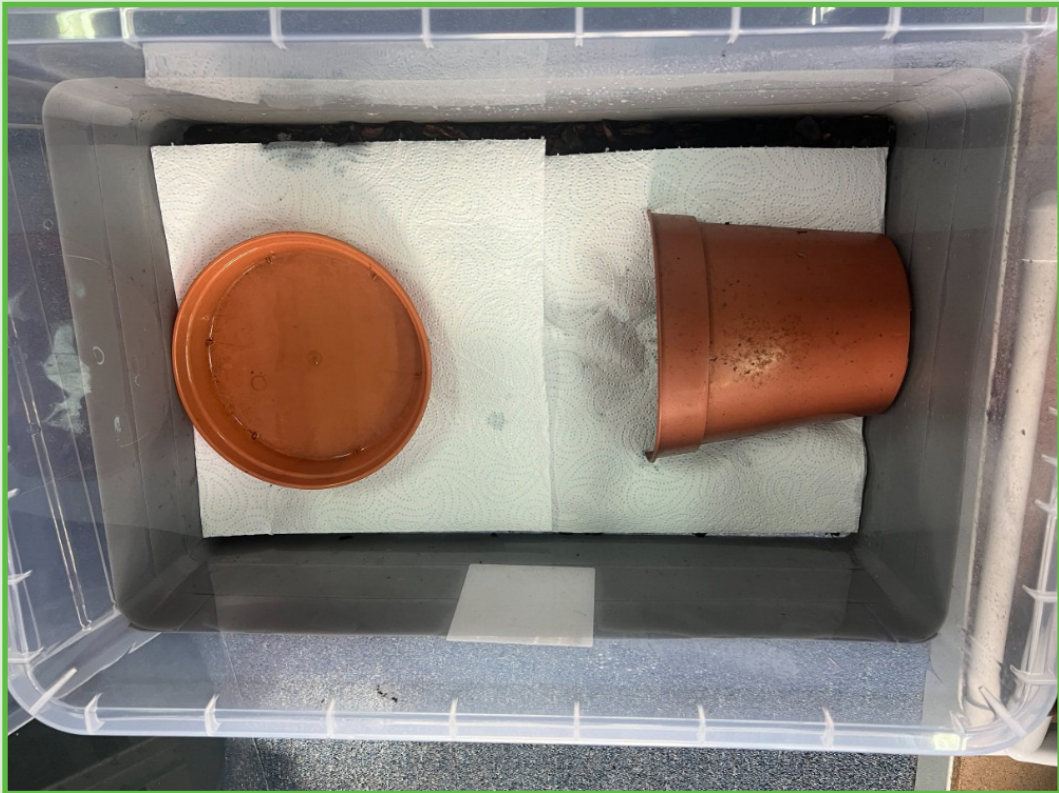


Figure 3. Quarantine housing for the first 6 months.



Figure 4. Malayan and Indonesian male *Megophrys* size comparison, as you can see the Indonesian specimen is significantly bigger.



Figure 5. 2 captive bred specimens; both are 2 months old with a clear difference of head shape.

as best as possible. This method should be adopted in a quarantine bio secure area away from any other amphibians, decreasing the potential risk of disease spreading to other healthy individuals.

Treating

24 hours after arrival, a swab sample should be taken and sent away to be assessed at a specialist lab. *Batrachochytrium dendrobatidis* Longcore, Pessier & D.K. Nichols 1999 "Bd" also known as Chytrid fungus is a massive killer of amphibians, summoning many species to extinction or on the brink of, therefore it is vital testing is actioned.

Once the results are back, the individual still needs to be kept in quarantine conditions for a 6-month period, continuing with the bio secure protocols. If the results come back positive, a plan of action should be carried out with the advice of a specialist herpetological vet.

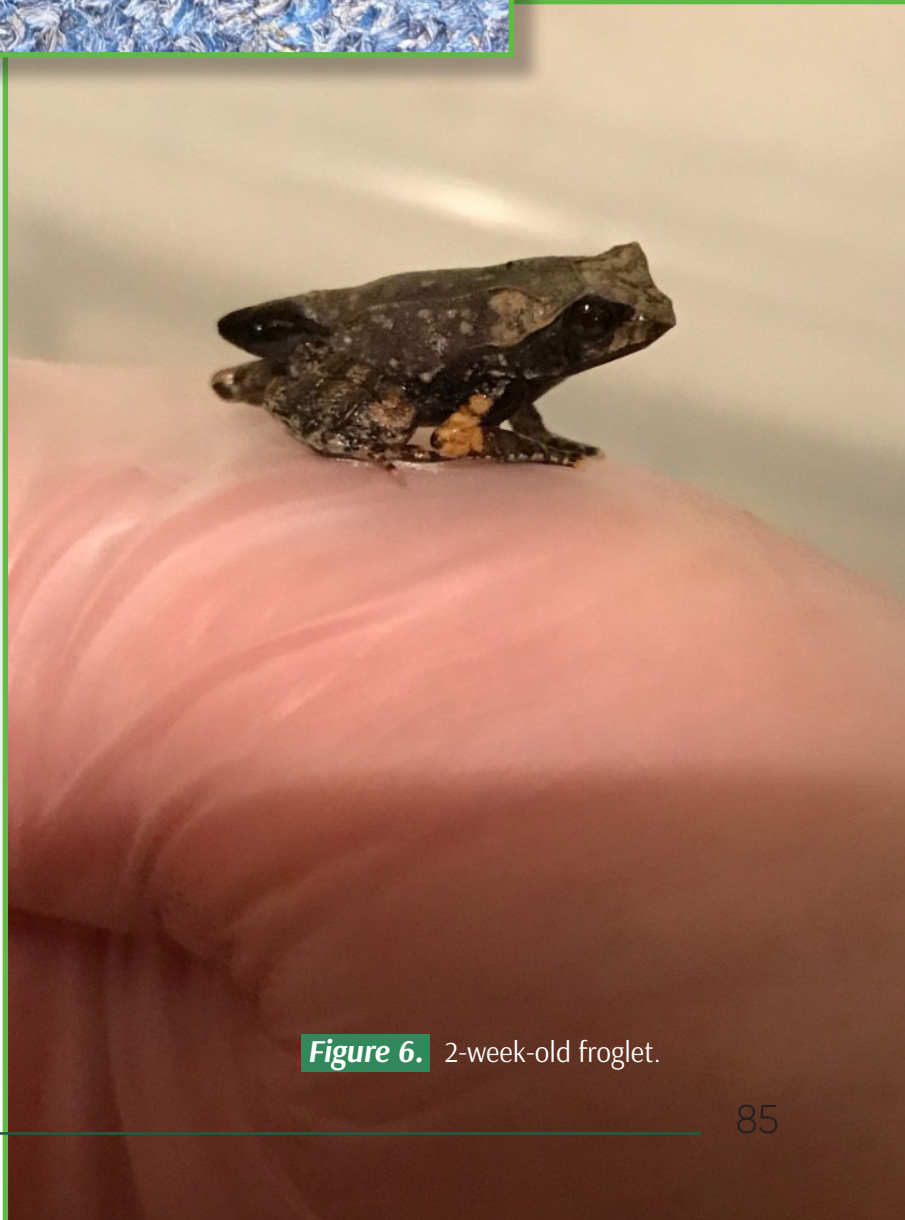


Figure 6. 2-week-old froglet.

Individuals that are Bd negative should now be wormed over a 7-day period. Various worming applications are widely available, but most are dangerously overpowering for amphibians. My preference is Levacol, a treatment that is fantastic for freshly imported species. Levacol is exceptionally easy to administer, using a pipet place 1 droplet of the solution on the back of the frog, the solution is quickly absorbed. This is a brilliant completely stress-free treatment.

After a week of treatment and extensive rehydration, finally the frogs can be introduced to food. By this time the frog will

have increased energy, therefore increasing the appetite. Feeding immediately on arrival causes added stress, and through past experiences I have found that this can be the fatal, causing significant fatalities.

Sexing *M. nasuta*

M. nasuta have always been known to be an easy species to sex and therefore sold as sexed pairs with very little hesitation. Breeding of the species is notoriously rarely heard of, and so makes you wonder if something is perhaps incorrect with this theory.

There are various localities of the species and I have found that males especially



Figure 7. An adult leaf frog in the terrarium.

vary in size. With some localities I have seen male specimens the size of females of other localities.

Typically, wild caught female *M. nasuta* range from 12–14 cm (4.72–5.51 in) snout to vent (SVL), with males anything from 5–10 cm (1.96–3.94 in).

When Indonesian shipments come in, I have found that both sexes are larger than that of its Malayan locality. I have seen Indonesian females as big as 16cm snout to vent! I believe that this misconception has allowed the species to be sold as sexed pairs, but actually small and large males. I have been working with the species for over a decade and have compiled some of these findings.

M. nasuta have a unique and distinctive vocalisation call sounding almost like the quack of a duck. It's a single note call that is unlike any other frog I have ever heard, in its own way its rather beautiful! The call is incredibly loud and is the main reason males are so easily collected for the pet trade.

Females do not call in anyway and so therefore are rarely captured unless there has been a storm, when females head out of the undergrowth and towards streams.

As stated previously females are substantially larger than the males, nearly 3 times the size, a very impressive specimen indeed. Due to the large size difference, Cannibalism is something that has been recorded in the past by fellow keepers in the industry. I wasn't convinced that this would be possible, until recently, when unfortunately, I witnessed this myself, as long as the females have been fed well the males should be safe!

Sexing captive bred specimens

Captive breeding of the species is rarely seen and so there is minimal information as to how to breed them successfully, let alone being able to sex froglets at such a small size.

Having successfully bred them over the years myself, I have established a simple and reliable method of sexing young individuals. I strongly believe this is possible within the first 2–3 months after morphing.

The width of the area just below the head is the key. With males it is much narrower, to that of a female where it is significantly wider. Proceeding towards the head, the width of the

head itself is much wider with males. There is a folded ridge separating the head and the body. Even with this, the head of a female is generally the same width as the body itself. As the female grows, the head is of such a size it frequently equates to the same size of an adult male!

There is no evidence at this time stating that a temperature difference of the water can affect the sexes of froglets produced. Going forward I plan to experiment with this with my next successful spawning. I will rear some at room temperature without any additional heating, and then also some with added heat at around +26 – +28 °C (78.8–82.4 °F).

It will also be interesting to find out whether the temperature variation affects the growth rate. With many other species it is well documented that the growth rate is significantly faster at higher temperatures. *M. nasuta* tadpoles can take as long as 12 months to fully morph, an unusually long time for a frog!

Conclusion

There are so many "ifs", "buts" and "maybes" with the species and frogs of Megophryidae family. I hope to have further findings to share in the years to come. My goal is to decrease the need for significant wild caught specimens, and increase the captive bred population throughout the industry.

I appreciate that this is very much a long-term goal, but in the short term I would really like to see importers, shops and hobbyists implement the methods suggested in this article. If the welfare of the species can be improved in all of these areas, I feel there is some real positivity for the species and also a chance many others can join me on this journey with enjoying and hopefully breeding this fantastic species.



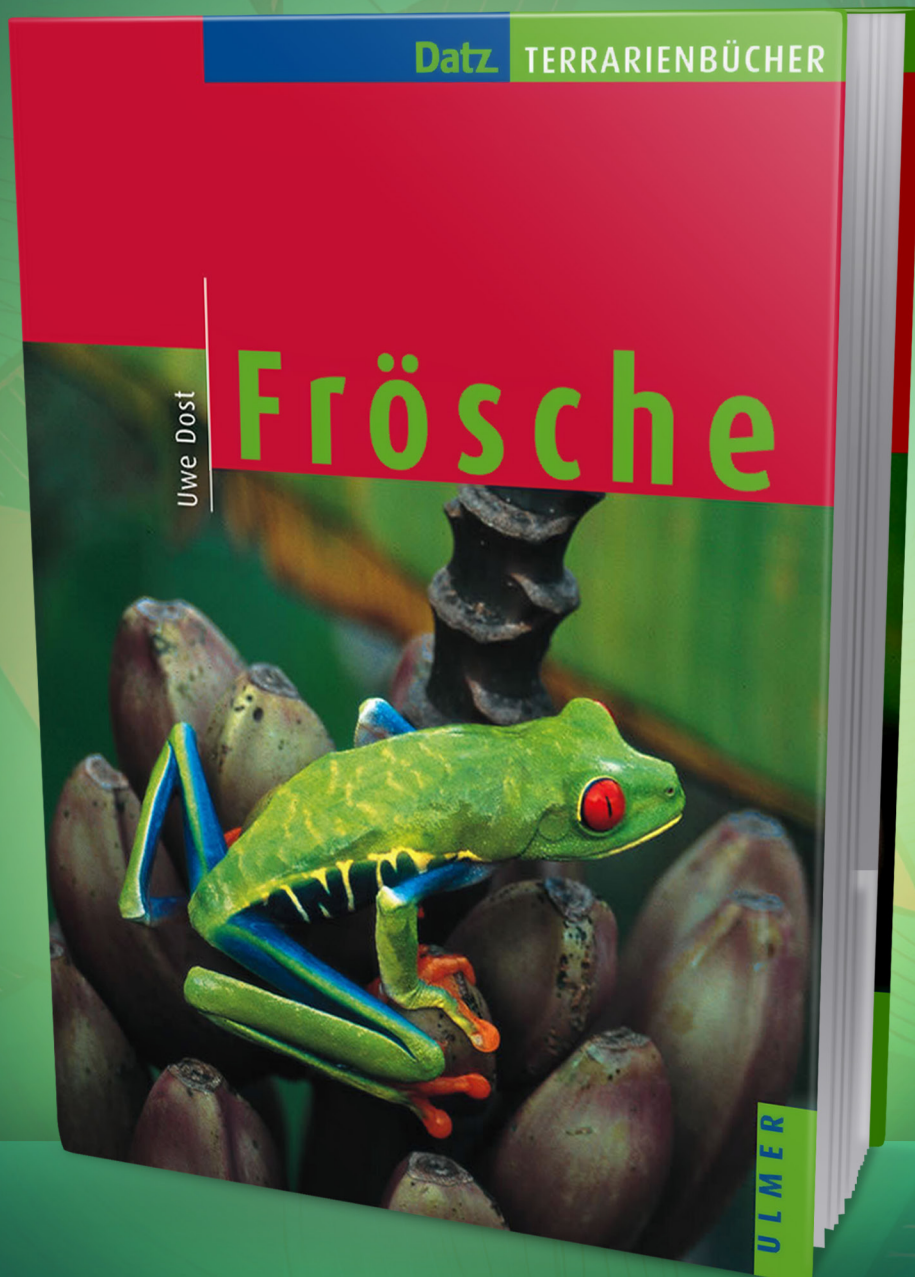


BOOK REVIEW

• Frösche

von Uwe Dost

/Frogs by Uwe Dost/



"Frogs" by Uwe Dost is an excellent book for anyone who is interested in keeping frogs or simply wants to learn more about these fascinating animals. With its clear language and helpful illustrations, it is a valuable companion for a journey into the world of amphibians.

Fascinating Amphibian World "Frogs" by Uwe Dost is a comprehensive guide for all terrarium enthusiasts who are interested in keeping frogs. It is also suitable for beginners. It offers a deep insight into the evolution of amphibians, their physique, senses, lifestyles and reproductive strategies. Particularly noteworthy are the detailed portraits of 16 frog species that are well suited for keeping in terrariums. The book not only passes on theoretical knowledge, but is also a practical guide.

It contains useful tips on setting up the terrarium, feeding them correctly, keeping them healthy and raising their offspring. The instructions are clear and easy to understand, making it an indispensable tool for anyone who wants to keep frogs in a terrarium. Readers can discover the variety of shapes, colors and lifestyles of the frogs presented in this book. It is an invitation to observe nature up close and understand how to care for these wonderful creatures in a species-appropriate way. Overall, "Frogs" by Uwe Dost is an excellent book for anyone who is interested in keeping frogs or simply wants to learn more about these fascinating animals. With its clear language and helpful illustrations, it is a valuable companion for a journey into the world of amphibians. Our editor recommends it from personal experience.



IN THE NAME OF THE OCEAN – PROTECTING SEA TURTLES TOGETHER WITH TURTLE FOUNDATION



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**All photos by Turtle Foundation unless otherwise stated*

Foreword

Sea turtles are undoubtedly some of the most charismatic reptiles with their outward appearance. Many people make their first contact with these curious creatures on vacation during a dive in the sea. The feeling of encountering a sea turtle underwater is indescribable for many people. Those who are particularly lucky, have even been able to observe the hatchlings on their dangerous journey into the ocean. Such moments will remain in the memory of many forever and are certainly a highlight of the vacation trip. However, what tends to fade into the background is the fact that these are highly endangered creatures that are dependent on our protection. It is precisely this task that the Turtle Foundation team has dedicated itself to, which Thomas Reischig reports on below.



Figure 1. Hatchling of a Green sea turtle (*Chelonia mydas* (Linnaeus, 1758)) shortly after leaving the beach. © Wouwsedivers.

About the founding of Turtle Foundation

During a diving vacation on the Indonesian island of Sangalaki, Swiss co-founders Christine and Frank Zindel witnessed the professionally organized overexploitation of green sea turtle nests. After watching the documentary "Hikers in the World's Oceans", which focused on these processes, they contacted the author Eberhard Meyer. Together with him and other members, they founded the "Turtle Foundation" in Germany in March 2000. Through intensive negotiations and public relations work, Turtle Foundation achieved the first collection quotas for turtle eggs on Sangalaki. From January 2002, a complete ban on egg collection was enforced there and a protection station was opened, which is monitored by local rangers. The rest is history.

Turtle Foundation now consists of seven national organizations that are recognized as non-profit organizations under national law. In addition to Germany, these are based in Switzerland, Liechtenstein, the USA, Indonesia, Cape Verde and the UK. Christine and Dr. Frank Zindel, Margrit Roduner Gabathuler, Martin Gabathuler, Lars Ölke as well as Reisa and Kevin Latorra are still active from the founding members or members of the early beginnings, both as board members and through active cooperation.



Figure 2. Logo of Turtle Foundation.

However, I would like to make special mention of Dr. Hiltrud Cordes, initially one of the founding members of the Board, now Managing Director of the Turtle Foundation Germany and cross-organizational Programme Director, who has helped shape the organization from the very beginning and today plays a key role in shaping its form and face.

The personal and financial commitment of these individuals, as well as the members who have since left the organization, in building up the young Turtle Foundation is incredible and a true example of how the dedication and



Figure 3. Sea turtles, here an adult Green sea turtle (*C. mydas*), are a highly endangered group of animals. © P. Minnasch.

commitment of individuals who are passionate about a good cause can create great things and bring about change.

After an intensive phase of organizational development a few years ago, we were able to open our first office in Cologne as an international office for the administrative activities of Turtle Foundation. In addition to the Managing Director, four other permanent employees work there in the areas of management assistance, fundraising and marketing and communication. The need for a good organizational structure and a dedicated team for the efficient management of complex projects cannot be overemphasized. In the project countries Indonesia and Cape Verde, there is a local office in Denpasar, Bali, and Sal Rei, Boa Vista, with a management team and permanent staff for the specific tasks. Special mention should of course be made of our rangers, who carry out the actual conservation work on the beaches in the projects.

Finally, I would like to mention our support association Turtle Foundation Friends, which, in addition to the activities of its members, lives above all through the commitment of board members Thorsten Hölser and Petra Minnasch. Our vision is a future in which sea turtles and their habitats are sustainably protected, healthy and safe from extinction and destruction. Our mission is to participate in the protection of sea turtles in our own

project areas by working with the local population to create a future in which both people and sea turtles have a secure livelihood.

Sea turtles within the project

Zoologically, the sea turtles represent a small group with only seven recent species within the group. They are largely adapted to life in the sea. They are divided into the leatherback sea turtles (*Dermochelyidae*) with only one species (*Dermochelys coriacea* (Vandelli, 1761)) and the hard-shelled sea turtles (*Cheloniidae*) with the remaining six species. Of these, two species live in limited geographical regions (Atlantic ridley sea turtle *Lepidochelys kempii* Garman, 1880: Gulf of Mexico and coastal waters of the US East Coast; barrier reef turtle *Natator depressus* (Garman, 1880): shelf waters between northern Australia and southern New Guinea). All other species, including the leatherback turtle, are found in all tropical and subtropical ocean regions, with the leatherback turtle even regularly occurring in temperate latitudes. All species are on the IUCN Red List with an endangered status of either Endangered, Critically Endangered or Threatened with extinction, except for the barrier reef turtle, for whose classification some necessary population data is still missing ("Data Deficient"), but which is also considered Endangered in Australia.



Figure 4. Youngster of a green sea turtle (*C.mydas*) swimming in the ocean. © P. Minnasch.

We focus on the following species in our projects.

Green sea turtle (*C. mydas*): Projects Berau and Sumatra (Indonesia) IUCN status: Endangered. The only species that prefers a vegetarian diet as an adult (seagrass, algae). In terms of average body size, the largest of the sea turtles with a hard shell. Formerly highly sought after for its meat and greenish fat (old German name "Suppenschildkröte", but this name is rarely used today); still hunted today in some

regions, although now officially banned almost everywhere.

Loggerhead sea turtle

(*Caretta caretta* (Linnaeus, 1758)): Project Boa Vista (Cape Verde) IUCN status: Vulnerable. The loggerhead sea turtle is sometimes referred to as the largest hard-shelled sea turtle instead of the green sea turtle, as one or a few specimens found may have been slightly larger than the largest green sea turtle ever measured. On average, however, it usually remains significantly smaller than this. Nevertheless, they are imposing animals, whose massive head is particularly striking (hence the English name "loggerhead"). This is mainly due to their pronounced jaw muscles, which are presumably an adaptation to their preferred diet of hard-shelled marine animals (mussels, snails, crabs). However, some populations also prefer to live pelagically, where they feed mainly on fish and cephalopods.

Hawksbill turtle (*Eretmochelys imbricata* (Linnaeus, 1766)): Anti-tortoise shell project, Indonesia IUCN status: Threatened with extinction. In addition to the "usual" threats to sea turtles from humans, the hawksbill turtle is hunted for its coveted turtle shell, which is why it is now one of the most endangered sea turtles. This "use" is now also banned almost everywhere, but is often little observed and enforced. This is also the case in Indonesia, where turtle shell products are often offered not only at markets but also online. The hawksbill turtle feeds to a large extent on fast-growing sponges and corals and therefore plays an important ecological role in the "maintenance" of coral reefs and the preservation of their biodiversity.

Leatherback turtle (*D. coriacea*): Project Sumatra IUCN status: Vulnerable. While the populations in the Atlantic are still relatively stable, the leatherback sea turtle has become very rare in the waters of the Indian and Pacific Oceans. The leatherback sea turtle is the largest living sea turtle, with one record find weighing in at around 907 kg. However,



Figure 5. Leatherback turtle (*D. coriacea*) after egg laying on Selaut Besar island, off west Sumatra. © Meriussoni Zai.

the majority of adult animals weigh between 300 and 650 kg, with carapace lengths of between 140 and 180 cm (55.12 – 70.86 in). The leatherback turtle mostly feeds on jellyfish, of which it has to consume large quantities, as these consist of around 98% water. It therefore plays a role in our fisheries that should not be underestimated, as jellyfish swarms influence fish stocks. The leatherback turtle holds the diving record of all sea turtles with proven diving depths of up to 1200 meters. Their ability to actively regulate their body temperature is also remarkable, which is why they can also venture into cooler marine areas.

Olive ridley turtles (*Lepidochelys olivacea* (Eschscholtz, 1829)) also nest sporadically on some of the beaches of our Sumatra project. Although they do not form the core of the project, we naturally also look after them there.s

Projects of Turtle Foundation

Project Berau (Indonesia)

This project in the province of East Kalimantan (Borneo Island) [district of Berau; archipelago consisting of 31 mangrove and coral islands, 4 of which are permanently inhabited] is one of our oldest projects (occasion of the founding of Turtle Foundation Germany on March 27, 2000) that has the green sea turtle as its target species. The largest nesting population of the green sea

turtle is in Indonesia, but possibly only a remnant of about 10% of the population size of 70 years ago. About 90 % of the nesting activity is on 5 coral islands of the archipelago (Sangalaki, Bilang-Bilangan, Mataha, Belambangan, Sambit). The endangerment is mainly due to the mass, sometimes complete collection of eggs, which was legal until the end of 2001 (despite a national ban as early as 1999, but the district government issued collection licenses for the highly organized egg trade until the end of 2001. These licenses were a significant source of income for the district government). After the ban, however, egg collection continued illegally wherever there was no active protection (yet). This began on the island of Sangalaki, where from January 2002 we ran a year-round protection station together with partners, from which rangers patrolled the island's beach several times a day with the permission of the local nature conservation authority. Expansion of the project to the islands of Bilang-Bilangan and Mataha in January 2008, Belambangan in March 2019 and Sambit in August 2020.

The project has a checkered history due to local politics. The conservation initiatives on all islands have since been taken over by other organizations, but we have been

active again on Bilang-Bilangan and Mataha since January 2023. Apart from the unclear status of Sambit, the islands of Sangalaki and Belambangan continue to be actively protected. This allows the clutches of around 15,000 nests per year on average to mature unaffected by poachers. In the time that we have been active on the islands, around 10 million hatchlings have reached the sea that would otherwise have ended up as eggs in the cooking pots.

Sumatra project (Indonesia)

The project targets several nesting beaches on the islands off the southwest coast and the mainland of Sumatra itself. The aim is to protect the leatherback turtle. The leatherback turtles that nest on and off Sumatra belong to a distinct population in the north-eastern part of the Indian Ocean, whose core nesting area is actually the Andaman and Nicobar Islands. Nevertheless, our research has shown that a larger proportion of the population also nests on/near Sumatra than previously assumed. Little is known about this population overall, but it is obvious that it is highly endangered due to the low numbers of individuals and the persistent persecution



Figure 6. Ranger team on Boa Vista, Cabo Verde, tagging a female loggerhead sea turtle. © T. Reischig.

by humans in many areas. In our project, we are working to protect the nesting beaches of this population in Sumatra. Unfortunately, both eggs and nesting animals are readily consumed by the local population. Before our research, some of these nesting beaches were unknown to anyone except the local population. The particular challenges in managing this project are the remoteness of the nesting beaches and sometimes, large distances from each other.

One of these islands (Selaut Besar) also has a remarkably large population of green sea turtles. A few unprotected beaches and islands are still on our list and can hopefully be integrated into the program soon. The leatherback turtles nesting on and off Sumatra belong to a distinct population in the north-eastern Indian Ocean, whose core nesting area is actually the Andaman and Nicobar Islands. However, our investigations have shown that a larger part of the population also nests on/off Sumatra than previously

assumed. Overall, little is known about this population, but due to the low number of individuals and the persistent human persecution in many areas, it is obvious that it is highly endangered. In our project, we are working to protect the nesting beaches of this population on Sumatra.

Project Boa Vista (Cape Verde)

Before Cape Verde was colonized by humans in the 15th century, loggerhead turtles probably nested almost undisturbed on the pristine sandy beaches of the archipelago in their tens of thousands every year. However, this changed in the course of Cape Verde's eventful settlement history. The population of the barren islands celebrated the start of the nesting season every year in mid-June, as this often meant the end of long periods of hunger. On the more densely populated islands, however, the turtles became increasingly rare, and only on the rather sparsely populated eastern islands, including Boa Vista, were



Figure 7. This leatherback turtle was fitted with a tracking device to obtain important research data. Euclides Resende (Executive Director of Fundação Tartaruga, Cabo Verde), and Program Director of Turtle Foundation Dr. Hiltrud Cordes.



Figure 8. Regular training with the conservation dogs is important to maintain their abilities. © T. Reischig.

there still significant nesting populations. Today, turtle meat is no longer a staple food for the poor and starving population, but an expensive delicacy that is traded at higher prices than ordinary foods, including meat. In some families, turtle meat is still a tradition, like the Christmas goose, which people do not necessarily want to be forbidden. Some poachers also like to be unbending. Interestingly, an important "clientele" are some Cape Verdean emigrants who simply want to be served the smell and taste of their past childhood in their old homeland in the form of turtle meat when they visit home.

As a result, the pressure on turtles has increased in recent decades, even on remote islands. On Boa Vista, a local organization counted around 1,200 slaughtered turtle carcasses on the island's beaches in 2007 alone, around a third of the nesting population of the same year. The threat to the survival of the population was obvious. The killing of turtles on Cape Verde has been officially banned since the 1990s, but was practically not prosecuted and has only been a real criminal offense since 2018.

The above-mentioned organization for research and protection of the loggerhead turtle on Boa Vista launched an international

call for help, to which Turtle Foundation responded and started its first small beach protection program on Boa Vista back in 2008. Since then, the project has been greatly expanded and we are currently protecting around 30 kilometers of beach in the north, northeast and southeast of the island through so-called "conventional beach patrols". During these patrols, teams of two rangers or one ranger and one volunteer are out on the beaches at night in two shifts. Any nesting turtles encountered are measured, tagged and guarded until their safe return to the sea, and all turtle nesting activity is counted and geolocated. There are two other organizations on the island, Cabo Verde Natura 2000 and BIOS.CV, who also do this on other beaches in the east of the island and with whom we work closely. Other beaches in the southwest are being monitored by a community-based project. This means that all of the island's important nesting beaches are now involved in active conservation programs.

Of course, these beach patrols have no real power against the poachers as they have no enforcement powers. But the poachers simply don't want to be seen, because poaching is now severely punished and we naturally report every new case to the police.

Therefore, the presence of the patrols on the beaches is usually enough to deter the poachers. The number of cases has been significantly reduced almost everywhere in the last 15 years or so. However, as mentioned above, there are still some persistent offenders and notorious consumers who do not want to give up their old habits. The beach patrols can of course also be outwitted, and there are sections of beach, particularly in the east of the island, that cannot be so closely guarded despite the high nesting density. The rate of female turtles killed while nesting on Boavista was therefore still around 4.5 % in 2017. In order to reduce this further, we launched a project in 2018 for alternative techniques to protect nesting sea turtles, from which our now internationally renowned dog and drone team emerged.

The project involves the use of conservation dogs and modern night-vision technology, consisting of drones with night-vision-capable thermal imaging cameras and night-vision binoculars. We use these as part of coordinated deployment concepts and strategies. Our aim is to deter poachers in advance and, if this is not enough, to support

the authorities in prosecuting them. The team does not operate in a vacuum, but sees itself as technical and personnel support for the nature conservation authorities and the police in the fight against poaching. Accordingly, many night missions are accompanied by police officers. Operations without police escort are also possible, but as our team cannot and may not take action itself in suspected cases, the police must then be called and directed to the scene of the crime.

All the above-mentioned active and repressive measures to combat illegal, nature-damaging behavior can only ever be a part of nature conservation work, as it can be assumed that the old conditions will return if the measures are relaxed or abandoned. Genuine sustainability can therefore only be achieved by changing the attitude of stakeholders towards nature conservation. This ranges from the local population, who live in, use and manage the affected natural areas, to the various levels of government. Social commitment is therefore an essential core of our work and requires long-term thinking and action.



Figure 9. The Dog and Drone Team on Boa Vista, Cabo Verde” © T. Reischig.

Cooperation with the local population for nest protection

An important factor is the training and recruitment of staff from the local population who are responsible for implementing the project objectives. These are mainly rangers who patrol the beaches and collect nesting data. In some cases, we have even succeeded in recruiting former egg collectors and turtle hunters as rangers, who naturally bring an enormous wealth of experience to our projects. Such conversions “from poachers to conservationists” are always a particular success for us.

But the work on the beaches also needs to be organized and coordinated. Here too, ideally people from the project areas are involved, but this is not always possible.

Of course, projects that offer people alternative income opportunities are always ideal, in order to make poaching for a living superfluous in the best case. One example of this is the TAMBRA women’s cooperative and the Tarafes workshop on Boa Vista. In the Banggai region of Sulawesi, Indonesia, we have helped a fishing village to optimize the cultivation and marketing of seaweed.

Accompanying programs that benefit people and raise awareness of their environment are also important. Here we like to mention our swimming project on Boa Vista, where children can learn to swim free of charge. It’s hard to believe, but many of them can’t do it properly, which means that serious accidents happen time and again. We help to prevent these and at the same time teach the children about the beauty of the sea and its inhabitants. Accompanying programs that benefit people and raise awareness of their environment are also important. Here we like to mention our swimming project on Boa Vista, where children can learn to swim free of charge. It’s hard to believe, but many of them can’t do it properly, which means that serious accidents happen time and again. We help to prevent these and at the same time teach the children about the beauty of the sea and its inhabitants. Other community projects include beach clean-ups and a new plastic recycling project on Boa Vista.

Environmental education

Environmental education is one of the most important pillars of sustainable nature



Figure 10. Portrait of an adult *E. imbricata*. © P. Minnasch.



Figure 11. Adolescent green sea turtle (*C. mydas*) resting in a coral reef in the Berau archipelago, east Borneo. © P. Minnasch.

conservation. Direct protection measures, such as beach patrols to protect against poachers, are only ever half the battle and are not sustainable if you have to assume that the exploitation of nature will start all over again if the intensity of the measure decreases or is even discontinued. Ultimately, people will only want to preserve or even actively protect what they know. Children naturally have a special role to play here, as they are the most likely to bring about changes in behavior and attitudes, but also have an influence on the behavior of their parents.

Environmental education therefore takes place at various levels, from presentations in schools to trade fair appearances such as last January at Boot in Düsseldorf.

Measures against turtle shell

The trade in turtle shell in particular has brought the hawksbill turtle to the brink of extinction. This is particularly true for Indonesia, which used to be an important source for exporting tons of tortoiseshell to Japan. While this export hardly plays a

role today, the trade in turtle shell products (jewelry, combs, etc.) is prohibited within the country, but is still widespread. It is still relatively easy to buy tortoiseshell products via the internet – and I am not referring to the darknet, but to established shopping platforms or social media marketplaces. In order to counteract the tortoiseshell trade in Indonesia, we launched a multi-point program in 2019 that works on various levels.

Targeted educational measures for various customer groups were designed to reduce the demand for turtle shell products. The focus was on a broad-based media campaign on radio, television and social media, which primarily addressed the emotional side of the problem (cruel killing of turtles, etc.). As part of this campaign, Kimi, our famous cartoon mascot, was born, who promotes the hawksbill turtle cause in a short-animated film, among other things. In addition, the supply of tortoiseshell products in Indonesia is to be reduced by identifying manufacturers, retailers and stores and first politely asking them to remove such products from their range; in the event of persistent refusal, charges will also

be brought. We have been able to achieve significant reductions in the online range of tortoiseshell products in particular.

We were also interested in the origin of the turtle shell: the aim was to find out where the tortoiseshell offered in Indonesia comes from. We found 10 hotspots. At one of them, in the Banggai region in Central Sulawesi, we even tried to start a protection project for hawksbill turtles. Unfortunately, it turned out that there were almost no more turtles there... Unfortunately, we were too late here. Unfortunately, setbacks cannot always be avoided and this experience reminds us of the urgency of our task to save Indonesia's remaining hawksbill turtles.

Previous successes

In all of our beach protection projects, poaching of turtles or their eggs has fallen drastically, in some cases to zero. We expect this to lead to a stabilization and recovery of the affected population, although this will only become visible after decades due to the long time it takes for sea turtles to reach sexual maturity.

Our community measures are very popular, but naturally their impact is the most difficult to measure directly. However, a social study we initiated on Boa Vista suggests that the measures have significantly changed the population's attitude towards the conservation measures. This is the only way to ensure the sustainability of the direct conservation measures.



Figure 12. Some divers with an adult Green sea turtle (*C. mydas*). © P. Minnasch.



Figure 13. Young sea turtles, in this case *C. caretta*, on their dangerous journey towards the ocean.



Figure 14. Sea turtles, here *C. mydas*, usually only come to the surface to catch their breath. © T. Reischig.



Figure 15. Measurements on *C. mydas* by the team on Selaut Besar island in the west of Sumatra.



Figure 16. Female of *C. mydas* on the beach on her way to lay her eggs on Mataha, Berau archipelago, east Borneo. © T. Reischig.



Figure 17. Many dangers lurk for young sea turtles, here *C. mydas*. © P. Minnasch.

Turtle Foundation has launched extensive environmental education programs to raise awareness of sea turtle conservation among the local population and the international community. Workshops, school visits and public campaigns are used to impart knowledge about the importance of turtle conservation.

In addition, Turtle Foundation conducts scientific research to learn more about sea turtle behavior, migration and threats. This data is crucial for the development of effective conservation measures. Turtle Foundation collaborates with other conservation organizations, universities and government agencies to advance sea turtle conservation globally and share knowledge. These successes show that Turtle Foundation is making a significant contribution to protection of sea turtles and their habitats.

Financing

Just over two thirds of our funds are raised through grant-making foundations, i.e. national and international organizations that finance nature conservation projects. The rest comes mainly from public donors, companies and private donations. Further income comes from donations from our Friends' Association, our web store and also fines distributed to non-profit organizations. The area of private donations in particular is on the increase, despite all the difficulties of recent years, which is particularly pleasing for

us not only because of the funds raised, but also because it shows people's commitment to nature conservation issues.

Our German-based support association "Turtle Foundation Friends e. V." currently has around 150 members who support the work of the Turtle Foundation through their membership fees. This annual contribution is particularly valuable to us due to its reliability and regularity. However, many members also play an active role, for example by looking after information stands. We are very happy about every new member; you will find all the necessary information on our website under "Take action"!

Threats

Until relatively recently, the main threat to sea turtles was the mass exploitation of the animals for their meat, eggs or shells. For many coastal peoples, sea turtles have always played a major role in their culture as well as in their food supply. However, this was not a substantial threat to the animals until the seafaring era and the later onset of the industrial revolution. It is estimated that a few hundred years ago there were as many green sea turtles living in the oceans as there were people on land, i.e. around one billion. However, seafarers then mainly used green sea turtles in very large quantities as provisions, and in the meantime the number of people increased everywhere, and the industrial revolution created further demand but also further access to sea turtles as a food resource. Since then, the number of sea turtles worldwide has declined drastically, and some populations have even died out completely.

However, new threats have also emerged, such as the development of nesting beaches, which is not only problematic due to the destruction of these beaches, but also due to artificial light. Turtles usually nest at night and use the fact that the horizon over the sea is normally brighter than over the mainland for orientation. This is the only way they can find their way back to the safety of the ocean after nesting. Artificial lighting, however, changes this situation into the opposite, and so the turtles run away from the sea and thus to their certain death.

The same applies to the newly hatched hatchlings; instead of finding their way straight to the sea, they languish in the heat of the day or fall prey to diurnal predators. Here, of course, it would be particularly important to protect the sea turtle nesting beaches from further development. Where this is not possible or development already exists, special measures can make the existing lighting turtle-friendly and thus largely prevent disorientation. In the USA, for example, there are exemplary and strict regulations for this, but in many other parts of the world, far too little attention is paid to this fact. We also have this problem on Bia Vista with a large hotel complex belonging to a well-known travel company, which is why we have to relocate all new nests in the vicinity of the hotel to a hatchery.

Another very significant and relatively new problem is the massive bycatch of sea turtles in fisheries, especially large industrial fisheries. Thousands of sea turtles die every year on longlines or in trawl nets. Set nets, in which the animals become entangled and drown, are also very problematic. In addition, hundreds of kilometers of torn or discarded nets drift through the oceans for years as "ghost nets" and are death traps for sea turtles and many other sea creatures.

In the last few decades, the pollution of the oceans with plastic waste has increased exponentially. Especially on Boa Vista, where I often visit for work, I cry every time I see how these wonderful beaches are covered in plastic. Plastic harms the sea turtles in many ways. Ingested pieces clog the gastrointestinal tract and often lead to an agonizing death. The garbage on the beaches has a negative impact on nesting behavior, but also on the development of the embryos in the eggs. Hatchlings become entangled in plastic waste etc.

The effects of climate change, some of which are already being felt, are not yet foreseeable but could be catastrophic. The sex of the animals is not determined by sex chromosomes, but by the average nest temperature in a sensitive phase of embryonic development. If this is too high, too few or no males hatch, and the hatching

success (hatched young per quantity of eggs) also decreases. In summary, it can be said that the problem of the direct stalking of turtles and their eggs has been practically solved for many populations, or at least is no longer the main threat. This is the result of the tireless, sometimes decades-long efforts of numerous committed conservationists and nature conservation organizations. In some projects that have been running for decades, an increase in population sizes can even be observed again; exemplary results of successful nature conservation.

In light of the new threats mentioned above, however, this almost seems like the easier part, as these new threats are much more difficult to combat. Nevertheless, our work will have been in vain if we do not succeed, and so we must adapt to the new challenges.

Forms of support

First and foremost, you can make a donation, become a member, sponsor a child or organize a fundraising campaign. Volunteer at one of our beach camps on Boa Vista!

Avoid plastic waste wherever possible.

If you are on vacation at sea turtle nesting beaches, please avoid visiting the animals on your own. The animals are very sensitive to disturbance. Join a professionally guided turtle watching tour.

When traveling to the tropics, never buy tortoiseshell products that may be offered to you at markets or by hawkers. This seems obvious to us, but sometimes even genuine tortoiseshell products are passed off as imitations to tourists, as the traders are already familiar with critical questions from tourists, especially Western tourists. Just don't buy anything that looks like turtle shell. At best, professionally guided turtle watching tours offer a valuable source of income for the local population without harming the turtles, which we approve of. Unfortunately, there are always a few black sheep here too; the tours are often overcrowded, white light is used (only dimmed red light may be used near the turtles), the animals are pushed too close, tourists are allowed to ride on the turtles, etc. Do not take part in any tours that are obviously run in this way, or leave the tour under protest if you witness such harmful practices.

If you are diving and are lucky enough to see sea turtles, please do not disturb them, but you are probably already aware of this. On Boa Vista, we run a volunteer program in which volunteers can participate directly in our conservation program for two weeks or several months, usually between July and September. Based in beach camps, they go on patrol every night together with experienced rangers. Almost every time, turtles are found nesting, measured, tagged and protected until they have safely reached the sea again. Apply on our website; many call it "The summer of your life"!

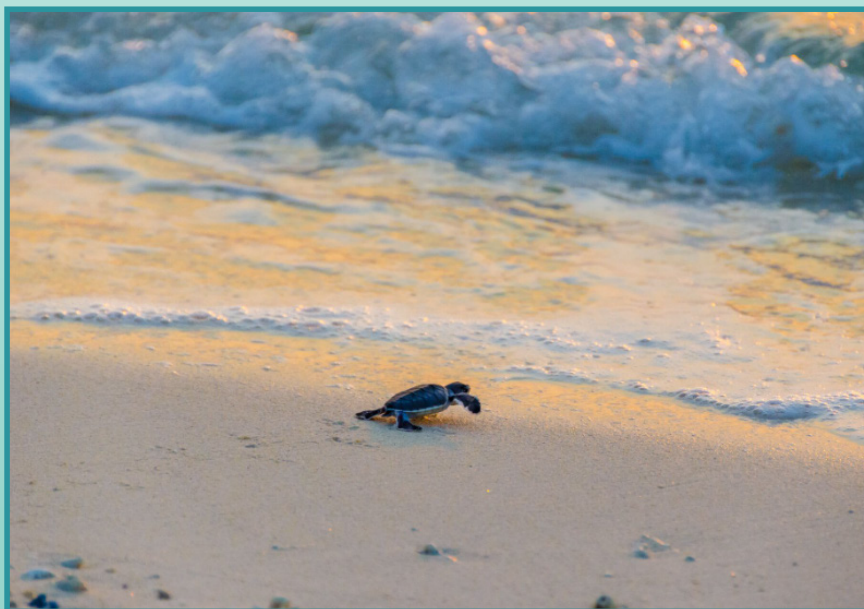


Figure 18. The surf is also very dangerous for the little survival artists and requires a lot of strength.



Future and goals

Turtle Foundation has grown considerably in recent years, both in the number and complexity of our projects and in our organizational structure. One of our most important short-term goals is therefore to consolidate ourselves in order to ensure the sustainability of our projects. Projects in organizations often grow faster than the ability to manage them well, which can be very dangerous and something we want to avoid at all costs. Nevertheless, there will be some innovations:

- off and on Sumatra there are some newly discovered unprotected nesting beaches of the very rare leatherback turtle there, which we want to integrate into our conservation program as soon as possible;
- in Indonesia, a major project is currently underway to strengthen the organizational structure of the local organization, including the standardized training of rangers and the general transfer of knowledge in this area.
- in Boavista, a project for the production and local marketing of products made from recycled plastic called Lixu Limpo is being launched, in which suppliers of recyclable used plastic are rewarded via an app-controlled system.



Figure 19. The author Thomas Reischig.

My name is Thomas Reischig. During my diploma thesis in Regensburg, my doctoral thesis in Regensburg and Marburg, and my time as a research assistant at the Institute of Zoology at the University of Göttingen, I worked on neurobiological issues in insects. This phase lasted until 2010, when I started looking for new challenges. I was involved in documentary film projects in Indonesia and also started working for Turtle Foundation at this time. What began as a part-time job with a focus on data analysis soon developed into a full-time position in which I took on numerous administrative and project management tasks in addition to processing and analyzing the nesting data from our projects. With the increasing professionalization of our organization in the administrative area, permanent specialists are now taking over these tasks, so that I can now concentrate more on project-related and scientific tasks.



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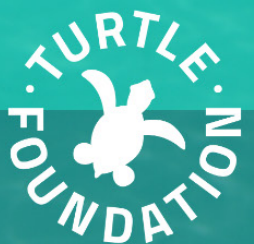


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I N SEARCH OF GUATEMALA'S PALM VIPERS



Author(s): **René Villanueva Maldonado**, Artist and Herpetologist
(www.historianatvrae.com.), Mexico

Guatemala is a country with a very high diversity of herpetofauna. Just speaking of reptiles, it has about 386 species, which makes it a megadiverse country for this group of vertebrates, particularly in proportion to the size of the territory it has. This diversity is explained by the geographical position in which the country is located, as well as by its intricate topography and climatic diversity.

Guatemala has mountain ranges, plateaus and a lot of volcanic activity, which gives it optimal properties to have a mosaic of ecosystems full of biodiversity. From coastal plains, high mountain peaks, lava spills, pine and oak forests, cloud forests, humid tropical forests and semi-desert shrublands with low deciduous forests, Guatemala is undoubtedly an evolutionary and biogeographic laboratory for biodiversity. Among some of the most striking and enigmatic species that any herpetologist or naturalist wants to observe, are the palm vipers, locally called "Gushnayeras" due to their close association with palms that receive the same name.

The genus *Bothriechis*

The genus *Bothriechis* constitutes a group of mostly green tree snakes, however some others such as *Bothriechis nigroadspersus*

(Steindachner, 1870) or *Bothriechis supraciliaris* (Taylor, 1954), as well as the rest of the *Bothriechis schlegelii* complex, present enormous chromatic variability. They are from the family Viperidae, and from the subfamily Crotalinae, the real pit vipers, characterized by having a solenoglyph dentition, teeth



Figure 1. One of my records of *Bothriechis aurifer*.

articulated by the maxillary bone and with long retractable fangs that project forward during the biting process. These are venomous animals with mainly hemotoxic and cytotoxic toxins. *Bothriechis* are medium to small sized snakes measuring between 50 cm (19.68 in) and 100 cm (39.37 in), which inhabit cloud forests and tropical rainforests in Central and northwestern South America. They are arboreal animals, well adapted to life in trees, with thin, muscular bodies and prehensile tails. Like the rest of the crotalines, they have thermoreceptor pits located between the nostrils and the eye. Their diet consists of frogs and lizards when they are juveniles, adding small mammals and birds when they are adults. They can often be seen carrying subdermal parasites associated with feeding on frogs.

There are two main clades of snakes belonging to this genus.

The *Bothriechis schlegelli* complex has 10 species in total, distributed mainly in South America, 3 of which are found in Central America and reach their distribution as far as Mexico. And then there are *Bothriechis* nested in a Mesoamerican clade, which are found from Panama to northern Mexico.

The latter are little variable compared to the *Bothriechis schlegelli* complex, and have the following species:

- *Bothriechis rowleyi* (Bogert, 1968): Oaxaca and Chiapas, Mexico;
- *Bothriechis aurifer* (Salvin, 1860): Chiapas and Guatemala;
- *Bothriechis bicolor* (Bocourt, 1868): Chiapas and Guatemala;



Figure 2. *B. aurifer*.



Figure 3. Catching *B. aurifer*.

- *Bothriechis thalassinus* Campbell & Smith, 2000: Guatemala, Honduras and possibly El Salvador;
- *Bothriechis guifarroi* Townsend, Medina-Flores, Wilson, Jadin & Austin, 2013: Honduras;
- *Bothriechis nigroviridis* Peters, 1859: Costa Rica and Panama;
- *Bothriechis nubestris* Doan, Mason, Castoe, Sasa & Parkinson, 2016: Costa Rica;
- *Bothriechis marchi* (Barbour & Loveridge, 1929): Guatemala and Honduras;
- *Bothriechis lateralis* Peters, 1862: Costa Rica and Panama.

Five species of *Bothriechis* are distributed in Guatemala. Despite the size of Guatemala, it is a great effort to reach all the territories where the *Bothriechis* live, since often the distances are long and the sites are somewhat inhospitable, they are found in private places, or in indigenous territories.



Figure 4 *B. aurifer* (photo by César Barrio-Amorós).

Bothriechis aurifer

It is a snake that measures between 60 cm (23.62 in) and 100 cm (39.37 in), is lemon green in color and has a black rhombus or zigzag pattern on the back. Inside the rhombuses it has a bright yellow color, although the presence and intensity of this pattern can vary from great intensity, to looking washed out, to being completely lost in some specimens. The head is prominent, lance-shaped, with well-marked black post-ocular lines, bordered on the upper part with a yellow stripe. Females are larger and more robust than males, with the head wider at the base, while males have a slightly narrower head, and the body is more slender. The tail is usually blue or yellowish, with a zigzag pattern. This species lives in mesophilic and pine-oak forests, with high humidity, at altitudes ranging from 1,200 to 2,000 meters above sea level, and with temperate and cool temperatures, with constant precipitation. It is usually associated

with the mythical and spectacular birds known as the Quetzal (*Pharomachrus mocinno* La Llave, 1832). It is distributed in the south of Chiapas, in some high parts of the Lacandon jungle, Montebello lagoons, and the Tojolabal mountain range, while in Guatemala it is found in the Cuchumatanes mountain range, in the Minas mountain range, quetzal biotope, high and low Verapaz. They are nocturnal, although they can sometimes be seen resting during the day in palms, tree ferns and small bushes. They are arboreal, and although they can be found at a height ranging from the ground to 50 cm (19.68 in), they can climb to the canopy of trees, although this part of their life is very little known.

This species was always a mythological animal for me, a very beautiful viper that I used to see in books and in some rare photographs on the internet. Without a doubt this snake is portentous and magnificent, I never imagined that the day would come when I would see it in its habitat.



Figure 5. Typical habitat of *Bothriechis*.

Although this species lives in Mexico, the country where I am from, currently this species is a ghost, it has disappeared from many places where it was originally found due to the destruction of its habitat, and the few places where it remains are very remote, with social and political problems and with very secretive indigenous communities, making it an extremely difficult species to reach, added to the fact that it is already recorded to be very rare.

On the other hand, for a long time, although this species was better known in Guatemala, it was not a common animal that was known to be sighted very often. However, recently populations in a very good state of conservation of this species were revealed within small private reserves, which is why, suddenly and even more so with the massive use of social networks, populations in good condition were revealed. of the species, so in a short time it became one of the most photographed.

My first contact with this species was in 2018, during an expedition through Chiapas and Guatemala, filming documentaries. Just looking for it was a dream for me, and this expedition began with the renowned nature photographer Andrés Novales, who is widely experienced in searching and tracking these animals in Guatemala. It all started by heading to one of the most extraordinary places possible, a cloud forest at 1,500 meters above sea level where quetzals thrive in a magic place where tree ferns dominate the landscape, giving it the appearance of a Jurassic forest. That's right, the search for this species is carried out in an authentic natural paradise, a cold forest where the rain almost does not stop and where staying dry is an impossible challenge to achieve. We arrived in Baja Verapaz, where Andrés Novales welcomed us and immediately said, let's go look for them!

I didn't even settle on where I was going to sleep, the only thing I was interested in was knowing if that dream animal was real.

We began by going into a steep mountain in the middle of the night, where the water ran down like a stream due to the constant rain that fell on us. Almost crawling, it didn't take long, when Andrés shouted: *Bothriechis*!!

At that moment I couldn't believe it, I quickly turned to a small fern about 40 cm (15.74 in) from the ground, and indeed, a beautiful and sparkling *Bothriechis* was revealed before my eyes, illuminated by my flashlight. With my glove I went to take it. In my hands was one of the most desired animals of my entire life, finally in front of me. An animal that, as I will describe later, became one of the emblems of my life. Shortly after, other additional specimens appeared. We saw 3 in total on that trip, and the whole point was that Andrés already knew very well the habits of these snakes and the places they frequented. The following year I decided to return to Guatemala, this time with a course on tree canopy exploration that I taught for the same *Bothriechis* reserve. And it was great, on that trip we were able to observe a total of 9 individuals, which were also already being part of a monitoring program supported by several zoos in the United States. So we had the opportunity to contribute great conservation work, where we implanted microchips and took records of the animals that were within the monitoring program. We also coincided with the presence of the BBC naturalist presenter Nigel Marven, who was in search of this snake, and with whom we were able to share the search for this wonderful animal.

In subsequent years I continued going to see this snake, always aware of the progress and achievements that the reserve was making to protect the forest and this mythical animal.

On the Natvrae History channel you can see the documentary we made about this species: <https://www.youtube.com/watch?v=dk-O6u8m3sA&t=652s>

Bothriechis thalassinus

It is a snake that measures between 60 cm (23.62 in) and 100 cm (39.37 in), yellowish green in color combined with striations and amorphous patterns of intense blue color that tend to turn gray with age. It is common for this species to present some naturally turquoise blue specimens. It usually has a blue post-ocular line. This species is very physically

similar to *B. marchi* and *B. bicolor*, especially to populations from the Sierra Madre of Chiapas, Mexico.

B. thalassinus is found distributed along the foothills of the Sierra del Merendón, Sierra Caral, and other mountain ranges in Guatemala and Honduras. It lives in high tropical jungles and cloud forests, between 500 and 1000 meters above sea level, in penumbra forests with tropical temperatures and high precipitation. This species was described in 2000 by Jonathan Campbell and Eric Smith.

In 2021, I carried out an expedition with Cesar Barrio-Amorós, Andrés Novales, Gerardo Ramos and Diego Ugalde, through Guatemala, where the possibility of visiting a coffee farm where this species was well known unexpectedly arose. It should be noted that almost all the access to the mountains that have the species are private properties, so it is practically inaccessible unless you have contact with one of the owners of the land, which was our case: a friend of Andrés Novales: Cristian Chinchilla, received us at the farm, where we camped for a few nights. The

site was an agricultural coffee and banana plantation, subjected to a significant amount of agrochemicals, however it seemed like it would be a promising place to see reptiles and amphibians.

Unfortunately that was not the case, it was one of the emptiest places of fauna in general that I have ever seen in my life. For days and nights we were searching a trail along which a local led us. Hours and hours of rain and extensive walks. However, we knew that this species was one of the most difficult and rare among the snakes of the *Bothriechis* genus, one of the species with the fewest records.

The entire team split up, we searched in small streams, a common place to see *Bothriechis* in the vegetation, on the banks, but nothing. It was the last day, something like 3 am in the morning, when we were exhausted from having seen nothing more than a very common snake called *Imantodes cenchoa* (Linnaeus, 1758), a snake that, although it is pretty, is frankly disappointing to me when one makes such a great effort. to reach such remote places.



Figure 5. *B. thalassinus* (photo by César Barrio-Amorós).



Figure 5. Taking photos of our probably most valuable find – *B. thalassinus*.

I was walking back with Andrés Novales along the trail, already waiting to meet with the rest of the team to take the road back to the camp. At that point I remember that there was a small deviation, a small ravine, and Andrés said, - I'm going to go down and check it out. I, already tired and discouraged, let him go down and didn't pay much attention. At most 30 seconds had passed when I heard a loud scream saying: AQUÍ CABRONES!!!!!! At that moment, I had a rush of adrenaline and fatigue, I went into an explosion of energy, I ran and threw myself as best I could through the ravine, when I saw Andrés pointing at a flashlight on one of the walls of the ravine, at a small twig near the ground. There he was, a

big female of *B. thalassinus*!!! One of the rarest *Bothriechis* and the most elusive snakes in America.

A wave of screams began! *Bothriechis*! *Bothriechis*!! And from the depths of the jungle the other companions that we thought were lost began to arrive. We were all dazzled by the discovery of this animal. The snake was kept for a while in order to film and photograph it the next day. Satisfied and exhausted, we considered the mission accomplished.

Some of this film material can be seen on the YouTube channel: <https://www.youtube.com/watch?v=ilGbkD-5T-M&t=2s>



Figure 6. Habitat of *B. bicolor*.



Figure 7. *B. bicolor* (photo by César Barrio-Amorós).

Bothriechis bicolor

It is a somewhat variable snake, with two main morphs; the morph of the Sierra Madre of Chiapas, which is green and blue, a true spectacle. This morph is only found in Mexico. The other morph is a uniform green color, and we find this south of Chiapas in the Tacaná volcano and in the volcanic mountain range that runs along the Pacific side of Guatemala. This Pacific side constitutes a massif of volcanoes, many of them active. The habitat of this species ranges from humid tropical forests to cloud forest, from 500 meters above sea level to 1000 meters and a little more. It is a snake that reaches 100 cm (39.37 in) in length, which has small scales on its head.

In 2021, together with my friends Cesar Barrio-Amorós, Andrés Novales, Diego Ugalde and Gerardo Ramos, I undertook the mission of finding this species in a beautiful lodge dedicated to bird watching called Los Tarrales. This site, in addition to having beautiful facilities, is one of the best in Guatemala to observe the rare Horned Pavo, or Pavo de cacho *Oreophaps derbianus* G.R.Gray, 1844, a rare and elusive member of the Cracidae family. In this place it is also possible to see the Mesoamerican Quetzal *P. mocinno*.

We arrived at this place at night, ready to settle into the comfortable rooms that this place offers. As soon as we got the equipment down, we set out to do a search that night in the vicinity of the Lodge. That day the search was not very fruitful, some frogs, and a small snail snake of the genus *Tropidodipsas*, but not much else.

Bothriechis are nocturnal, so there was little to do during the day. However, at dusk the next day, we prepared to venture into a much higher area, a remote and wild site that was quite inaccessible, where we could barely pass with the 4x4 truck.

As soon as we reached the point where we would start the search, we divided into two

teams. The weather was quite cool, with fog and some constant drizzle. It was a site quite altered by coffee crops and deforestation. We were able to locate some frogs of the genus *Plectrohyla* next to a stream, and soon at a nearby site a black-eyed tree frog *Agalychnis moreletii* (Duméril, 1853), a very striking species of frog that can glide and has a quite impressive size. In the background you could hear the rumblings of volcanoes erupting, followed by fiery lava spills that illuminated the horizon. Without a doubt a very interesting experience. We walked for several hours, almost until 4 am in the morning without success, and finally after enormous frustration because we knew that there would be no other opportunity to look for her because the next day we were leaving the place, we began the walk back to the truck.

When we were returning to the truck, Andrés and Diego appeared in the darkness, who had separated, and asked us how it went. Disappointed we said, too bad, we didn't see anything worthwhile. And they, in a somewhat suspicious way, told us, we didn't get anything either, just an ugly snake... so Diego showed us a small cloth sack and gave it to us, knowing that, despite the disappointing expectation, we would just open it. to find out what species it was. So we opened it, and immediately realized he was ripping us off. IT WAS AN ADULT *BOTHRIECHIS BICOLOR*! From that moment on everything was screams of excitement and euphoria! We had the goal! Mission accomplished!

We kept that snake to take photos and videos the next day. She was an exceptional female of approximately 80 cm (31.49 in), of a uniform green color, with some flashes of blue between the scales.

This snake appears on the YouTube channel at the link <https://www.youtube.com/watch?v=tomSgxokJqc&t=705s>



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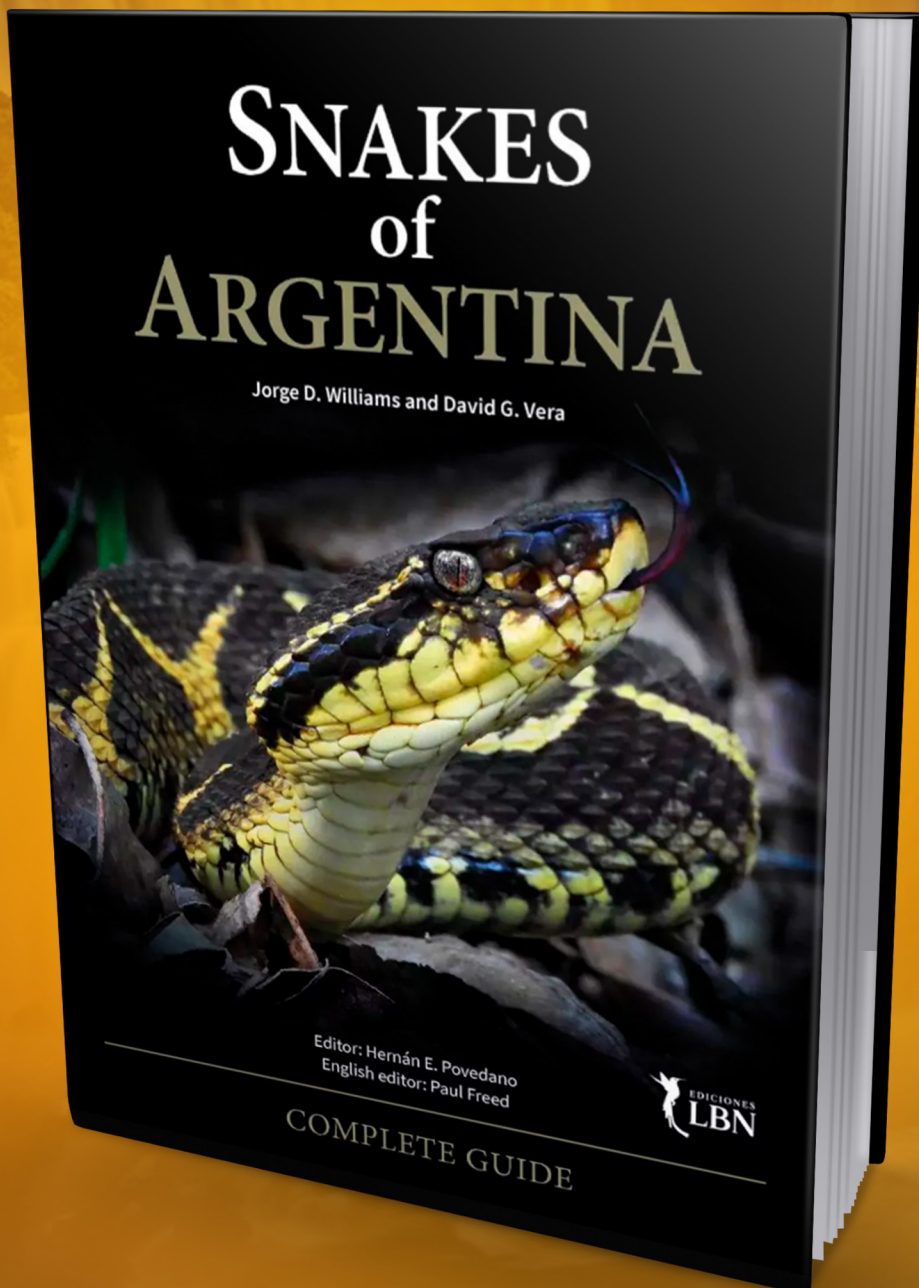
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BOOK REVIEW

• SNAKES OF ARGENTINA

by Jorge D. Williams & David G. Vera





**536 colour photos, b/w illustrations,
140 colour distribution maps!**

Argentina is a huge country of 2.78 M km², with a lot of different bioregions, from subtropical in the north to subantarctic in the south, including vast plain extensions (Chaco, Pampa and Patagonia) and the highest peaks of the Andes (Aconcagua). With almost 47 M, Argentina is the third Spanish speaking country in population. Despite its large size and different regions, the snake fauna is not well known, and for many years a book like this was anticipated. This volume starts with an introduction, a chapter on the Ecoregions of Argentina, Generalities of Snakes, little chapters on Origin and evolution, shedding, feeding, reproduction, and an appropriate chapter on venom and envenomation in the country. Then the accounts of every known species in the country (130), starting with Typhlopidae (1 sp), Leptotyphlopidae (7 sp), Anomalepididae (2 sp), Boidae (4 sp), Viperidae (10 sp), Elapidae (8 sp), Colubridae (8 sp), Dipsadidae (86 sp). Every account includes the scientific name, English and Spanish common names, a quick identification text, also about habits and feeding, reproduction and potential danger for humans. Also treats the conservation issues and some taxonomic notes. The distribution is commented and a map is shown. Probably the most outstanding feature is the amount and great quality of pictures of every species. The book ends with a glossary for terms, an index of common and scientific names and a list of references. In general the book is well structured, with a comfortable size of 24 x 17 cm, and not very heavy. Without doubt, an essential book for your library if you are minimally interested in Neotropical or American snakes or reptiles in general.

Jorge D. Williams and David. G. Vera. 2023. Ediciones LBN, Buenos Aires; 351 p.

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Author(s): **Laura Addy**, Contributing Editor, RHJ, Australia

A wild juvenile Yellow-spotted Monitor (*Varanus panoptes* Storr, 1980) was brought into the Jindalee (Brisbane, Queensland) clinic of the Unusual Pet Vets after being attacked by a pet dog.

Yellow-spotted Monitors, also known as Argus Monitors, are large varanids (growing to a total of around 1,2 m (47.24 in)) that can be found in the arid regions of Western Australia and the northern tropical areas of Western Australia, the Northern Territory, and Queensland. Primarily terrestrial in nature, they feed on insects and a wide variety of small vertebrates: including reptiles, birds, and small mammals.

The juvenile monitor presented with cuts and injuries on the right side of the abdomen that had perforated the coelomic cavity (the main internal section of the body that holds the internal organs and contains the gastrointestinal tract). Whilst the extent of the injuries was unclear at the time, there was no hiding what was happening – every



©Jesse Campbell

Figure 1. *V. panoptes* (photo credit: Jesse Campbell).

breath the Yellow-spotted Monitor took distended and extended the abdomen in areas where it should not – with the poor animal blowing up like a balloon!

Despite initial efforts to draw the air out from the coelomic cavity the inflation persisted: the treating veterinarian, Dr Joshua Llinas, then began to hypothesise that there were also internal injuries to the lung, ribs, and surrounding body wall tissues – all of which had combined to cause a pneumocoelom. A pneumocoelom occurs when air is dispersed into the coelomic cavity. If left untreated it can be fatal. The air was also leaking out from the coelomic cavity and migrating under the skin – resulting in a condition called subcutaneous emphysema. After the initial consult, the monitor was sedated to facilitate X-rays to determine the magnitude of the injuries. The subsequent course of action was surgery. Dr Llinas conducted a cranial lateral coeliotomy – which is a complicated way of saying he made an incision to access the abdominal cavity. The process involved maneuvering through the hole to the lungs, then isolating the holes responsible for the leaking air by utilizing positive pressure ventilation (pushing air into the lungs) and a small amount of saline solution: the saline provided enough liquid to see the air bubbling out from the ruptures in the surface of the lung. After suturing the holes shut, the team collected tissue samples from the surrounding areas to check for the initial signs of infection, after which the entire region was flushed with saline. With the ruptures repaired all that was left to do was close the initial surgical incision and wake the monitor up.

The day following the surgery the monitor was entrusted to the care of Reptile Rehabilitation Queensland Inc., a volunteer-run organization dedicated to the rescue and rehabilitation of native reptiles and amphibians. Wildlife rehabilitators and rescuers play a pivotal role in reducing the number of deaths of wildlife by dedicating their time, knowledge, and houses to caring for injured or sick animals before (hopefully) re-releasing them back into the wild. While the monitor settled into its new temporary home the volunteers were responsible for feeding, giving pain medication antibiotics, wound care and sanitization, and observing the overall daily progress. Even with

this specialized care the path to freedom was not direct: within the first few days of arriving the carers noticed unusual areas of blood and lymph fluid leaking from previously unaffected areas of the animals back. After ascertaining that there was nothing in the enclosure that could have contributed to these new wounds, the reptile rehabilitators returned the monitor to Dr Llinas at The Unusual Pet Vets to check it over. Upon examining it, Dr Llinas concluded that no further intervention was required and that the wounds would heal by themselves. Volunteers postulated that the subsequent injuries had either come from the animal biting itself due to the initial trauma of the wounds, or that there had been more damage under the skin than had been first thought. Luckily, Dr Llinas was correct and the injuries healed quickly without further treatment. The juvenile monitor shed approximately one week later which saved the need to remove the sutures from the initial operation as they came out with the old skin. The amazing carers at Reptile Rehabilitation Queensland kept the monitor for 35 days, during which they continuously checked on its progress. This story has a happy ending as the monitor then was released into a dedicated wildlife corridor approximately 120m from where it was initially found – although this time it was a safe distance away from any dogs!

A probing *Pogona* problem

One of the most common reptiles that The Unusual Pet Vets encounter is the Central Bearded Dragon (*Pogona vitticeps* Ahl, 1926), which is consistently one of the most popular reptilian pets available in Australia and around the world. This particular case is about a Central Bearded Dragon called Maple and her audacious attempt to eat equipment.

Maple's careful caregivers had setup her enclosure with all of the things a good bearded dragon enclosure should have: various decor, ultraviolet lighting, heating, a thermostat, and a thermometer probe to monitor the internal temperature in the tank. The night before arriving at the Jindalee (Brisbane, Queensland) clinic of The Unusual Pet Vets, Maple's owners were conducting their nightly check of her and the enclosure when they noticed that something was different about the temperature gauge inside the enclosure:

the end of the probe was missing! After thoroughly checking the whole enclosure and not finding the lost probe, her owners had the unfortunate realization that Maple must have eaten it. The following morning, they booked an emergency consultation with Dr Stefanie Ramsey, who carefully checked Maple over before confirming that the probe was indeed located inside the bearded dragon. Maple was then X-rayed to identify where the probe was positioned and whether it would require surgery in order to remove it. The X-ray revealed that the temperature probe was inside the stomach: reaching all the way from the back of the pylorus region (posterior or back of the stomach that connects it to the intestines) through to the oropharynx (posterior region of the throat). Luckily the foreign body did not require surgery, but it did require an extra pair of hands! After injecting Maple with a sedative to allow the removal of the probe, Dr Ramsey enlisted the help of a vet nurse to hold Maple's mouth open: gently revealing the very tip of the black temperature probe at the back of the throat. Dr Ramsey was then able to grasp the probe with tweezers and tenderly slide the object out of the lizard's mouth.

Maple made a full recovery with no further interventions required. Her owners are definitely hoping that this pesky *Pogona* pursues only insects and vegetables from now on! This is a good reminder for keepers to stay vigilant and to regularly check the equipment in and around their herpetofauna enclosures to maintain a safe environment for their animals and to hopefully avoid these situations in the future. Ensuring that probes and other instruments inside of the enclosure are kept out of reach of the herpetofauna is one method to reduce the likelihood of this happening.

A tale of a troubled turtle tail

The Macquarie River turtle (*Emydura macquarii* Gray, 1830) is a species of turtle endemic to the Eastern coast of Australia, most strongly associated with the enormous Murray-Darling River system which has an area of over 1 million square kilometres and is 3375 km in length. Commonly kept in captivity, they are an unusual for a turtle species because they exhibit genetic sex determination through chromosomes, contrary to approximately 75% of studied turtles (only 24% of the 361

described species have been investigated) which exhibit environmental sex determination (the most comprehensively studied of which is temperature-dependent sex determination).

Jerry, a 20-year-old Macquarie River turtle, had a run-in with a tank mate of his that resulted in a rather nasty wound on the dorsal portion of his tail. He was brought into The Unusual Pets Vets clinic at Jindalee (Brisbane, Queensland) with damage so significant that the caudal vertebrae (bones of the tail) were able to be seen through the wound. Dr Joshua Llinas was tasked with assessing the injury and deciding the best method for treatment. X-rays were ordered, the results of which dictated that, whilst there was no damage to the bones themselves, surgery would be required to debride the area (the process of removing dead and damaged tissue from a wound).

The debridement was successful in removing the necrotic flesh, although there was not enough remaining tissue to close the wound over the bare bones. Despite their slow metabolism, turtles have a remarkable capacity to heal injuries. Jerry was administered analgesia (pain medication) following the surgery and had his tail meticulously wrapped with bandages designed to aid in growing and strengthening the flesh and muscle underneath (specifically to stimulate granulation tissue which is new connective tissue). In order to maximize the efficacy of the treatment, Jerry had to be prevented from entering water for the first 24 hours after the procedure – a process known as 'dry-docking' which is an accepted and prevalent method for treating turtles. After the first day his rehabilitation consisted of being slowly allowed more access to water, with frequent in-depth checks of the water quality ensuring that the tissue did not continue to degrade or allow a bacterial infection to take hold. Standard water testing for turtles should include checking the ammonia, nitrate, nitrite, pH, and water hardness (mineral content) weekly (at a minimum). While Jerry was on the mend, the process was slow, and both Jerry's owners and Dr Llinas decided that multiple visits would be required to monitor the progress. Happily, though Jerry has made a full recovery and amazingly only has a small scar over the area as a reminder of his ordeal.

This story serves as a cautionary tale of a turtle's tail to Testudines keepers out there: it is

Figure 2. *P. vitticeps*
(photo credit:
Jesse Campbell).

not recommended to keep Australian turtles together in the same tank. This is because wild turtles are solitary in nature and will usually only be observed interacting if they are looking to mate. When multiple turtles are kept together in the same tank or pond one animal will dominate the other: this can look like one animal taking the bulk of the food, or one animal occupying the majority of the area with the less dominant turtle being relegated to a small section of the environment. The less dominant turtle will usually be suffering from chronic stress long before the keeper notices anything wrong with the animal.

A Stumpy-tailed saga

The Shingleback lizard (*Tiliqua rugosa* Gray, 1825) is one of Australia's most enigmatic and recognizable reptiles. A large, rugged-looking skink they can grow to over 30 cm (11.81 in) and inhabit most of southern Australia. There are four subspecies that range from the lower third of Western Australia across through the bottom half of South Australia, the upper two-thirds of Victoria, majority of New South Wales (except for coastal margins), and extend into the lower inland portion of Queensland. Known to be generally slow-moving, they are also called 'Sleepy Lizards'. Many Australians know them by the colloquial names 'two-headed' or 'bob-tail' skinks due to their head and tail bearing a striking resemblance.

Monty is a 26-year-old Shingleback skink whose owner noticed a worrisome bump on the left side of the base of his tail. Having noticed bumps similar to this previously, and having had them investigated by vets before, his owner believed this was a case of a recurring hemipenial abscess – prior sores had responded well to antibiotics and so it had been a few years since it last occurred.

Hemipenes are the male sex organs of reptiles – that's right, they have two! Located in the base of the tail posteriorly to the cloaca, they evert themselves in order to mate. Knowing the sex of your animal is often critical to providing the best care for them: many reptiles can suffer from sex-specific afflictions or injuries such as prolapses (in the case of males with hemipenes) or dystocia (seen in females, also known as ovostasis or being egg-bound, which can be life-threatening). How do you find out if your reptile is a male or female? Many lizard and gecko species can be quite simple to visually identify: male geckos develop a defined bulge behind their cloaca, at the base of their tail, that females do not possess, and similar cylindrical bumps can be seen in the base of the tail of many different types of lizards (these are called hemipenial bulges and are only present in males – females will generally be smooth by comparison). However, this does not work for snakes. The most prevalent method of sexing

snakes is called probing and involves a person inserting a round-ended metal probe in through the cloaca and extending towards the tail. Males will probe deeper than females due to the presence of the hemipenes. This should only ever be undertaken by someone who is experienced with this method of sexing because it can very easily damage the animal permanently. Other, less common, techniques for sexing reptiles are illumination (passing a bright light behind the base of the tail in an attempt to observe the blood vessels inside the hemipenes – this only works with animals that have thin tails as thicker tails will not allow for as much light to pass through), popping (exactly what it sounds like: applying pressure to force the hemipenes out – this should only ever be done by an extremely knowledgeable person or specialist reptile vet), X-ray (using X-rays to see if bone has formed at the end of the hemipene, which is fairly common for Varanid species, although it isn't a guarantee as many males will not feature the ossification needed to determine the sex of the individual), ultrasound (an easy and accurate approach that is typically used in larger species), and endoscopy (often seen as a last resort due to the need for general anesthesia, a small camera is introduced into the animals' body cavity to visually ascertain whether they have ovaries or testes present).

After being given antibiotics, anti-inflammatories and pain medication, Monty

and his annoying hemipenal abscess were booked in for surgery in the coming week. Dr Amber Lee from The Unusual Pet Vets Peninsula clinic in Frankston, Victoria, operated on the skink. Monty was provided with different kinds of pain relief before, during, and after his general anesthetic, as well as a local anesthetic block for the soft tissues and skin in this sensitive area. Dr Lee cut an incision over the afflicted area and lifted the sizeable osteoderm scales to reveal the abscess. The region was filled with purulent material (pus) which was then removed, with the underlying tissues diligently cleansed using a saline solution to reduce the likelihood of the abscess reoccurring. Closing the wound in the typical matter (pulling the two sides of the incision together) could have caused the abscess to reform due to an inability to drain adequately, so Dr Lee used a technique called 'Marsupialisation'. This approach involves suturing the tissues to perimeter of the incision – leaving the abscess exposed and therefore able to drain freely.

With the operation a success, Monty began his slow healing process. Two months after the procedure Monty was given the all clear, thanks to the efforts of his owner and The Unusual Pet Vets team at the Peninsula clinic. Monty could have had a very different outcome if his owner had not been attentive and proactive about his ailment.



Figure 3. *T. rugosa* male (photo credit: Jesse Campbell).

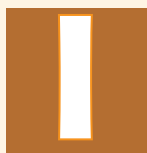
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NEVITABLE GALAPAGOS



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Text and photos are provided by the author

The Galapagos Islands are the world's most famous archipelago; the cradle of a unique natural richness and of Darwin's discoveries, including his famous theory of the origin of species. The characteristic animals of these islands are stars of evolution and do not suffer scenic fear; naturalists and tourists can approach them without fear of scaring them even though they are protected and they cannot be touch; only them can walk around without restrictions. While it is a costly trip, there are ways to visit its islands at low costs if certain steps are taken.

If there is any place in the world where every naturalist agrees to want to know,

this is undoubtedly the world's most famous archipelago: the Galapagos. We all know the species that live there, we've all seen them countless times in documentaries on TV. But who do not want to look closely at these giant turtles, these sea iguanas, these nice birds that don't run away when man appears in distance?

Galápagos is synonymous with primitive nature, an unparalleled underwater world, tropical penguins and sea lions, boobies and swimming iguanas. But above all it is a place that fanatic Christianity dislikes. This is where the theory that shook all the foundations of creationism was born, the



Figure 1. Young marine iguana (*Amblyrhynchus cristatus* Bell, 1825) at Puerto Ayora, main town in Galapagos.



Figure 2. Santa Cruz lava lizard (*Microlophus indefatigabilis* Baur, 1890), omnipresent in that island.

patio of experiments of a genius who gave the nail, since his theory is no longer an idea, but a well-proven fact.

Charles Darwin arrived in the Galapagos in September 1835, and there he began his collection of specimens, among which are the different varieties of finches he captured on the different islands. Among other observations, observing at the various varieties of finches and tortoises would help him in the future to elaborate a theory that, although currently more than proven, still has severe detractors, the religious fundamentalists.

The similarity of the finches of different islands was evident to Darwin, but each of them was adapted to a different diet, and that was externally denoted in the shape of their peaks. Some of them were fat and powerful to break hard grains, others were elongated to pinch small insects, and others were like stitches for pinching birds and extracting their blood. These observations, along with those of the different shapes of the shells of the tortoises that came from dry or wet islands (those of dry islands had the front part of the skull very high and the neck enlarged to be able to look for fruits of cactus and other succulent plants that do not grow

on the ground, while the ones that inhabited wet habitats could pasture the grass on the soil and their necks were shorter with a shell more similar to the land tortoises, we all know).

Of course, on arrival in the Galapagos, a naturalist (even an ordinary tourist) wishes to be able to see all these protagonists of evolution, not only because their exoticism, but for how easy it is to approach them without being frightened. I've seen thousands of frigate birds flying in other parts of the world, but never nesting 2 meters from me without being disturbed. Marine iguanas and land iguanas have always been among my favorite animals... besides the giant land tortoises, and the stunning marine world, which cannot be left aside. Although a trip to Galápagos has a reputation for being expensive, there are ways to reduce spending and see most interesting species and places at a backpacking price (see at the end).

There are two airports on the islands, that of the capital San Cristobal, and that of Bartra, which supplies the most populous island, Santa Cruz (with a population of around 25,000). Usually one arrives at Bartra and stays a few days in Santa Cruz. On this island the first thing that we will discover when walking through the village of Puerto

Ayora, is a bunch of sea lions (*Zalophus wollebaeki* Sivertsen, 1953) that camp at its widths. They are the kings of the village, especially in the *malecón* (the typical front coast walking promenade in Latin American coast towns), the harbor, and very especially in the fisheries, where fishermen or fishmongers must pay their tribute to those reckless inhabitants, but they also penetrate inside the town through some streets, so much so that you can find one napping at a bench anywhere. Of course, all the animals in the Galápagos are protected, and no one can touch them, but they can roam freely. Many of them, especially the younger specimens, are found playful swimming in the crystal clear waters of the town coast and mangroves. In the port itself, at night, when it is illuminated, typical lovers' promenade, it is possible to see sharks of medium and small size swimming slowly along with rays of various species.

Another inhabitant of the village, and indeed, of all the islands, is the famous marine iguana (*A. cristatus*). In the village itself, it is difficult to see adult specimens, but juveniles are all over, both in the *malecón* and in all coastal areas. In fact, there are many opportunities to observe them. The first thing I got was going to Tortuga Bay, a half-hour walk from the village, crossing a xerophytic area where finches abound. If you arrive in the afternoon, between 16.00 and 15.00 h, you can see the iguanas coming up from the sea...

They have been swimming all day basically feeding on algae, but they



Figure 3. Las Grietas, a narrow cold sea water canyon easy to visit from Puerto Ayora.



Figure 4. Adult female of *M. indefatigabilis*.

have lost their body heat, and already in the afternoon they go to reheat and rest on the beach. They come out of the water slowly, walking as if there was no one on the beach, which belongs to them. Tourists, of course, are like non existing for them. If you respect their space, you will be allowed to take amazing photos very closely. If someone recognizes these sea iguanas, it may not be for the documentaries, but for the film *Godzilla*, which was based on them. And in fact, of the 11 recognized subspecies, one, the Isabela Island, is called *Amblyrhynchus cristatus* subsp. *godzilla* Miralles & Macleod, in honor of the huge monster. The subspecies that we will see most commonly if we go to Santa Cruz, Isabela and Floreana, are *Amblyrhynchus cristatus* subsp. *hassi* Eibl-Eibesfeldt, 1962, *A. c. godzilla* and *Amblyrhynchus cristatus* subsp. *venustissimus* Eibl-Eibesfeldt, 1956, respectively. There are other places to see

marine iguanas as well, such as on the island of Isabela, where they are also abundant on any beach, or in Floreana, where they are beautiful, with black and pinkish red spots (those from Santa Cruz and Isabela are black).

Another reptile he wished to observe in his natural environment was the terrestrial Iguana. (*Conolophus subcristatus* (Gray, 1831)). But they are almost extinct from the large islands, so you have to search them in the satellite islands of Santa Cruz for example, such as Seymour North or Plaza Sur. I was eager to be able to photograph them in their habitat, but I never imagined that they were so abundant and blurred. They walked around the island without paying attention to people, crossing, sunbathing and feeding on cactus (*Opuntia*) without any trouble to be punched by this unappealing meal. Land iguanas are gregarious, and in some spots was possible to see several animals close by.



Figure 5. A portrait of an adult male marine iguana.



Figure 6. Magnificent adult male marine iguana (*A. c. hassi*) at Tortuga Bay.

This same North Seymour Island is a paradise for sea bird observers. At least four precious birds nest here, the swallow-tailed gulls (*Creagrus bifurcates* (Nébox, 1842)), the blue-footed booby (*Sula nebouxii* Milne-Edwards, 1882) and two species of frigate birds (*Fregata magnificens* Mathews, 1914 and *Fregata minor* (Gmelin, 1789)). Gulls are

observed in the coast breaker, but frigates and boobies breed in the interior of the island. Boobies are especially gentle, allowing to approach even while in the nest. Its mating parade is striking, consisting of a deployment of the male's wings, while lowering the neck and raising the head and tip. The female, in general, seems indifferent to such attention,



Figure 7. A Coastal leaf toed gecko, *Phyllodactylus reissii* Peters, 1862, the original occupant of my room at Puerto Ayora.



Figure 8. A magnificent frigate adult male in breeding disposition with its mate.



Figure 9. A mating display of blue footed boobies.

making the situation quite funny. The scene seems just being part of a Jurassic spectacle. The frigates, as is known, are the pirates of the air, and they are not fishing birds, they like to chase boobies and pelicans to take away their fish. They are common in all tropical seas, but it is not easy to approach their breeding colonies. For example, in Costa Rica, these

are found on a few rocky inaccessible islets. It is a visual pleasure to be able to see the magnificent males with their intense red gular deployment, which stands out over the black of the rest of the plumage.

Another typical bird of the Galápagos, but few imagine in the tropics, is the Galapagos Penguin (*Spheniscus mendiculus* Sundevall,



Figure 10. *C. hoodensis* at the Charles Darwin Biological Station, Galapagos.



Figure 11. The author with a recently generated carapace.

1871), the only real tropical penguin (although the Humboldt Penguin can also reach tropical latitudes at certain times of the year). To observe it, the easiest way is to head to Isabela's harbor. They are quite playful and can be seen even in the port where boats anchor, swimming among huge green turtles.

It is also an unexpected pleasure to swim with sea lions, which can approach you with the mere purpose of playing around and examining you, long and strange ape, swimming quickly...

Finches are not as striking animals as the others. They are black or brown birds, but they stand out not only for their evolutionary importance as living examples of this fact, but for their elaborate behavior. You can see finches everywhere, in the village, on the beaches, in dry areas and wet forests.

Undoubtedly, the most recognized representatives of the islands are the land tortoises. In the Galápagos (remember that galápagos is a Spanish term for turtle in

general), there are eleven species of land turtles, four of which are already extinct. The last extinct species was *Chelonoidis abingdonii* (Günther, 1877), represented by the last single male, "Lonesome George". She was searched for females on her home island, Santa Cruz, but found none. He spent his last years spoiled at the famous Charles Darwin Biological Station. With him, another species of the planet sadly disappears.

This station, along with another on Isabela Island, is responsible, among other research tasks, for breeding and raising the different species of Galápagos terrestrial chelonians, to reintroduce them into their natural habitat. Santa Cruz island there is an opulent population of terrestrial turtles (*Chelonoidis porteri* (Rothschild, 1903)), from lowlands to high and humid areas, where the larger specimens are found. The southern Isabela tortoises (*Chelonoidis vicina* (Günther, 1874)) are somewhat smaller in size, as are those at Española (*Chelonoidis hoodensis* (Van Denburgh, 1907)).



Figure 12. *C. porteri* from Santa Cruz Island, Galapagos.



Figure 13. *A. c. venustissimus*, the Floreana marine iguana, with pinkish red and black coloration.



Figure 14. An impressive adult male of *C. subcristatus* standing in front of some frigate birds at Seymour Island.



Figure 15. Portrait of the formidable claws of a land iguana.

Other ubiquitous reptiles with little attention, compared to their larger cousins and turtles, are the lava lizards (genus *Microlophus*). There are 10 species spread across all islands, the most observed being *M. indefatigabilis* in Santa Cruz and *Microlophus albemarlensis* (Baur, 1890) at Isabela. Their common name, lava lizards, comes from the fact that almost all of the substrate of the islands is volcanic, so it is very common to see these saurians (as well as iguanas) wandering through the abundant black lava that forms the islands. These lizards are omnivorous, predating insects, other smaller lizards, fruits and seeds. Sometimes it is fun to watch them swinging the horizon mounted on some impassible marine iguana. They are eaten by reptiles, snakes, and introduced species such as cats and rats.

Unfortunately, during this visit, I did not have the chance to observe live snakes (only a newly D.O.R one). A scene in a BBC documentary is famous, in which snakes of the genus *Pseudalsophis* chase newly hatching offspring of sea iguanas very quickly. There

are nine species on the islands, of diurnal and terrestrial habits; they are extremely fast and difficult to catch.

Another dream to fulfill someday, although is very difficult to get the right permits, is to visit the pink land iguana (*Conolophus marthae* Gentile & Snell, 2009) in its own natural habitat. This species is highly endangered (there is an estimate of around 250 individuals left) and the access to Volcan Wolf is highly restricted.

A visit to Galápagos cannot end without entering its fantastic underwater world, even if you're not a diver. Just half a meter deep you can already observe with a mask and a simple snorkel an impressive variety of fish and marine invertebrates, from moray eels to stingrays. If you go a little further, there are sea turtles (especially *Chelonia mydas* (Linnaeus, 1758)), sea horses, sea lions and some harmless sharks. Already with diving equipment, you can perform unparalleled dives, observing Galapagos sharks, manta rays, whale sharks and many other wonders.

Apart from the fauna, the Galápagos possess an undoubted landscape charm,



Figure 16. A satisfied land iguana eating and enjoying a spiky cactus fruit.

especially due to its volcanic origin. Several volcano craters can be visited, such as Los Gemelos in Santa Cruz, or Sierra Negra in Isabela, which seems the horrific landscape of Mordor.

Tips for travelling to Galápagos at a reasonable price*

If you start to see cruise prices that take you to the different islands, you can fall back. There are specials for divers (the most expensive), from 8 to 16 days, or shorter. The price will vary depending on the days and the quality of the boat used. But if we focus on a trip that is accessible to many of us, my recommendation would be the following. The flight, unfortunately for non-residents in Ecuador, will be the most expensive, around \$450 and \$500. The entrance fee to Galápagos includes multiple entries to the national park (basically the entire archipelago) and costs US\$ 110. That means that by arriving

you have already spent around \$600 without doing or seeing anything!!! Well, let's not despair. You get to the airport of the small island of Baltra, where a free bus (one of the few things free on the islands) takes you to a small ferry to cross to Santa Cruz (one dollar). From there you have to take another bus to the village of Puerto Ayora, on the other side of the island, this takes approximately one hour (3 \$). Fortunately, looking well, there are several hostels for \$25 a night, single room with bathroom, or \$15 in shared room. Of course if you are willing to pay more there are accommodations of all price and luxury. In my room I saw quickly a coastal leaf toed gecko *P. reissi*. In order to eat, you can head to Hunger Street or Calle del Hambre (very close to the *malecon*), for \$5 the basic lunch (soup and second dish, without great pretensions).

I enthusiastically recommend for breakfast a dish that I loved so much, guatita (tripes in peanut sauce with rice). There are two excursions that one can do for free on his

own. One is the mentioned walk to Tortuga Bay (although the last comments say that you must now hire a guide). You must bring plenty of water (at least 2 liters for 2 hours), sunscreen and swimming suits. Ask any inhabitant of the village how to go, it only takes half an hour and you can see the marine iguanas on the beach. Another mini trip is to Las Grietas, a narrow canyon occupied by sea water, deep and cold, but beautiful, and with crystal clear waters. To do this you have to go to the harbor and order a water taxi (one dollar min.), and tell him to leave you to visit las Grietas, according a return hour. The path is taken from the landing ground and you do not leave it until you arrive. You can stop at a beautiful beach where you can swim and observe morays and stingrays. In Las Grietas you can swim too, there are some dwarf fish, and apparently no dangerous animals, only many wasps so it is wise have to carry antihistamines in case of being stung.

In Puerto Ayora you can also visit the facilities of the Charles Darwin Biological Station for free. The part for the public is like a mini zoo where the different species of the islands are observed, including the land tortoise nursery.

The rest of the visits are paid, some in shared tours or solo. For example, to see the largest tortoise population of the islands, in El Chato, I hired a tour for myself that cost me \$40, with guide and transportation, including also a visit to the twin craters and the caves known as Lava tunnels (quite interesting!).

A one-day tour to Floreana Island costs \$70. The truth was the one I like the least. I was sick of the sea, and the people were very dizzy during the two-hour journey back and forth. You see more tortoises, but this time in semi-captivity (much better at El Chato). It's a wet island with a grotesque history, but for me nothing special. For those who want to see red and pink marine iguanas (*A. c. vesnustissimus*) it is the nearest and cheapest place to do so. The tour to Seymour North is highly recommended; there you will see the famous land iguanas, boobies, gulls and frigates, and also a dream snorkel in shallow water. Luckily you can see some penguins. But it's the most expensive tour, \$140 a day (lunch included).

To Isabela you can go on a day tour, which I do not recommend because of how far away It is (more than 2 hours one way) and how interesting it is to stay there. It is best



Figure 17. An adult female and young marine iguanas at Isabela (*A. c. godzilla*).



Figure 18. An adult female *Chelonoidis guntheri* (Baur, 1889) at Isabela Island.

to go on your own, each ticket costs \$30 (each way). I stayed in a cheap hostel that costed met \$25 in a single room! The meals are a little more expensive than at Sta Cruz, \$7. There are several interesting tours. One is to the Tintoreras, which can be in the morning or in the evening, lasts about 3 hours, including a walk through the volcanic area seeing marine iguanas, plenty of penguins and a sea crack where several sharks rest. Includes a snorkel (60\$).

Another tour is to go see Sierra Negra volcano. It's about 10 km between going and going. If it's clear, you can see one of the

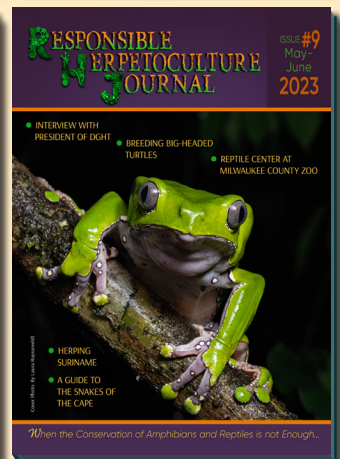
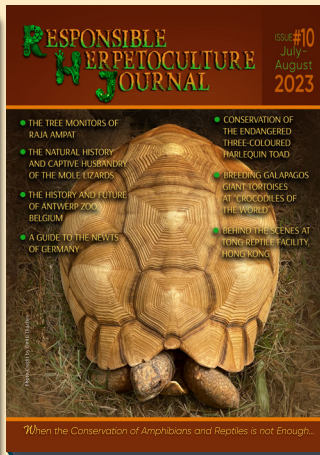
world's largest volcanic craters. But it's better to go in dry season. After walking another hour, you arrive at Volcán Chico, which is not small at all. There are a series of smoke holes and craters not too large, but you can see the results of several recent eruptions, the last in 2005, with its lava rivers, etc. The feeling is walking towards Mordor. The tour includes a snack and costs \$50.

Another recommended tour is to the tunnels, eminently one day at the sea, you visit several islets where the blue-legged boobies' nest, and snorkeling is one of the most fascinating I ever done in my life: you see several huge sea green turtles (*Chelonia*), grazing quietly and letting approaching enough, sea horses, penguins, sea lions, rays, octopuses, lobsters, and harmless sharks. The tour costs \$100 and includes water and light food. In total, I spent \$1300 in 10 days, nowadays could be around \$1500.

*These prices were valid 10 years ago. Now, upon consultation, most prices have raised (and updated herein) but you can only take them as an approximate idea. Ask better first to confirm.



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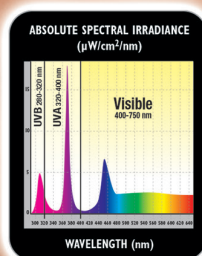
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