

28 MAY – 3 JUNE 2023  
NATIONAL PARK OF BOUHEDMA

# TUNISIAN LIZARD CAMP

Report



The Tunisian Lizard Camp (TLC) was an immersive educational research program organized by Erell Institute in collaboration with the Tunisian Association for Wildlife and ATR-Akouada. TLC focused on providing university students with a background in biology and ecology with a comprehensive understanding of lizard ethology and ecology while teaching them how to conduct scientific research through hands-on fieldwork and workshops.

The TLC spanned one week and consisted of a series of lectures, interactive workshops, and field excursions to diverse habitats in Bou-Hedma National Park to study the behavior and ecology of lizards. In addition, participants had the opportunity to engage in field explorations, where they actively surveyed reptiles and invertebrates, encountering fascinating species such as the Saharan horned viper (*Cerastes cerastes*), unique insects, scorpions, and various geckos.

The students actively participated in workshops on lizard behavior observation techniques, data collection and analysis, habitat assessment, and field ecology. The learning objectives aimed to enhance their skills in ethological research methods and provide practical experience in applying theoretical knowledge to field research and understanding the dynamics of natural ecosystems.

The lizard camp provided participants with valuable educational experiences, allowing them to utilize their theoretical knowledge in real-world scenarios and gain insights into field ecology. The camp fostered students' passion for studying ethology and ecology, empowering them to contribute to a broader understanding of animal behavior and ecosystem dynamics.

Based on the resounding success of the TLC, we recommend continuing to organize similar camps that encompass not only lizard ethology but also other taxa and ecology in general. By bridging the gap between theoretical knowledge and practical field research, these camps offer unique opportunities for students to develop their scientific skills and inspire a lifelong commitment to the study and conservation of biodiversity, equipping Tunisia with future wildlife and conservation biologists who can promote biological integrity in our nation.





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# 01. SUMMARY

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# 02. INTRODUCTION

The Tunisian Lizard Camp (TLC) is an immersive program designed for university students in the field of biology and ecology. This unique camp aimed to provide participants with a comprehensive understanding of lizard ethology and scientific research methods. By combining hands-on fieldwork and interactive workshops, the TLC offered an enriching experience that bridged the gap between theoretical knowledge and practical application.

The primary objective of the TLC was to equip students with the necessary skills and knowledge to conduct scientific research in the fields of ethology and ecology, with lizards serving as an ideal model for studying animal behavior. By immersing participants in the study of lizard ethology, the camp not only enhanced their understanding of these fascinating reptiles but also fostered scientific inquiry skills and promoted a deeper appreciation for the natural world.

Studying lizard ethology holds broader implications for the fields of biology and ecology. Lizards play crucial roles in ecosystems, influencing energy flow, nutrient cycling, and population dynamics. Further, lizards are an integral component of Tunisian wildlife, particularly in desert and desert scrub habitats. By unraveling the intricacies of their behavior, researchers gain insights into the adaptive strategies and ecological interactions that shape ecosystems. Furthermore, understanding lizard behavior contributes to our knowledge of conservation biology, animal communication, reproductive strategies, predator-prey dynamics, and responses to environmental change.

Through a series of workshops, field excursions, and engaging activities, participants of the TLC acquired essential research techniques, including behavioral observation, data collection and analysis, and habitat assessment. These practical experiences not only deepened their understanding of ethological research methods but also nurtured their passion for scientific inquiry and conservation.

In conclusion, the Tunisian Lizard Camp offered a unique and immersive experience for biology and ecology students, fostering their understanding of lizard ethology and providing them with practical skills in scientific research. By combining theoretical knowledge with hands-on fieldwork, the camp aimed to inspire the next generation of researchers and conservationists to contribute to the study and conservation of biodiversity.

A photograph of a light-colored lizard, possibly a spiny-tailed lizard, resting on a sandy surface. The lizard is positioned diagonally across the frame, facing towards the top left. Its body is covered in fine, overlapping scales, and it has a long, thin tail. The sand is a warm, golden-brown color with some small dark specks.

# 03 CAMP OVERVIEW

The Tunisian Lizard Camp (TLC) was a one-week program held from 28 May to 3 June 2023 in Bou-Hedma National Park and Houch Bou-Hedma.

The camp encompassed various activities and components designed to foster participants' knowledge and skills. The central focus was on teaching participants how to design and execute a research project, with lizard ethology serving as the main theme. Prior to the camp, applicants received research papers and books related to ethology and lizard studies, including information on the model lizard species, Bosc's fringe-toed lizard (*Acanthodactylus boskianus*), which is common in Bou-Hedma, and the importance of maintaining field notebooks as scientists and naturalists.

Throughout the program, participants engaged in lectures, interactive workshops, and field excursions. They learned about ethology and ecology, observed and documented lizard behaviors, and developed a catalog of behaviors. Workshops covered topics such as lizard handling techniques, including how to safely catch lizards using a noose pole, and how to make body measurements, as well as sessions on movement ecology and vegetation sampling techniques. Participants also practiced lizard identification and taxonomy.

The main learning objectives of the camp focused on research skills, including documentation, research problem formulation, data collection, analysis, and interpretation. Participants gained practical experience in designing and executing a research project within the one-week timeframe. They also learned field ecology techniques, such as path-marking to study lizard movement patterns and using transects to characterize vegetation.

Expert discussions were led by Douglas Eifler and Maria Eifler along with their students Makenna Orton and Kaera Utsumi. Makenna delivered a presentation on movement ecology, while other sessions involved constructive debates and recap sessions, where participants discussed their observations and findings.

Additionally, the camp included field explorations where participants searched for and encountered reptiles and invertebrates. Participants had the chance to set up a light trap to demonstrate the use of this sampling technique in discovering local entomofauna. They also collaborated to create a lizard trap that was utilized during fieldwork activities.

The TLC provided participants with a structured and immersive learning experience, combining theoretical knowledge with practical fieldwork. By the end of the program, participants had acquired essential research skills, expanded their understanding of lizard ethology and ecology, and developed a passion for the study and conservation of biodiversity.



# 04 PARTICIPANTS

The selection process for participants in TLC involved an online form, through which interested individuals at various academic levels, including bachelor's, master's, doctorates, and post-doctorates, applied. The rigorous selection process resulted in a diverse group of 8 participants, each coming from different academic backgrounds. The participants included a biology undergraduate student, a master's student in landscape management, master's students in evolutionary and functional ecology, a PhD student in marine microbiology, and a neuro-psychologist, among others. This diverse composition of participants contributed to the vibrant and dynamic discussions that enriched the entire camp experience, as different perspectives and areas of expertise were brought together.





# 05 WORKSHOPS AND FIELDWORK

After arriving, participants gathered to introduce themselves and kickstart the Lizard Camp experience. The instructors, Douglas and Maria, began by acquainting us with the general schedule and guidelines for the camp. Douglas provided an overview of the camp activities, emphasizing the focus on lizard ethology and the importance of conducting scientific research in the field. Maria addressed important aspects of safety, well-being, and ethical considerations. She shared valuable insights on staying protected under the intense sun of the camp region, such as using sunscreen and wearing sunglasses, as well as the importance of wearing long-sleeved shirts to minimize sun exposure. She highlighted the significance of staying hydrated and advised us to carry small snacks to provide an energy boost during field activities. Furthermore, Maria emphasized the ethical handling of animals. She stressed that we should only handle or catch animals for scientific purposes and not for recreational purposes. When flipping rocks or searching for critters, Maria instructed us to flip the rocks away from ourselves and avoid putting our fingers deep into the ground to ensure our safety and minimize disturbance to the micro-ecosystem. We were taught to return each stone or rock to its original position to maintain the integrity of the habitat.

With these guidelines in mind, we were prepared to embark on our journey of workshops and fieldwork, where we would gain valuable skills and knowledge in lizard ethology and field research techniques.



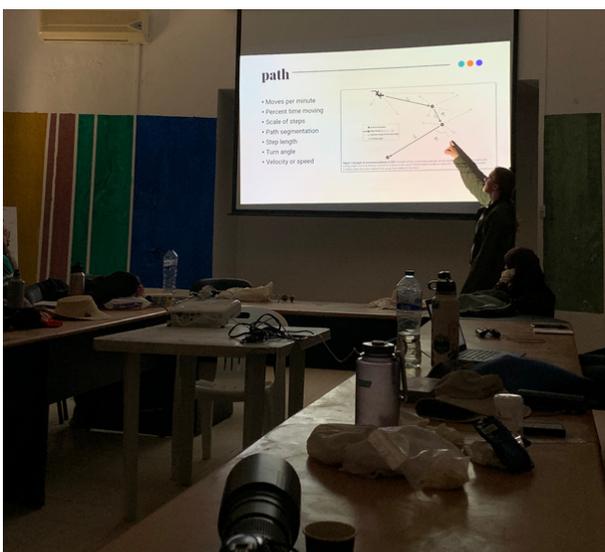
# 1. Designing and conducting the lizard ethology research project

## 1.1. Introduction to lizards and ethology

Through a combination of discussions, lectures, interactive presentations, workshops, and fieldwork, initial TLC activities provided participants with a basic understanding of fundamental concepts in ethology and of lizards from biological, ecological, and behavioral perspectives.

One of the first discussions centered around the pre-camp materials provided to the participants, including research papers and books on ethology. The resources offered insights into the basics of the discipline as well as specific information about our model species, Bosc's fringe-toed lizard (*Acanthodactylus boskianus*).

Furthermore, Maria, one of the instructors, conducted a practical session demonstrating the proper handling techniques for lizards using Wolfgang's wall geckos (*Tarentola fascicularis*) as live examples. Participants were guided on the appropriate methods, which involved applying gentle pressure with our fingers to secure the main parts of the lizard's body, such as the shoulders and waist, ensuring both immobility and safety for the animal (Fig. 2).



**Figure 1.** Makenna Orton giving a presentation on movement ecology  
© Ines Kamilia Chakroun



**Figure 2.** Two ways to handling lizards safely while securing them  
© Ghassen Kmira

## 1.2. Steps in research project execution

Participants were guided through the fundamental steps of conducting a research project during a lecture delivered by Douglas. His lecture covered the key components of research, including documentation, research topic exploration, project design, problem definition, data collection, and analysis and interpretation. By understanding these steps, participants gained a solid foundation for executing their own research projects.

To further enhance the participants' skills in generating relevant research questions, Douglas introduced two interactive exercises (fig. 3). The first exercise, “the 4-Whys”, involved asking "why" in four different ways to uncover different aspects of underlying causes or motivations. This iterative questioning technique encouraged critical thinking and enabled participants to delve into the complexities of their research topics, ultimately leading to more focused investigations.

The second exercise, “20 Questions”, involved asking up to 20 questions , to systematically explore a topic. This approach helped participants articulate testable questions and hypotheses for research study by breaking down complex subjects into manageable parts. The exercise stimulated their thinking about different dimensions and aspects of a research problem. Through this exercise, participants developed the ability to generate insightful questions that would guide their research with clarity and purpose while facilitating further exploration.



**Figure 3.** Interactive exercises about generating relevant research questions

© Mouhamed Boulbaba Bouhajja

### 1.3. Identifying research questions in lizard ethology

To define interesting and feasible research questions that could be addressed within the one-week duration of TLC, participants actively engaged in exploring the ethology of lizards. They were divided into small groups of 2-3 individuals and were introduced to the concept of ethograms, which are catalogs of behaviors. Their task was to closely observe a lizard for a period of 10 minutes, documenting its behavior without disturbing its natural activities. Participants received detailed instructions on how to accurately record ethological information, emphasizing the need for objective and quantitative descriptions of each movement.

At the end of the observation period, a recap discussion was held to create a collective catalog of behaviors.

Each group shared the notes they had taken on the observed behaviors, facilitating a comprehensive overview of lizard behavior during the camp. Subsequently, participants were encouraged to propose research questions based on the intriguing observations from the ethograms and the knowledge they had gained about lizards and ethology.

Under the guidance of Douglas and Maria, a brainstorming session ensued, resulting in the formulation of two research questions that met the criteria of feasibility, relevance, and originality within the one-week timeframe:

1. Resource selection: How do *Acanthodactylus boskianus* lizards utilize the available vegetation resources?
2. Eco-morphology: How does the morphology of *Acanthodactylus boskianus* vary between sexes and in relation to their ecology?



## 1.4. Field data collection and sampling methods

After formulating the research questions, participants embarked on the fieldwork phase, which involved various data collection methods and sampling techniques. The major tasks were defined and presented to the participants, providing a clear direction for their field activities.

One significant aspect of the fieldwork was the characterization of the vegetation within the study site, which would directly help in understanding the resource selection of *Acanthodactylus boskianus*. To accomplish this, six transects, each spanning 140 meters, were established. Along these transects, participants measured and documented relevant information for each plant encountered, including its species name, height, width, and % cover. Detailed photographs of all plant species were also captured to complement the vegetation characterization.



**Figure 4.** a group of participants collecting data along one of the transects  
© Housseem Ben Othmen



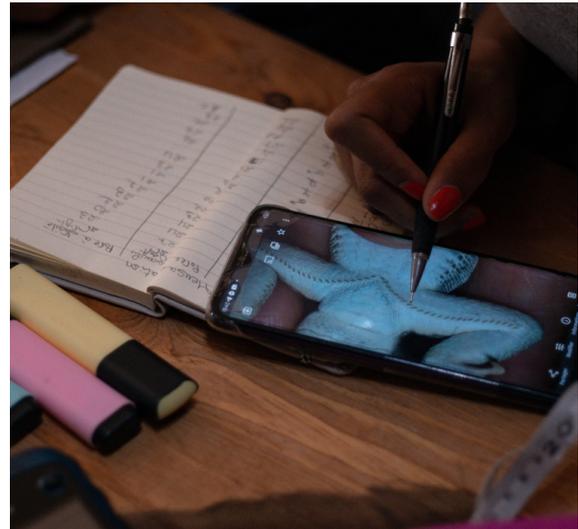
**Figure 5.** participant attempting to catch a lizard under the supervision of the instructors  
© Housseem Ben Othmen

Simultaneously, groups of participants were assigned to search for and capture lizards. To study resource selection, the first plant to which each individual lizard fled during capture was identified and tagged, while its measurements were recorded. Additionally, the captured lizards themselves were brought back to our housing area (i.e., “laboratory”) for processing, and GPS coordinates were taken at each capture location. During this phase, participants gained hands-on experience using a noose-pole to catch lizards, which proved to be an effective and non-invasive capture method. Furthermore, a lizard trap constructed by the participants was utilized to capture additional lizards. Capturing lizards provided valuable insights into their behavior, movement patterns by tracking their footprints, and burrow usage. A total of 64 individual lizards were successfully collected during the fieldwork activities.

All data collection procedures were executed with meticulous attention to detail, ensuring the systematic and rigorous nature of the research process.

## 1.5. Laboratory procedures: measurements, sexing, weighing, and marking

In the “laboratory”, specific data collection procedures were carried out to gather comprehensive information about each individual lizard. In the first step, photographs of the underside of the hind legs of each lizard were taken to count the number of femoral pores. The femoral pores contain a waxy substance that the lizards use for communication. By capturing clear photos and counting the glands from the images, the participants were able to obtain accurate and non-invasive data with minimal disturbance to the lizards



**Figure 6.** counting the number of the femoral pores, © Housseem Ben Othmen

The next step was to determine the sex of each lizard. To do so, a gentle and careful procedure was followed wherein a probe dipped in antibiotic gel, which served as both a lubricant and disinfectant, was inserted into the lizard's tail. The depth of the probe insertion provided a reliable indicator of the lizard's sex. If the probe did not penetrate deeply, indicating a shallow tail opening, the lizard was identified as female. If the probe extended deeper into one of the two lateral pockets corresponding to the location of the hemipenes, it indicated a male lizard.



**Figure 7.** determine the sex of the lizard using a probe, © Housseem Ben Othmen

Weighing the lizards was another important aspect of the laboratory work. Each lizard was placed in a small plastic cup that had been previously weighed. The lizard was gently placed inside, and the weight of the container with the lizard was recorded. Simple math (or taring the scale) allowed for accurate measurement of the lizard's weight, providing valuable data on its size and overall condition.



**Figure 8.** Weighing the lizards, © Housseem Ben Othmen

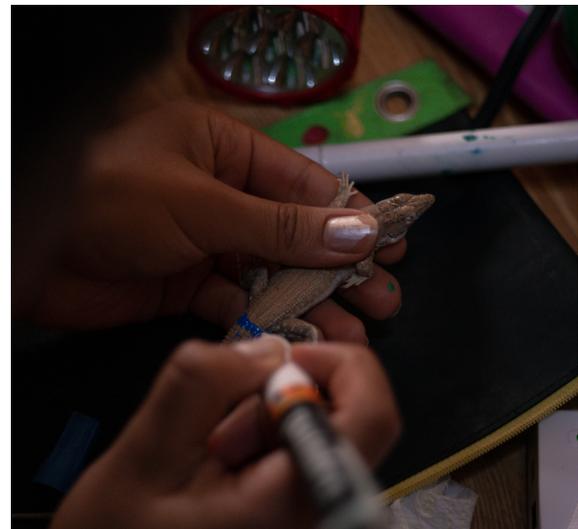
The last step involved measuring the length and width of various body parts, including the snout to tail, tail length, the head, and parts of the front and hind legs. The morphometric measurements provided important insights into the lizard's body proportions and structure, and will be tied back to their ecology.

After collecting and measuring all the necessary data from the captured lizards, each lizard was uniquely marked on the base of its tail with a small amount of non-toxic acrylic paint (fig. 10). This marking technique allowed for easy visual recognition of previously captured individuals, eliminating recaptures. By releasing the marked lizards back into their original capture site, we ensured minimal disturbance to their natural behavior and population dynamics.

The laboratory work proceeded in a systematic and meticulous manner, ensuring the collection of reliable and precise data for further analysis and interpretation.



**Figure 9.** measuring the length of the lizards using a ruler, © Housseem Ben Othmen



**Figure 10.** marking the lizards using non-toxic acrylic paint, © Housseem Ben Othmen



## 1.6. Data analysis and interpretation

Participants then proofread the data to identify errors, ensuring accuracy. Once the data were proofed, the focus shifted to data analysis, beginning with descriptive statistics, which involved analyzing the distribution of the data and identifying trends and patterns, providing a foundation for further analysis.

Following the lizard camp, data analysis and interpretation continued through online meetings. Participants were given guidance on scientific writing, literature review, and were assigned specific tasks to produce a publishable manuscript. With the team working collaboratively, the manuscript summarizing the findings and conclusions of the research project is currently being completed. We expect to submit the manuscript to a peer-reviewed journal for publication in early October 2023.

## 2. Field explorations

### 2.1. Overview of the field exploration activities

During field exploration activities, which we conducted alongside the main activities focused on research, participants had the chance to observe and study various organisms in their natural habitats. Guided by experts in reptiles, amphibians, and arthropods, we encountered fascinating species and gained insights into their ecology and behavior.

Throughout our explorations, discussions and interactions among the participants and instructors were encouraged, fostering an environment of learning and curiosity. The exchange of knowledge and experiences further enriched the field exploration activities, creating memorable moments and a deeper understanding of the natural world.

Overall, the field explorations provided participants with an invaluable opportunity to engage with nature, observe organisms in their natural habitats, and gain a deeper appreciation for the intricate relationships between species and their environment.



## 2.2. Diurnal explorations : direct observation and hand-sampling

During the diurnal explorations, participants learned about the versatile technique of hand-collecting, which is commonly used to study biodiversity. However, note that no organisms were collected during these activities; they were solely observed in their natural habitats. Participants engaged in searching for organisms on the ground, by flipping rocks and inspecting vegetation. These techniques allowed for the observation of a wide range of species, including the Saharan horned viper (*Cerastes cerastes*), a desert mantis (*Eremiaphila denticollis*), the ocellated skink (*Chalcides ocellatus*), various lizards, spiders, scorpions, and other invertebrates. These encounters provided valuable insights into the diverse wildlife found in Bou-Hedma National Park and enhanced participants' knowledge of the local biodiversity.



**Figure 11.** (A) *Cerastes cerastes*, (B) *Androctonus australis*, © Housseem Ben Othmen  
(C) *Tropicolotes tripolitanus* © Hamdi Ben Boubaker,  
(D) *Chalcides ocellatus* © Mouhamed Boulbaba

### 2.3. Nocturnal explorations: flashlights and headlamps

Nocturnal explorations using flashlights and headlamps provided participants with the opportunity to observe the diverse nocturnal wildlife, particularly geckos, spiders, and other reptiles. Nighttime excursions often yielded surprising findings, as many species that are difficult to spot during the day become more active and visible at night, including inconspicuous species that employ camouflage, as well as those that hide in deep burrows or under rocks during daylight hours.

During the nocturnal explorations, participants identified several interesting species, such as the peculiar locust *Eugaster guyoni*, large wolf spiders of the genus *Lycosa*, and the Northern Elegant Gecko *Stenodactylus mauritanicus*, among others. These encounters provided unique insights into the nighttime biodiversity of the region.



**Figure 12.** (A) *Stenodactylus petrii* © Hamdi Ben Boubaker, (B) *Lycosa* © Makenna Orton, (C) *Androctonus* sp, (D) *Eugaster guyoni* © Hamdi Ben Boubaker

In addition, with the assistance of Souhaïel from ATR-Akouada, participants had the opportunity to observe the use of an endoscope in the field. The endoscope, equipped with a camera and light source, was used to enter and inspect the interiors of insect, spider, and lizard burrows without destroying them. The resulting non-invasive exploration and observation of the hidden world beneath the surface provided valuable insights into the behavior and occupancy of burrows.



**Figure 13.** An endoscope used to inspect a wolf-spider burrow © Hamdi Ben Boubaker

## 2.4. Light-Trap setup: attracting flying insects

During the final night of the lizard camp, participants were introduced to the use of a light-trap, which is an effective and straightforward method for sampling local entomofauna. The setup of the light-trap involved hanging a white sheet against a wall and directing a strong white light towards it. While everyone gathered for dinner, the trap was left in place to attract flying insects.





As the evening progressed, participants gathered around the light-trap to observe the diverse range of insects and arthropods that were drawn to it. The trap proved particularly attractive to moths (Lepidoptera), beetles (Coleoptera), flies (Diptera), ant-lions and green lacewings (Neuroptera). The activity provided a valuable opportunity for participants to learn about insect taxonomy and nomenclature, as Ghassen shared insights into the different insect Orders and how to identify them.

Although the focus of the trap was on flying insects, we indirectly attracted other organisms as well. Predatory species such as spiders, camel-spiders (Solifugae), and geckos also were drawn to the light-trap, highlighting the complex interactions within the Bou-Hedma region.

The light-trap activity provided participants with hands-on experience in sampling and studying the local insect diversity, showcasing the important role that such techniques play in ecological research and understanding the dynamics of the ecosystem.





# 06 IMPACT AND FUTURE DIRECTIONS



The Lizard Camp had a significant impact on the participants, providing them with valuable experiences and enhancing their understanding of ethology, local biodiversity, and ecology. Through the immersive and hands-on nature of the camp, participants gained practical knowledge and skills in conducting research, observing lizard behavior, and analyzing data. The camp fostered a deeper appreciation for the intricacies of ethology and its relevance to ecological studies.

Furthermore, the camp played a pivotal role in the career development of the participants. By actively engaging in fieldwork, workshops, and discussions, participants gained insights into the research process and developed critical thinking and problem-solving skills. The camp served as a stepping stone for many participants, inspiring them to pursue further studies and careers in ecology, ethology, and related fields.

Looking towards the future, we recommend continuing to organize similar initiatives that focus not only on lizard ethology but also on other taxa and broader ecological concepts. By bridging the gap between theoretical knowledge and practical field research, these camps offer unique opportunities for students to develop scientific skills and inspire a lifelong commitment to the study and conservation of biodiversity in Tunisia.

In addition, future camps could consider expanding collaborations with experts from various disciplines and institutions to provide a more comprehensive and multidisciplinary learning experience. Broad collaborations would allow participants to explore different aspects of ethology and ecology and gain greater perspectives on conservation and local biological issues.

Overall, the impact of the Lizard Camp was profound, empowering participants to become active contributors to ethology and ecology in North Africa. Through continued support and the organization of similar initiatives, we can nurture a new generation of passionate researchers dedicated to unraveling the mysteries of animal behavior and advancing our understanding of the natural world.



# 07 CONCLUSION

The Lizard Camp proved to be a resounding success, leaving a lasting impact on the participants and even achieving interesting outcomes in the field of lizard ecomorphology. Throughout the camp, participants engaged in a range of activities and workshops that enhanced their understanding of lizard ethology, research methodologies, and fieldwork techniques.

The camp created a vibrant and convivial environment, fostering not only scientific growth but also the forging of lasting friendships and professional connections. The camp's success can be attributed to several key factors. Firstly, the diverse group of participants, hailing from different academic backgrounds and stages of their careers, provided a fertile ground for knowledge exchange and collaborative learning. This diversity brought together a variety of perspectives, creating a sense of complementarity and contributing to the overall richness of the camp experience. The participants formed strong bonds and continued to connect with one another beyond the camp, fostering a supportive network of like-minded individuals.

The camp also facilitated interactions with experts in lizard ethology, including Douglas and Maria, who shared their extensive knowledge and expertise. These interactions expanded the participants' networks, allowed for professional connections, and opened doors for future collaborations. The expertise and guidance provided by the instructors enriched the camp's educational value and encouraged participants to pursue further studies and careers in ethology and related fields.

Beyond the scientific impact, the Lizard Camp provided a space for enjoyment and camaraderie. Participants not only delved into the world of lizard ethology but also had the opportunity to bond with one another, creating lifelong memories and friendships. The camp fostered a sense of community and belonging, with participants appreciating the convivial environment that balanced work and science with a spirit of enjoyment and relaxation.

In conclusion, the Lizard Camp was a resounding success, leaving an indelible mark on the participants and paving the way for their future endeavors in ethology and ecology. The camp's achievements extended beyond the acquisition of scientific knowledge, encompassing the formation of lasting connections, the fostering of a supportive network, and the cultivation of a sense of joy and camaraderie. The impact of the camp will reverberate through the participants' future research, collaborations, and contributions to the field of lizard ethology.

# 08. ACKNOWLEDGMENTS

We would like to express our heartfelt gratitude to the following individuals and organizations who made the lizard camp a success:

- The volunteers and experts from the three co-organizers, Erell Institute, ATVS, and ATR-Akouda, who played a pivotal role in organizing and conducting the lizard camp. Their unwavering support, expertise, and enthusiasm greatly enriched the learning experience for all participants.
- We extend our sincere thanks to Erell Institute for providing the funding that made TLC possible. Their support enabled us to create a unique and valuable educational opportunity.
- We are grateful to the General Directorate of Forestry for granting the necessary authorizations for the lizard camp and allowing us access to Bou-Hedma National Park. Their support and cooperation were vital in ensuring a successful and well-organized camp.
- A special appreciation goes to ATR-Akouda for generously providing accommodation at Houch Bou-Hedma. We would like to express our gratitude to Boulbaba from ATR-Akouda for his invaluable assistance in managing food supplies and cooking, ensuring that our camp ran smoothly.
- We are grateful to the families in Houch Bou-Hedma for their warm hospitality and friendly interactions. Their kindness and welcoming nature added a special touch to our stay.
- We would like to express our appreciation to the conservator of the national park, Abdellatif, for his hospitality and assistance throughout our time in the park. We are also grateful to the park rangers for their valuable support and guidance during our field activities.



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We are deeply grateful to all those mentioned above and to everyone else who supported us in various ways during the lizard camp. Their contributions were instrumental in making the camp a memorable and enriching experience for all participants.



