XVIII Congreso Luso-Español de Herpetología
XXII Congreso Español de Herpetología
XIX Jornades Herpetològiques Catalanes

Comunicacions orals i pòsters • Comunicaciones orales y posters •
Comunicações orais e cartazes • Oral communications and posters

Congrés Herpetològic

Congreso Herpetológico • Congresso Herpetológico • Herpetological Congress

De l'1 al 4 d'octubre
Barcelona 2025

congres.soccatherp.org

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Conservation through education: tracking marine turtles with elementary school students

Alejandro Alegría, Patricia Romero-Fernández, Laís V. Ramalho, Davinia Torreblanca, Ricardo Borrego-Santos, Teresa Pérez-Sánchez, Jorge J. Santos-Bruña, Francisca Salmerón, Carolina Johnstone, María José Gómez, Pilar Rioja, Tatiana Oporto, Julissa de la Rosa, José Carlos Báez

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Loggerhead turtle (Caretta caretta) is one of the flagship species of marine megafauna in the Mediterranean Sea, and its conservation is a priority under the EU Habitats Directive. While threats such as bycatch and marine pollution are well recognised, climate change is emerging as a more subtle yet increasingly significant pressure on the species. Rising sea temperatures are triggering a gradual colonisation process in the western Mediterranean, resulting in the emergence of new nesting areas in regions where reproduction was previously absent. Although juvenile loggerhead turtles are commonly found in these waters, the understanding of their nesting behaviour remains limited.

In the framework of the project 'Plan complementario de I+D+i en el 'area de Biodiversidad (PCBIO)', funded by the European Union within the framework of the Recovery, Formation and Resilience Plan—NextGenerationEU; by the Spanish Ministry of Science, Innovation and Universities; and by the Regional Government of Andalusia (subproject ALMA), different educational workshops and interactive games were conducted on the beaches of Fuengirola (Spain), in cooperation with the local city council authorities.

The main aim of these workshops was to promote responsible coexistence with loggerhead turtles by focusing on their ecology, the threats they face, and how to identify and respond to signs of nesting on beaches. The participants learned how to recognise turtle tracks and react appropriately to potential nesting events. A total of 971 primary school students from Fuengirola took part in the activities — 395 in 2024 and 576 in 2025.

The students demonstrated strong curiosity and engagement, and teachers expressed high levels of satisfaction with the initiative. Moreover, various media and public figures showed interest and attended several of the events. It has been shown that interactive learning outside of the everyday environment reinforces learning and influences long-term memory, not only facilitating the assimilation of knowledge but also improving the ability to recall it from memory. Therefore, this type of workshop potentially has a greater and more effective impact on student learning than other, more academically oriented activities.

The Role of Insularity on Climatic Niche Evolution in Mediterranean Wall Lizards

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The role of ecological adaptation in diversification is a major topic of research in evolutionary biology. In this respect, the study of how species' climatic niche—defined as the range of climatic conditions a species can occupy— converge or diverge over evolutionary time, provides a macroecological view to the processes that underlie species' divergence. Understanding these patterns is crucial, as climatic niches influence not only species' distributions, but also their potential for adaptation and speciation.

Islands provide an ideal setting to explore these dynamics. As isolated systems with distinct environmental conditions, they drive unique evolutionary trajectories and offer a natural framework for testing how climatic niches evolve under contrasting geographic and ecological constraints.

In this study, we investigate the influence of insular environments on climatic niche evolution in Podarcis wall lizards, a speciose genus of lacertid lizards (about 25 species) distributed across Europe and North Africa. This group predominantly exhibits parapatric continental distributions and has independently colonized multiple Mediterranean islands, making it an ideal model to assess how climatic niches respond to insularity and environmental heterogeneity.

An updated phylogeny of the genus (44 lineages), extensive occurrence data (76,076 records), and seven bioclimatic variables (at 30" (~1 km^2) resolution) are used to examine patterns of niche evolution. Employing a comprehensive phylogenetic comparative framework, we combine principal component analysis (PCA) with advanced evolutionary modeling—including stochastic character mapping, OUwie models to infer adaptive regimes, and analyses of niche disparity, evolutionary rates, and convergence/divergence.

Our results show that insular *Podarcis* species not only occupy distinct climatic niches compared to their continental relatives but also exhibit slower rates of niche evolution and more constrained climatic preferences. We will further discuss the implications of these findings for understanding adaptive evolution in insular systems.

Vocal Diversity revealed in Peruvian *Phyllodactylus Geckos* (Squamata, Phyllodactylidae)

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Among lizards, geckos are known for their unique ability to emit sounds thanks to structures very similar to our vocal cords. Although there are isolated reports or studies on the vocalizations of other lizards, it is clearly the geckos distributed in Africa, Asia, and Eurasia that have attracted the most attention since the beginning of these studies in the 1970s. In contrast, species from other regions have remained largely understudied in this regard. Here, we present the results of our study, in which we analyzed, for the first time, the vocalizations of geckos of the genus *Phyllodactylus* from Peru.

We report acoustic traits of eleven Neotropical leaf-toed geckos (*Phyllodactylus spp.*) Of them, we obtained novel data of the vocal repertoires of four species: *Phyllodactylus clinatus*, *P. kofordi*, *P. microphyllus* and *P. sentosus*, revealing mainly, greater acoustic complexity than previously documented. Our study characterises distinct advertisement and distress calls across the studied species. Our results support some acoustic patterns seen in other Gekkota lineages. Beyond ecology, this work establishes bioacoustics as a new relevant tool for investigating *Phyllodactylus* biology.

Genomics on a warming sea: structure and adaptation of the Mediterranean loggerhead (Caretta caretta) nesting populations

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Sea turtles are predicted to be heavily impacted by climate change, causing feminisation of the populations and decreasing hatchling survival rates. Here, we genotyped 243 individuals from 11 Mediterranean loggerhead sea turtle nesting populations using 2bRAD and obtaining a panel of 5,998 curated SNPS. We then combined this genomic information of with environmental, behavioural and reproductive data to investigate their population structure and understand their mechanisms of adaptation. We found substantial genetic differentiation among almost all rookeries, with a major break separating Greek locations, and a second break separating Libya from the Levantine. This genetic structuring, caused by male and female philopatry, was also shaped by adaptation with strong genomic signals associated with all phenotypic and environmental variables tested. A conservation prioritisation analysis, to identify the areas with higher priority for protection, concluded that protecting all rookeries is essential as some areas are key to retain the genetic diversity and adaptive potential of the Mediterranean region, while others play a crucial role maintaining connectivity that is fundamental for the long-term survival of this vulnerable species.

Monitoring the reintroduction program of the European pond turtle (*Emys orbicularis*) in the Parc Natural del Delta de l'Ebre (Catalonia, NE Spain)

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By the 1980s and 1990s, the European pond turtle (*Emys orbicularis*) had nearly disappeared from the Ebro Delta. In response, the Parc Natural del Delta de l'Ebre initiated a conservation program in 1988 that included the reintroduction of a few individuals. Population monitoring began in 1992, and captive breeding was added to the program in 1994. In 2006, conservation efforts were revitalized, significantly increasing the number of captive-bred individuals released into the wild. From 1991 to 2024, a total of 1,842 turtles were reintroduced into four wetland areas within the Natural Park (Canal Vell, Buda Island, Alfacada, and Violí), with 97.5% of releases occurring between 2006 and 2024. Most released individuals were subadults, and due to captive breeding conditions, males predominated until 2011.

Since 2002, standardized annual monitoring using capture-recapture protocols has been implemented at most sites. For all individuals (including those of unknown sex), apparent annual survival was estimated at 77% during the first year post-release and 81% in subsequent years (2008–2024). When considering only sexed individuals, annual survival reached 86%, with no significant differences between sexes or years.

Despite the high number of released turtles, only 46 wild-born individuals have been captured to date. Population monitoring has identified key positive factors contributing to population establishment (survival rates, sex ratio, site fidelity, body condition), but it has also revealed emerging threats, including habitat changes, invasive species, and increasing mesopredator pressure. These challenges require site-specific management and conservation actions.

Developing an accessible machine learning workflow for acoustic monitoring of anuran assemblages

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Passive acoustic monitoring (PAM) generates vast datasets that challenge traditional ecological analysis methods, especially for taxa with complex vocal behaviors such as anurans. To address this need we first built AnuraSet, one of the first large-scale annotated collections of Neotropical anuran calls. This dataset was compiled through a collaborative PAM program across Brazil between 2019 and 2024. AnuraSet comprises 1,612 one-minute annotated audio recordings equivalent to 26.87 hours of audio from four Neotropical sites, with detailed species presence-absence and audio quality metadata. This open-access resource was designed to support reproducible research and benchmarking for automated identification of anuran calls, offering a realistic-scale evaluation task and a foundation for developing robust machine listening models in complex tropical soundscapes.

To reinforce the AnuraSet framework, we finally built a streamlined machine learning pipeline for multi-species recognition of anuran vocalizations. We adapted embedding extraction from the BirdNET-Analyzer package and used these representations to train a neural network classifier, employing standard data stratification and multi-label binarization to ensure robust model evaluation. A key methodological advance is the transformation of the neural network's unitless confidence scores into meaningful probabilistic outputs using logistic regression. This probabilistic calibration addresses critical limitations of traditional thresholding by allowing quantitative, application-specific decision rules, reducing false positives, and facilitating more accurate ecological inference in large-scale, multi-species surveys.

Our results demonstrate that this modified pipeline not only improves model performance for most species compared to previous implementations but also enhances the reliability and interpretability of predictions in uncurated datasets. By coupling specialized feature extraction with probabilistic interpretation, our approach offers a scalable and accurate solution for biodiversity monitoring, marking an important advancement for the analysis of continental-scale acoustic datasets of anuran vocalizations in ecological research.

Regional assessment of landscape connectivity in amphibian communities in Central Spain

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Habitat loss and fragmentation are major contributing factors in the amphibian crisis. This is especially concerning in anthropized areas, where artificial elements separating suitable habitat patches impede landscape connectivity, compromising long-term population viability. Robust comparative assessments of regional population connectivity can drive evidence-based conservation measures for biological communities, but require comprehensive field surveys to provide reliable inferences. Here, we assessed patterns of landscape connectivity in 16 native amphibian species grouped in four communities in the Community of Madrid, the most populated region in Spain. We surveyed 2,303 water bodies across the entire region to characterize amphibian communities and developed whole-range distribution models relating species presence data and remote sensing covariates. Then, we projected predicted global distributions in the study region with high resolution and used landscape resistance models and clustering analyses to reconstruct connectivity networks of all species and identify potential ecological corridors and barriers contributing to population fragmentation. We recorded 18-866 breeding sites per species, and generated models with high statistical performance. Connectivity varied spatially and across communities and species, highlighting barriers to dispersal comprising natural (mountains, rivers) and artificial features (water reservoirs, dammed rivers, urban areas), and also ecological corridors, including peri-urban green areas, river valleys and moorlands, and mountain passes. Our work presents a novel methodological framework leveraging data from local (field surveys) and global (online databases) scales across multiple species, enabling robust assessment of community-level connectivity patterns to inform conservation planning.

Dishonest signals? immune function and sexual selection in human-altered landscapes

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Sexual selection processes can be disrupted by environmental degradation, especially when sexual signals reflect the physiological condition of individuals. This presentation shares the results of a study on twenty populations of the palmate newt (Lissotriton helveticus), suggesting that both the degree of habitat alteration and whether the site is located within a Natural Park are related to male immune capacity, body condition, and the development of sexual signaling traits.

The study is based on field data from breeding ponds characterized according to their level of anthropogenic disturbance and whether they fall within protected areas. In each population, immune response was measured using the phytohaemagglutinin (PHA) test, and two secondary sexual traits —toe webbing and crest height— were quantified, alongside assessments of male body condition. Results show that newts from more disturbed or unprotected habitats generally display lower immune responses or poorer body condition. More importantly, the results reveal that in these environments the relationship between physiological condition and sexual trait expression weakens, so that sexual signals no longer reliably indicate individual quality.

These patterns are discussed in light of experimental studies showing that environmental stress can affect both immune performance and the expression -as well as the correlation- of secondary sexual traits. We propose that habitat disturbance may compromise the honesty of sexual signals, thereby altering sexual selection dynamics and triggering evolutionary and conservation consequences in the medium and long term. Finally, we highlight the potential of simple immunological tools, such as the PHA test, to monitor the physiological state of wild populations in the face of global change.

Tortoise and freshwater turtle trade in Spain: the role of digital markets

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In recent years, wildlife trade has increasingly shifted to online platforms, where illegal activities often escape detection and regulation. In Spain, trading wildlife species classified as protected or invasive alien is illegal, and as a party to CITES, Spain is subject to its regulations on listed species. This study analyzed the online trade of tortoises and freshwater turtles over four years on a Spanish digital marketplace. We found widespread commercial activity, including illegal trade in protected native species (*Testudo hermanni and T. graeca*) and invasive exotic species (*Trachemys scripta*). Based on advertisement content, the animals were primarily traded as pets, with no indication of other uses. Sampling averages were 80.2 ± 19.4 advertisements and 27.5 ± 9.1 species. Of these, 60% included CITES documentation, while 40% did not mention any. The trade involved 58 chelonian species and one hybrid, including 12 tortoise species and 46 freshwater turtle species. The most commonly offered tortoises were *T. horsfieldii*, *Centrochelys sulcata*, *Stigmochelys pardalis*, *T. hermanni*, and *T. marginata*. Our results suggest improved regulatory compliance over time, likely due to a rise in professional sellers and more properly documented sales. For species catalogued in Spain, Testudo species showed a positive trend, whereas *T. scripta* remained largely unchanged. Environmental authorities and digital platforms should collaborate to monitor online listings and detect illegal trade early. Further research across additional online channels, such as social media, is needed to better understand wildlife trade dynamics and support strategies to combat illegal trafficking and poaching. Finally, initiatives implemented by public authorities, such as the TIFIES plan (a Spanish action plan against illegal trafficking and international poaching of wildlife species), are essential to combat the illegal wildlife trade.

Croaking against extinction: the challenge to overcome the Linnean amphibian shortfall in tropical biodiversity hotspots

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Global biodiversity faces severe anthropogenic threats, with alarming projected extinction rates. At the same time, most of Earth's diversity remains undescribed, meaning countless species may vanish before being documented. Therefore, there is an urgent need to discover and describe as many species as possible to achieve a representative global inventory and ensure effective conservation. Amphibians, the most endangered vertebrates, exemplify this challenge: while the number of threatened species rises, new species descriptions rapidly increase, and hundreds of candidate species are flagged annually, especially in the tropics, the most threatened regions. We used Madagascar's amphibian fauna, one of the best-studied tropical regions for amphibians, to quantify the unassessed species richness, analyzing 10,873 mitochondrial sequences alongside previously published bioacoustics, distributional, morphological, and nuclear data. Additionally, we analyzed the metadata from all anuran species described since 2000 across four tropical regions to quantify the time required to describe new frog species. In Madagascar, besides the 435 described species, we identified 310 divergent lineages that qualify as candidate species. Most occur in well-studied regions of the island, suggesting that more species may remain undiscovered in under-sampled areas. Incorporating this undescribed diversity could shift conservation priorities and lead to more effective resource allocation. Moreover, it takes 11.3 years on average to formally describe a frog species since the first specimen was collected, exacerbating the so-called taxonomic impediment. The pace of frog species descriptions is too slow to keep up with the accelerating biodiversity crisis. To win the race against extinction, we must prioritize and expedite the discovery and description of undescribed species.

Dissecting a predator invasion in real time: Coupled acceleration of spread and keystone prey extirpation on an island

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Understanding how biological invasions unfold over time and space is essential to anticipate their ecological impacts. Yet, empirical data capturing the internal dynamics of an invasion from establishment to the formation of invasion fronts remain scarce. Here, we use a uniquely detailed dataset combining citizen science, systematic trapping, and field surveys to reconstruct the 20-year spread of the invasive horseshoe whip snake (*Hemorrhois hippocrepis*) across Ibiza and its devastating impact on the endemic Ibiza wall lizard (*Podarcis pityusensis*). We show that invasion fronts form and accelerate as predators deplete local prey, pushing the spread forward. Critically, we find that the time between snake arrival and lizard extirpation has collapsed from over 10 years to just 3 years in recently invaded areas, revealing an alarming acceleration in ecological impact. By combining data on predator spread, prey depletion, and invasion timing, we provide rare empirical insight into how ecological feedback accelerates and structures a predator-driven invasion.

Demography of the Iberian midwife toad (*Alytes cisternasii*) in Sierra de Guadarrama: a long-term study (2009-2025)

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Amphibian populations are often characterized by strong fluctuations in abundance over time, which must be distinguished from true demographic declines in time to design management actions. In this regard, long-term monitoring studies are fundamental to characterize baseline temporal abundance dynamics and detect negative trends. Furthermore, these studies can document the breeding success of individuals, which is essential to assess the viability of populations. This study focuses on a population of the Iberian midwife toad (*Alytes cisternasii*) in Sierra de Guadarrama, near the north-eastern limit of the species distribution. We characterized the demographic structure of the population using data from an ongoing, long-term monitoring program initiated in 2009 based on the capture-mark-recapture method (using PIT-tags), as well as genomic tools. We estimated population census size and its temporal variation with robust design analyses of individual capture histories as implemented in software MARK. In addition, we investigated different aspects of annual and long-term breeding success in the population using a combination of capture histories (providing data on counts of egg clutches carried by males) and pedigree reconstruction using software PRIMUS with a sample of 161 individuals genotyped at 5,566 unlinked SNPs. Genomic tools allowed consolidation of capture histories for individuals which lost their PIT-tags during the study and estimation of the effective population size of the population. Census size estimates peaked at around 100 adult individuals in 2018, followed by a sharp decline to less than 20 individuals in the present. Effective population size estimates ranged from 12 to 34, with a parallel negative trend in the most recent years, and the Ne/Nc ratio was relatively high across most years. Based on field observations of egg counts, male breeding success exhibited significant variability across years, ranging from 86.2% to 11.1%. Mating events were observed all year round, especially in spring, summer, and autumn, but relative proportions of egg clutches varied extensively across years and seasons. A total of 79 males captured during the study period were observed carrying eggs at least once (53.16% carrying one clutch, 26.58% two clutches, 7.59% three clutches, 6.32% four clutches, and 6.32% five clutches) over the course of their lives (with capture histories spanning from 1 to >10 years). Our results underscore the value of integrating capture histories with genomic tools to reveal important yet little-known aspects of amphibian biology and demography, with applications for conservation.

Hot temperatures elevate the prevalence of deleterious turtle shell phenotypes in the red-eared slider, *Trachemys scripta*

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Organisms are subject to selective pressures that favor phenotypic stability by buffering from environmental conditions that may disrupt early development. To address this issue, we evaluated the thermal sensitivity and heritability of a suite of intricately interrelated traits: The turtle's shell. Unlike most terrestrial vertebrates, turtles lay eggs in subterranean nests wherein all stages for the formation of fitness-relevant traits are unattended by parents and might be perturbed by thermal fluctuations. Our results supported this expectation by demonstrating that shell scales (scutes) and correlated skeletal structures were more likely to develop abnormally in embryos that experienced laboratory-simulated heat waves. In the wild, performance and survival probability were affected in hatchlings displaying similar malformations. In older reproductive-age individuals, the occurrence of abnormal shells diminished by 61%. Following favorable egg incubation conditions, 53% of the variability in malformed scutes was attributed to heritable factors. Thus, the frequency of maladaptive phenotypes might be magnified by alterations in gene-by-environment interactions that await investigation. Collectively, we uncovered how phenotypic variance is initially amplified by adverse environmental conditions, while being subsequently modulated by negative selection in an egg-laying vertebrate. These findings expose population-level responses to detrimental effects of extreme weather events that might not be entirely mitigated by adjustments in maternal nest-construction behaviors.

FrogNet: Towards a global AI-classifier for automated acoustic monitoring of Iberian anurans

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Technological advances over recent decades have enabled the rise of emerging methods in ecology. Among them, passive acoustics stands out as a powerful and increasingly accessible approach to monitor wildlife in a non-invasive, scalable and automated way. While this technique is well-established for birds and bats, supported by sound libraries and automatic identification models, it remains underdeveloped for anuran amphibians.

In this talk, we will introduce FrogNet, an initiative to promote automated monitoring of Iberian anurans by integrating passive acoustics, artificial intelligence, and citizen science. This research project aims to develop a suite of interconnected and open-access tools, including: (1) *FrogNet base*, a standardized and annotated database of anuran calls; (2) *FrogNet AI*, an automatic species classifier powered by artificial intelligence; (3) *FrogNet app*, a mobile application for participatory field recording and species identification; and (4) *FrogNet software*, a professional software for acoustic analysis. Oriented to both researchers and the general public, these tools intend to improve our capacity to monitor Iberian anuran communities, while promoting public engagement in amphibian conservation.

To build FrogNet base, we have first conducted a systematic review on acoustic recordings of Iberian anurans in zoological sound libraries and repositories. This review revealed significant knowledge gaps in the acoustic diversity of Iberian anurans, with most of the recordings being focused on a few species and genera (*Hyla*, *Alytes*, *Pelophylax*, *Epidalea*, etc.), while a remarkable lack of information remains for other taxa (*Rana*, *Discoglossus*, *Pelodytes*, etc.). To address these gaps, we carried out an acoustic monitoring program in 30 breeding sites in Central Spain during 2024 and 2025, potentially recording acoustic activity of 11 anuran species.

Finally, we have developed a standardized annotated database of anuran calls, including 800 minutes of activity with both weak and strong labeling. With this database, we will build a global acoustic AI-classifier of Iberian anuran species and design a functional prototype of the mobile app to perform real-time detection trials in the field. Taken together, these efforts lay the foundation for a robust and participatory monitoring system that will be progressively scaled in the coming years.

UV-blue coloration affects male agonistic encounters in the European wall lizard (*Podarcis muralis*)

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Most species of wall lizards (genus *Podarcis*) exhibit ultraviolet (UV)-blue patches located in the outer ventral scales that are more conspicuous and abundant in males than in females. The UV-blue patches remain hidden in a resting lizard, but can be revealed to conspecifics by means of dynamic postural adjustments, which makes them suitable for a signaling function. Available evidence suggests this coloration could inform about fighting ability in males, but results are not conclusive and mainly based on correlational studies. Empirical attempts to confirm the communicative function of this coloration have been unable to confirm or refute this hypothesis. Here, we set out an experimental design to test the signaling function of the UV-blue patches of the European wall lizard (*Podarcis muralis*) in staged contests carried out in an observation chamber (9 m3) that simulates their natural habitat. A big male (68-73 mm) was placed into the chamber for at least one day with a female to be acclimated as the resident lizard, then eight different small males (57-65 mm) were introduced sequentially to observe the agonistic interactions between both. Small males were randomly selected to act as Control (painted with a brown stripe on the flank) or Treatment (painted with a brown stripe to cover the UV-blue patches). This asymmetric design (i.e., size and residence difference) allowed us to mimic natural conditions, in which a resident big male has to confront the arrival of different male contenders that enter his territory. After 90 trials with 12 different focal males, we found that aggression by big males was affected by small males' experimental manipulation, with less aggressive behaviors addressed towards Treatment males. Considering only trials with aggressive encounters, we found that big males performed significantly more raised-body displays and bites towards Control males. Therefore, resident males were more aggressive towards males that retained their original UV-blue patches than to males in which this coloration was completely obliterated. These results are the first experimental evidence of wall lizards using the UV-blue patches to make decisions during agonistic interactions and the confirmation that this coloration fulfills a signaling role in this species.

Habitat Specificity and Phenotypic Variation in Mediterranean Salamanders (*Genus Salamandra*)

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Mediterranean salamanders exhibit remarkable phenotypic diversity, both in their coloration patterns and in their reproductive strategies. Some populations are viviparous, giving birth to fully developed juveniles, while others follow an indirect development, in which larvae are deposited in aquatic habitats and complete their growth externally. This variability raises a key question: to what extent do these traits reflect adaptations to specific environmental conditions?

This study examines whether such variation can be interpreted as an adaptive response to different habitat types. Across a broad geographic range — including the Iberian Peninsula, North Africa, Corsica, and Italy — five species of the genus *Salamandra* were evaluated, taking into account factors such as elevation, vegetation structure, ambient humidity, and proximity to streams. We used the within-outlying mean index (WitOMI)—an extension of the outlying mean index analysis—to estimate the responses of species subsets grouped by specific categories. The main hypothesis is that certain phenotypes occur more frequently in marginal habitats — environments located at the edge of the species' ecological tolerance and requiring specific adaptations.

The results show a clear pattern of ecological differentiation. *Salamandra atra* and S. *lanzai* are found almost exclusively in high-altitude grasslands above the tree line — open environments with sparse vegetation but high atmospheric humidity. These populations are consistently viviparous and melanistic. In contrast, low- and mid-elevation populations, located in denser forests with access to water bodies, tend to exhibit the typical yellow-spotted black coloration and reproduce through larvae that require an aquatic phase.

Interestingly, melanistic morphs were also observed in some lowland populations, particularly in warm areas with little tree cover. This suggests that dark coloration may function as a resource-conserving strategy in especially demanding environments. On the other hand, predominantly yellow morphs appear in moderately warm and humid habitats, where — given the significant physiological cost of producing yellow pigments — such coloration would likely be viable only under optimal climatic conditions for these salamanders.

Taken together, the results indicate that phenotypic traits such as coloration and reproductive mode are closely linked to habitat characteristics. Moreover, marginal habitats seem to act as ecological filters, promoting the emergence of alternative morphological traits and reproductive strategies.

Co-exposure with the herbicide 2,4-D does not exacerbate Batrachochytrium salamandrivorans infection in the Italian crested newt (*Triturus carnifex*)

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Amphibians face a multitude of threats and therefore make a prime example of the current biodiversity crisis. Multiple amphibian stressors in anthropogenic landscapes include infectious diseases and agrochemicals. Synergic effects between these stressors may increase the negative impact of infections on amphibian health. In a 56-day trial, we assessed the impact of co-exposure to the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) and the pathogenic fungus Batrachochytrium salamandrivorans (*Bsal*) on infection parameters (infection intensity and disease severity) and health (body condition and telomere length) in Italian crested newts (*Triturus carnifex*). Twenty days post-inoculation with *Bsal*, newts were either exposed to 2,4-D for 12 days or not exposed (control). Most newts developed high infection loads that steadily increased towards the end of the trial. While body condition was negatively correlated with pathogen burden, only one out of 23 inoculated animals died. Telomere length remained unaffected by the pesticide and the pathogen. The 2,4-D treatment did not exacerbate Bsal infection. Most newts survived almost two months with steadily increasing pathogen loads; thus, even in a pesticide-infested environment, T. carnifex could be an important long-term *Bsal* reservoir for co-occurring species on the Italian peninsula, a urodele diversity hotspot.

Island Tails: How habitat shapes trophic niche and competition in *Teira dugesii* across Azores archipelago

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The Madeira wall lizard, Teira dugesii, native to Madeira and Selvagens archipelagos, recently colonized Azores archipelago. Exhibiting extensive phenotypic diversity and omnivorous diet, in its native range it is distributed across a wide variety of habitats, from intertidal zones to >1,800 m above sea level. The ecological role of this species in the Azores is still largely unexplored. Stable isotope analysis ($\delta^{13}C$ and $\delta^{15}N$) was used to assess habitat-related trophic niche variation of *Teira dugesii* across three habitat types (urban, coastal and altitude) on the nine islands of Azores archipelago. In parallel, we quantified tail regeneration rates as a surrogate of inefficient predation pressure. In colder, high-altitude habitats, with lower arthropod availability, lizards exhibited a more herbivorous diet, reflected in lower $\delta^{15}N$ values and lower trophic level. In contrast, urban populations displayed higher trophic levels and narrower isotopic niche, likely due to the exploitation of human-associated resources. In coastal populations, the increased trophic level might reflect the inclusion of marine invertebrates in the diet as indicated by the $\delta^{13}C$ signature. Tail regeneration patterns mirrored these habitat differences: larger individuals in both urban and coastal areas exhibited significantly higher regeneration rates. These areas have denser populations, suggesting that intraspecific competition for space and food, as well as predation attempts by anthropophilic mammals have high impacts on tail autotomy. The rapid expansion of *Teira dugesii* across an archipelago that evolved without native reptiles might have induced significant impacts on native trophic networks, which need to be monitored.

Modelling the future effect of threats and conservation strategies on the European pond turtle (*Emys orbicularis*) population size

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The European pond turtle (*Emys orbicularis*) is one of the most endangered reptiles in the Iberian Peninsula. Despite enormous conservation efforts, it has recently been listed as Endangered in Catalonia. The population of la Selva plain is considered the best-preserved in the Catalan territory and one of the most important in northeastern Spain. However, it is not free from threats, and the situation in some locations is particularly alarming.

For 38 years, the Fundació Emys has been monitoring the population status of la Selva plain using capture-mark-recapture methods. In this study, we have used ours and published data to build a future population size projection. Several scenarios have been constructed with Vortex software: base (population trend following current status), threats (trend with impacts and their interactions), and conservation (trend with actions to benefit the population).

The base scenario shows a progressive decline in the population over the coming decades, but without reaching extinction. The main potential hazard of the threat scenario is the progressive reduction of habitat, which can interact with drought and the destruction of water points, leading to a drastic decline in the population. Other factors, such as the occasional removal of individuals or the reduction in connectivity between ponds, do not seem to have a critical effect on overall population size.

Habitat expansion, through creation and increase of existing ponds, offers the greatest potential benefit to population size based on conservation scenarios. Techniques such as head-starting or the creation of satellite populations also appear to have a positive effect on the species status. Conversely, improving connectivity would not seem to have any appreciable effect, and releasing adults into monitored areas could even harm the population.
The results of this study demonstrate the vulnerable situation of the studied population and the need to increase the conservation efforts that are being carried out.

Thermal ecology, activity patterns and space use of *Lacerta bilineata* in the "Parc natural dels Aiguamolls de l'Empordà"

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Lacerta bilineata is a widely distributed species across Western Europe, typically found in humid and densely vegetated areas at high elevations (mean; 1500 m.a.s.l.). Despite its broad range, its ecological and demographic characteristics remain poorly understood, partly due to its recent taxonomic separation from *Lacerta viridis*. This study examines the thermal ecology, daily activity patterns, and spatial use of a *L. bilineata* population in the Parc Natural dels Aiguamolls de l'Empordà (PNAE, Girona, NE Iberian Peninsula). This population is of particular interest given its occurrence within a protected area and its rare presence at sea level, representing the lowest known altitude for this species in the Iberian Peninsula.

Field sampling was conducted between spring seasons of 2024 and 2025, by performing regular transects throughout the PNAE area where the species occurs. Lizards were captured and individually marked using photo identification. We recorded their body temperature using a digital thermometer with cloacal probe alongside spatial locations to track individual movements and space occupation. For each observation, we also noted air and substrate temperatures. Relationships between body and environmental temperatures were analysed using regression models, and spatial use patterns were explored using QGIS.

Preliminary results indicate s strong relationship between air and body temperatures, suggesting that daily activity patterns vary according to sex , together with seasonality. This study provides valuable insights into the thermal ecology of the species in a humid Mediterranean environment, with key implications for its conservation in this protected area.

Monitoring amphibian populations in seven parks of the Diputació de Barcelona during a historic drought: resilience or decline?

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In order to assess the conservation status and population trends of amphibians, from 2021 to 2025 a batracological, ecological, and health monitoring program was carried out at over 100 water bodies across seven parks in the Natural Parks Network of the Diputació de Barcelona. The protocol included 50 intensively monitored sites (four nocturnal surveys per year) and 50 additional sites surveyed at least once annually. Field data included detection method (visual, acoustic, and dip-net), the calculation of the ECELS ecological status index for each visit, and the collection of biological samples for the detection of emerging pathogens through PCR, histology, and necropsy. Species presence and abundance were analyzed using accumulation curves, occupancy models, and population trend analysis (TRIM). Over 1,200 surveys were conducted, yielding more than 3,000 amphibian records (each numerical record per species and site considered as one observation). This monitoring encompassed the entire duration of the 2021–2024 historic drought, as well as its initial recovery phase, allowing for an evaluation of the short-term effects of this extreme climatic event. Key findings include: (1) Accumulation curves suggest that several years of monitoring may be needed to detect all species present at a site, highlighting the importance of long-term efforts for accurate presence/absence mapping; (2) TRIM models reveal a sharp decline in detections of Pelophylax perezi adults during the drought, coinciding with a marked increase in *Epidalea calamita*, reflecting opposite strategies in relation to the hydroperiod of aquatic habitats; (3) A positive correlation was observed between ECELS scores and amphibian species richness, consistent with recent literature; and (4) *Batrachochytrium salamandrivorans* (Bsal) was not detected, but *B. dendrobatidis* (Bd) was present in ca. 20% of analyzed individuals. In conclusion, drought effects appear to have been especially severe for P. perezi, the species most closely tied to permanent water bodies and likely the most ecologically influential amphibian in the study area.

Population dynamics of the Chafarinas skink (*Chalcides parallelus*): insights from capture-mark-recapture methods

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The Chafarinas skink (*Chalcides parallelus*) has been found only along a narrow coastal strip between Nador in northeastern Morocco and Cape Carbon in northern Algeria. Thus, the known distribution of this species is limited to a small area and it is considered as Endangered by the IUCN. For effective conservation strategies, it is essential to understand its population dynamics, which requires estimating key demographic parameters. To this end, a series of capture-mark-recapture (CMR) campaigns were conducted between 2005 and 2011 in the Chafarinas Islands archipelago (Spain). We used climatic data and the Normalized Difference Vegetation Index (NDVI) to quantify environmental conditions of the archipelago along the study period. Using both Cormack-Jolly-Seber and Jolly-Seber models, we estimated survival rates and population sizes over time and under varying environmental conditions. Our results showed that survival rates and population size were negatively affected by periods of drought and limited primary productivity in its habitat. In the context of ongoing climate change, such periods of aridity are expected to become more frequent, so these findings highlight the importance of considering climate-related variables in conservation strategies for this poorly known species.

Recombination Plasticity in Response to Temperature Variation in Reptiles

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Reproductive processes are particularly vulnerable to environmental changes, especially in ectothermic species whose physiology is directly influenced by ambient temperature. While it is well-established that organisms activate common transcriptional pathways in response to temperature variations, the impact of temperature on recombination, a key source of genetic variability, remains largely unexplored. Previous studies in model species have shown that the frequency of recombination during meiotic prophase I can be influenced by extreme temperatures. Yet, it remains unclear whether this effect is also conserved in non-model vertebrates, especially in natural populations. In this study, we investigated the effect of temperature on meiotic recombination in the Guibé's ground gecko (*Paroedura guibeae*), an ectotherm species. We analyzed the formation of double strand breaks (DSBs) and crossovers (COs) by immunolocalizing the meiotic proteins involved in these processes. Additionally, we determined the frequency and chromosomal location of COs and assessed the levels of CO interference. Our findings reveal the presence of hyper-COs spermatocytes in individuals exposed to both high and low temperatures. Notably, this marked increase in COs was accompanied by shorter chromosome axis lengths and higher levels of DSBs in later stages of meiosis. These findings suggest that environmental temperature shifts can disrupt meiotic dynamics, with potentially affecting fertility and species adaptation. Overall, this study highlights a mechanistic link between environmental stressors and reproductive outcomes in ectothermic species.

Women's Contributions to International and Spanish Herpetology

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Gender bias in science is a well-documented phenomenon, and unfortunately, Spanish herpetology appears to be no exception. In this talk, we explore the valuable contributions of some of the most prominent female herpetologists, including historical and international figures as well as contemporary national leaders or promising young women. Additionally, we quantify recent female participation in Spanish herpetology by analyzing the annual membership intake of the Asociación Herpetológica Española (AHE), authorship of scientific contributions to the association's bulletin and its journal Basic and Applied Herpetology, the publication of monographs, bulletin reviews, and conference participation. Overall, we find that women are underrepresented in all aspects studied. For example, 80% of AHE members are men, although membership intake has become more balanced in recent years. Since 2010, women have only been first authors on around 20% of the association's publications, and senior authors on 13%. Since 2004, women have delivered only 18% of plenary lectures at AHE congresses. We hope that the recent creation of the "Equality, Inclusion, and Youth Committee" will help to improve this situation.

Detecting emerging pathogens in free-ranging amphibians in northern germany in 2025

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Amphibian populations are undergoing a dramatic global decline. Emerging infectious agents —including the well-documented chytrid fungi *Batrachochytridium dendrobatidis* (Bd) and *B. salamandrivorans* (Bsal), ranaviruses, and the recently described viruses bufonid herpesvirus (BfHV-1) and ranid herpesvirus 3 (RaHV-3) — are major threats to amphibians. In Schleswig-Holstein, Northern Germany, native amphibian species are facing declining population trends. In this study, regional surveys were conducted on live amphibians to determine the prevalence of key pathogens across multiple species in 2025. A total of 442 free-ranging amphibians from eight species were sampled via skin swabs in four locations in Schleswig-Holstein. PCR analysis was used to systematically test swabs for the presence of Bd, ranaviruses, and both herpesviruses in anuran species, and for Bsal in urodeles.

Preliminary overall prevalences were 6.3% for Bd, 10.9% for BfHV-1 and 5.6% for RaHV-3. Pathogen prevalences were significantly different between species. Bd was detected most often in water frogs (*Pelophylax spp.*) (12.6%), followed by common toads (*Bufo bufo*) (2.6%). BfHV-1 was mostly detected in common toads (*Bufo bufo*) (76.9%), while RaHV-3 was found in 25.4% of common frogs (*Rana temporaria*). Neither ranaviruses nor Bsal were detected in any of the samples. Initial analyses suggest spatial variability in pathogen detection across sampling locations, which may be influenced by local environmental conditions and variations in host community.

Our findings confirm the presence of multiple pathogens in northern Germany. However, the role of the different host species in the epidemiology and transmission dynamics of these pathogens remains unclear. Long-term monitoring programs are therefore essential to clarify the impact that these infectious agents have on native amphibian populations.

An agile pursuit: monitoring a population of an endangered amphibian (*Rana dalmatina*) using radio-tracking

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Amphibian movement ecology remains poorly documented. Quantifying terrestrial displacements in and out of their breeding sites is challenging due to logistical constraints related to their small size, inconspicuousness, and largely nocturnal activity, and the time and economic effort required to conduct individual monitoring over informative time periods. However, data on the frequency and spatial extent of their displacements are key to guiding conservation efforts in the face of generalized habitat loss and fragmentation. We focused on the agile frog (*Rana dalmatina*), a widespread European species with relict populations in the north of the Iberian Peninsula, listed as Endangered on the Spanish Catalogue of Threatened Species. Specifically, we monitored post-breeding displacements of adults in a population in Álava (Basque Country) using radio-tracking. During 2024 and 2025, we equipped 40 adult frogs with handmade harnesses containing small radio transmitters. We followed individuals for an average of 32 days, recording exact daily geolocations, and detailing the type of habitat (based on SIOSE categories) and microhabitat used. We calculated daily and total displacements, as well as the maximum distance from their closest breeding site, separately for males and females, and estimated their home ranges based on the Minimum Convex Polygon (MCP) containing all geolocations, as well as Brownian Bridge Movement Models (BBMM). Finally, we analysed the effects of sex, body size, habitat, and weather on recorded displacements. Most individuals performed few but long movements (migratory events), remaining inactive most of the time. Movements were dependent on precipitation, temperature, and season. Distances and home ranges were highly variable, with the longest distances (up to 1247 m) corresponding to the largest individuals. The main land cover type used by agile frogs was conifers, followed by grasslands and meadows, while the preferred microhabitat for shelter was herbaceous vegetation. Our results highlight the value of studies delving into the movement ecology of amphibians in applied conservation, especially in species threatened by habitat fragmentation, for example by identifying optimal locations for the creation of new breeding ponds connecting populations.

Effect of feral cat colonies on the catalan wall-lizard (*Podarcis liolepis*) in urban and peri-urban environments

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The domestic cat (*Felis catus*) is a globally dispersed species that has become invasive, posing a significant threat to wildlife due to its adaptability, active predation on local fauna and a general public negation of its ecological impact. However, scientific consensus recognizes the domestic cat as a serious threat to biodiversity.

This study aimed to characterize the impact of human-maintained cat colonies on the Catalonian wall lizard (*Podarcis liolepis*) in both urban and suburban areas. This species is chosen for its known predation by cats, ease of identification and well-documented populations in the study area. Specifically, we investigated potential differences in physical condition, population density and antipredatory behaviour across lizard populations with and without cat presence. For this purpose, we measured lizards' body size, mass and percentage of autotomized tails, and density of individuals captured in various sampling sites across the Collserola Natural Park. To investigate behavioural differences, we also evaluated capturability and conducted standard escape experiments that simulated a predator attack to measure flight initiation distance and distance to refuge.

Our results showed differences between cat-affected and cat-free wall-lizard populations in all studied parameters. Specifically, we found that both male and female wall-lizards were smaller and exhibited a higher percentage of altered tails, and populations showed lower capturability rates and generally lower densities in areas with cat colonies. In addition, our preliminary results suggested that antipredator behaviour also differed across populations, with those sites affected by cat presence exhibiting larger flight initiation distances –lizards fled earlier– and shorter distances to the refuge. Our results showed the negative impact of human-maintained cat colonies on the demography, physical condition and behaviour of wild lizard populations. Although this species is classified as Least Concern by the IUCN, our results could be extrapolable to other vulnerable or endangered reptile species, with which Catalonian wall lizards share habitat.

The relevance of visual ecology on the design of lizard social visual signals

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Lacertids (Lacertidae) represent one of the most exciting lizard groups to study the evolution of animal colours. They show an extraordinary colour variation, from striking highly contrasted patterns, often sexually dimorphic, to cryptic monomorphic designs. The presence of conspicuous ultraviolet (UV)-based lateral patches is common in many species, mainly in males. This type of patch is presumably related to a communicative function acting in male-male agonistic contexts. However, there exists a great inter-specific variation in the presence and design of this coloration. Whereas many species present UV-blue lateral patches, in other cases the patches are UV-green or UV-yellow, and numerous species completely lack any conspicuous patch. Theory predicts a trade-off between conspicuousness to increase signal efficacy and avoidance of signal exploitation by undesired observers (e.g. predators). Here we hypothesise that the variation in the design of the lateral conspicuous patches in lacertids is constrained by the complexity of the visual environment. In particular, we expect that the different patch types differ in conspicuousness (i.e. UV-blue > UV-green > UV-yellow > no-patch), with the most conspicuous present in species inhabiting complex habitats (i.e. most vegetated, with a high concentration of refuges) and the least conspicuous ones inhabiting simple habitats (i.e. open deserts). To test this, we adopted two complementary approaches. First, we used objective colour measurement techniques (spectrophotometry, visual modelling) to compare the conspicuousness of each patch type focusing on three representative species: *Psammodromus algirus* (UV-blue), *P. edwarsianus* (UV-green), and *Acanthodactylus erythrurus* (UV-yellow), which may occur in sympatry but use distinct microhabitats. Second, we used a comparative phylogenetic analysis to test if the degree of conspicuousness is related to environmental complexity at a macroevolutionary scale (N = 343 species). Our results confirm differences in conspicuousness among patch types and that species occupying visually complex habitats tend to possess more conspicuous patches than species inhabiting open areas. Altogether, our findings support our hypothesis that visual ecology constrains the design of conspicuous colour signals in lacertids.

Drivers of amphibian species richness in European ponds

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Amphibians are commonly occurring inhabitants of most lentic freshwater ecosystems, yet their global populations are in alarming decline. Ponds in particular play a crucial role in supporting amphibian biodiversity. In this study, we identified the main drivers influencing amphibian species richness by conducting a comprehensive ecological characterization in 201 ponds across seven European countries spanning a large latitudinal and longitudinal gradient. The amphibian species richness in each of these ponds was assessed using environmental DNA metabarcoding on water samples. The relative influence of climatic, local abiotic and biotic, and land use variables on variation in species richness across ponds was quantified using Boosted Regression Trees. Our results suggest that local factors, particularly chlorophyll-a concentration, but also pond area and depth, are the main drivers of amphibian richness, together with climatic variables such as annual mean precipitation and temperature. The highest richness was observed in low-nutrient, fishless, intermediate-sized, shallow ponds, located in warmer regions with higher precipitation rates. These potential drivers of amphibian richness should be considered in the planning and implementation of amphibian conservation and management actions.

Validation of eDNA methods for managing the terrestrial invasive snake Lampropeltis californiae on the Canary Islands

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Invasive snakes are among the most challenging invaders worldwide due to their exceptionally low detection rate and grave ecological impacts. Environmental DNA (eDNA) has emerged as a promising tool to improve invasive snake detection and enhancing management programs, yet its application to terrestrial snakes remains underexplored. This study provides the first advances in the use of eDNA techniques to detect the terrestrial invasive California kingsnake (*Lampropeltis californiae*). We designed L. californiae-specific primers and tested their effectiveness in detecting the species in different environmental samples, including swab samples from underneath artificial cover objects (ACOs) made of different materials, soil beneath ACOs, randomly collected soil, and researchers' boots. Additionally, we conducted a controlled experiment to assess the accumulation and degradation rate of L. californiae eDNA over a 14-day period (7 with snakes in the terraria and 7 after having removed them). We detected *L. californiae* eDNA in 9.31% of swab samples, in 2.22% of soil samples under ACOs, and in 2.56% of boot samples, while no detections appeared in randomly collected soil or controls. In the controlled experiment, eDNA was undetectable in terraria prior snake introductions, but remained detectable throughout the study, with no evidence of snake eDNA degradation after snake removal. These findings provide key insights for the implementation of an eDNA-based protocol for the detection of *L. californiae* in Gran Canaria, offering a valuable tool for monitoring this invasive species. Furthermore, this study could be used for refining eDNA methodologies to detect other elusive terrestrial snake species elsewhere.

Management of introduced alpine newt populations in the Catalan Pre-Pyrenees (2022–25): outcomes and insights

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Since the detection of the alpine newt (*Ichthyosaura alpestris*) in the Catalan Pre-Pyrenees in 2014, several studies and eradication attempts have been carried out. The most ambitious of these is an ongoing project launched in 2022 by the Catalan Herpetological Society (SCH) and the Amphibian and Reptile Rescue Centre of Catalonia (CRARC), with the support of the Barcelona Provincial Council. Following an initial assessment and minor methodological adjustments over time, systematic captures have been conducted at six water bodies within the affected natural area. In parallel, extensive diurnal and nocturnal surveys have been carried out in nearby locations to detect potential new populations. Capture efforts combined pitfall traps with perimeter drift fences and aquatic funnel traps, with methods adapted to the accessibility, hydrological conditions, and newt abundance at each site. To assess control effectiveness, generalized linear models were used to estimate adult capture probabilities per session, incorporating factors such as year, site, phenology, weather, and trapping method. To date, around 600 adult individuals have been removed, with a >70% reduction in capture probability - interpreted as a substantial population decline and a clear indicator of success. Results revealed highly uneven distribution among ponds, with key sites likely corresponding to the original introduction point. Phenological patterns showed a distinct spring peak in captures, aiding in the planning of annual control efforts. In contrast, the influence of weather variables on capture rates proved inconsistent and inconclusive, limiting their usefulness for optimization. Finally, perimeter fences combined with pitfall traps were found to be highly effective when a complete enclosure of the pond was feasible, significantly increasing capture success. Funnel traps proved useful both as a standalone method and as a complementary tool, capturing individuals that escaped other traps or exhibited atypical phenology.

Individual assignment for loggerhead turtles: creating a genomic baseline and evaluating its resolution

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Genomic techniques provide unprecedented resolution to evaluate the behaviour, reproductive success, and threats in species of conservation concern. For sea turtles, identifying the natal origin of individuals found in foraging areas, fisheries bycatch, or newly nesting sites is essential for making scientifically informed management decisions. Genomic reduction techniques are often employed to optimize costs in species with large genome sizes, such as sea turtles, and, among these, 2bRAD sequencing is additionally useful when the sample material yields degraded DNA. However, it is essential to apply a uniform methodology for cross comparisons and to assign an origin to individuals of unknown origin. For this reason, it is crucial to first build a genomic baseline using individual data from regular nesting areas belonging to different Regional Management Units (RMUs) and known Subregional Management units (SubRMUs), and second, use the same methodology to identify the genetic origin of unknown individuals sampled from mixed populations at sea.

In this study, we built a baseline using genomic data from 283 individuals from three RMUs, using 2bRAD (AlfI enzyme) and W-adaptors for secondary reduction. Sequences were mapped to the published loggerhead turtle reference genome. The dataset included 15 individuals from the North-West Atlantic (NWA) RMU, of which 12 individuals collected from Quintana Roo (QRO, Mexico), and 3 from Grand Cayman (CAY, Cayman Islands). We also genotyped 25 individuals from the North-East Atlantic (NEA) RMU collected in Boa Vista (BOA, Cape Verde). In addition, we incorporated data from 243 individuals from 11 nesting sites across the Mediterranean (MED) RMU, previously grouped into three SubRMUs: Libya (LIB), the Levantine region (LEV), and the Greek region (GRE). After filtering, we retained 6,589 SNPs genotyped in over 70% of the individuals,

revealing high genetic differentiation among the three RMUs. We then performed a hierarchical analysis focusing on the Mediterranean RMU using the same SNP panel, confirming genomic differentiation among the three SubRMUs. We evaluated the baseline assignment potential by analysing 124 juvenile loggerhead turtles, genotyped with the same methodology, collected from four Mediterranean foraging grounds: Catalan Coast (CAT), Lampedusa (LAM), Eastern Aegean Sea (EAS), and Western Aegean Sea (WAS). We tested different genotyping strategies and found that combining the genotype datasets of the baseline and the unknown individuals while retaining the filtered baseline SNPs in both datasets is fundamental to avoiding the loss of genotyped SNPs and ensuring reliable assignments.

For individual assignments, we used two approaches. First, we employed a hierarchical approach for the baseline to be used, starting from a global perspective (using the global baseline of the three RMUs) and subsequently focusing on a regional perspective (using only the Mediterranean nesting locations, grouped in the three SubRMUs). Second, we employed an all-at-once approach, in which all five genetic groups, the two Atlantic RMUs (NWA and NEA) and the three Mediterranean SubRMUs (LIB, LEV and GRE), were used simultaneously as reference groups for assignments.

The assignment of the 124 individuals with unknown origin (juveniles foraging in the Mediterranean) to a given RMU was successful with a probability greater than 85%, resulting in 2.4% individuals assigned to NWA, 0.8% to NEA, and 96.8% to MED. When using the Mediterranean baseline only, most individuals were assigned to the Levantine SubRMU, although some exhibited mixed assignments, suggesting potential gene flow or breeding among SubRMUs. Additionally, the assignment of individuals with an Atlantic origin, according to the global baseline of the three RMUs, to one of the Mediterranean SubRMUs, when using the Mediterranean baseline only, highlights the importance of including all relevant genetic groups in the baseline to ensure accurate origin assignments. Furthermore, using the all-at-once approach, we found that this genomic baseline provides a good assignment potential across all defined hierarchical levels. We found differences of primary contributing sources across the foraging grounds, GRE was the primary source of individuals in EAS (48%), individuals from LEV were predominant in WAS (72%) and CAT (74%), and the highest proportions of Atlantic (8%) and admixed (39%) individuals were found in LAM. Our methodology enabled the unprecedented assignment of all individual samples, offering novel insights into sea turtles dynamics and conservation. Overall, this strategy represents an effective methodology and baseline for identifying populations impacted by threats beyond nesting sites, and the knowledge gained can be transferred to other endangered species.

Tracking the 22 years of loggerhead turtle colonisation in Spain

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Due to the current changing environmental conditions, many species are changing their distribution and migrate to new areas to avoid potential extinction. Long-lived animals, like the loggerhead sea turtle (Caretta caretta), are particularly vulnerable due to its temperature sensitivity and life-story traits. Despite these challenges, the species has expanded its nesting range in the Mediterranean, colonising the western region. Nesting on Spain's east coast has been monitored since 2001, revealing a steady increase and providing a rare opportunity to characterise the early stages of colonisation and the foundation of a new population, a singular process with limited empirical evidence. To do so, we analysed 330 hatchlings and 13 nesting females from 59 nests along the Spanish Mediterranean coast (2001-2023). For each nest, we constructed individual 2bRAD genomic libraries using a variable number of hatchlings per nest and sequenced the D-loop region of the mtDNA from one hatchling per nest, as well as the nesting females when samples were available. We also collected reproductive data: clutch size, hatching success, viability, and incubation duration. Relatedness analyses identified at least 13 females that laid multiple nests in the same season (re-nesters). Notably, we detected six remigrant females nesting in different seasons, mostly in recent years. Two males sired offspring with different females across seasons since 2019, suggesting male philopatry. Parentage analysis estimated a minimum effective breeding population of 38 females and 47 males. We also assigned individuals to their populations of origin using a genomic baseline from three Regional Management Units (RMUs): Northwest Atlantic, Northeast Atlantic, and Mediterranean. Two nests were assigned to the Northwest Atlantic RMU, six showed admixed origin between the Northwest Atlantic and Mediterranean, and the rest were of eastern Mediterranean origin, mainly Greece or the Levantine region, with some admixed nests. We show that genomic approaches are powerful to study colonising events. Overall, our findings demonstrate the power of genomic tools to study a colonisation process. The results support an ongoing expansion and establishment of a new resident population in the Western Mediterranean. Monitoring this process offers a unique opportunity to observe colonisation in real time in a long-lived species, likely adapting its philopatric behaviour to climate change. Understanding these patterns is key to developing effective conservation strategies.

Raising cities in ponds: population dynamics of three amphibian species during urban expansion in Tres cantos, Madrid

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Urban development negatively impacts amphibian communities, especially in the Mediterranean region. Against this growing impact, amphibian demographic information is key to conduct accurate, compatible conservation planning across city expansions. However, the main demographic and ecological parameters of urban amphibian populations – such as population sizes or the use of space of individuals – remain poorly understood. In this study, we monitored three amphibian species (*Pleurodeles waltl*, *Pelobates cultripes*, *Epidalea calamita*) that have been subdued to an urbanization process (2020-2025) in the city of Tres Cantos, in the Community of Madrid. We initially sampled each water body in the study area (N=33, 2020), mainly located in plots where amphibian populations established through years. However, public works progressively replaced most of these amphibian breeding sites by buildings (N=25) during the study period, and the urbanization process also implied the construction of new roads and habitat degradation. At each breeding site and across terrestrial transects and roads, we hand-captured, sexed, weighted, measured and geolocated every individual of the three target species, and inspected them in search of scars or deformities. Then, we took a dorsal (anurans) or ventral photo (urodeles) and released them at the same place of capture. We identified individuals (around 252, 261 and 3,482 for *P. waltl*, *P. cultripes* and *E. calamita*, respectively) using photoidentification, which has been demonstrated as a non-invasive, effective tool for Capture-Mark-Recapture (CMR) studies. We estimated population sizes using software MARK and calculated maximum and cumulative distances and home-range areas for each species and sex. We assessed changes in movement patterns and population estimates along the study period, and explored the association between demographic fluctuations and the urbanization process. Finally, we assessed the status of each species and proposed restoration and protective measures, aiming to integrate amphibians within urban planning. Our results underscore the problem of intensive urbanization for amphibian conservation, including records of local extinctions documented with CMR monitoring programs.

Evidence of inbreeding in the breeding program of the La Gomera giant lizard (*Gallotia bravoana*)

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The reproduction plan for the giant lizard of La Gomera (*Gallotia bravoana*) was initiated in 2000 with six individuals (3 males and 3 females). Just four years later, the number of breeders increased to 12 individuals. Since then, more than 800 individuals have been bred; over 300 of which have been reintroduced into various locations in their natural habitat. However, only in the most recent reintroduction site (in 2022) there is evidence of any surviving individuals. The low number of individuals in the reproduction plan raised concerns about the possibility of inbreeding and a consequent loss of heterozygosity in the ex situ population. To prevent this, initial matings in the reproduction plan were carefully selected. In subsequent years, some malformations, like vertebral deviations in the tails of some lizards born in captivity were observed annually, although these appear to have no apparent effect on survival. However, after 25 years, a comprehensive review of 27 anomalous selected specimens revealed a total of 5 individuals (0.62% of the total born in captivity) with clear signs of expressing recessive traits. These traits include an ivory-to-white coloration covering the entire cephalic area, slight mandibular shortening (brachygnathia), and alterations in cephalic scales. Additionally, these individuals exhibit certain dermatopathies that are not observed in other lizards, such as cutaneous papillomas. Possible causes related to husbandry or nutrition were ruled out, as the affected animals live under the same conditions as unaffected ones, and health monitoring tests indicate that all animals are within normal parameters. Given the suspicion of inbreeding, it is recommended to conduct genetic studies to confirm the inbreeding process, introduce new breeders of wild origin, and remove from the reproduction program those individuals exhibiting any of the mentioned symptoms in order to prevent perpetuating these recessive traits.

The Iberian Vipers Population Monitoring Network

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Information on the life history and demographic and ecological traits of populations is key to properly assessing the conservation status of species and developing coherent management strategies. The three viper species present in the Iberian Peninsula—the asp viper (*Vipera aspis*), Lataste's viper (*Vipera latastei*), and Seoane's viper (*Vipera seoanei*)—are seriously threatened by anthropogenic factors such as habitat loss and climate change. However, the information available for these species at the population level is either non-existent or very limited, which limits the development of conservation measures at different scales. The "Iberian Vipers Population Monitoring Network" was born in February 2024. With the support of

various associations, it coordinates more than 40 researchers and naturalists in monitoring populations of the three species throughout Spain and Portugal. Currently, the Network monitors 33 viper populations (5 *V. aspis*, 19 *V. latastei*, and 9 *V. seoanei*), conducting capture-recapture transects six times a year (three in spring and three in summer-autumn). In this communication, we present the Network and the methodology used to carry out population monitoring, as well as a comparison of the results obtained from monitoring carried out during three sampling seasons (spring 2024, summer-autumn 2024, and spring 2025). We show geographical and temporal patterns of variation in the abundance of individuals within and between the three viper species, also highlighting some local conservation challenges faced by the different populations.

One spring to breed them all: temporal trends and drivers of explosive breeding in the natterjack toad (*Epidalea calamita*)

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Amphibians are currently facing widespread population declines, but conservation actions are often hindered by knowledge gaps about their life history and demography. Long-term monitoring programs are essential to characterize natural demographic fluctuations and identify the main intrinsic and extrinsic drivers of population dynamics. Some relevant parameters to assess population recruitment and turnover rates are the onset and extent of the breeding season, the average reproductive success of individuals, and their interannual variability. We analysed 16 years of individual-based capture-mark-recapture data from a population of the natterjack toad (*Epidalea calamita*) in Sierra de Guadarrama (Madrid, Spain) to characterize long-term reproductive patterns and identify major intrinsic and extrinsic drivers of temporal fluctuations in breeding activity. Specifically, we applied generalized linear mixed models to explore possible determinants of temporal variation in the number of i) sexually mature individuals present at the breeding area, ii) mating pairs formed during the season, and iii) egg strings deposited at the breeding pond (used as proxies for mating activity and reproductive success), as well as iv) the date of arrival of individuals to the breeding site and v) the extent of the reproductive period (a proxy for breeding phenology) over a 16-year timeframe (2010-2025). We assessed the environmental influences on breeding dynamics by examining the effects of climatic variables (precipitation and temperature), and explored the role of intrinsic factors by capturing variation in traits like individual identity, sex and body size. Preliminary results quantify the interannual variation of the reproductive effort of this explosive-breeding species, showing a relatively short, synchronized breeding period primarily driven by the number of days with cumulative rainfall > 3 mm across the first half of the hydrometeorological year (September-March) as well as the number of days in February with minimum temperatures > 4 ºC. We also found differences between males and females in the time of arrival and time spent at the breeding area and in their reproductive success, associated with body size. These findings contribute to unravel the breeding strategies of amphibian species and highlight the value of long-term, individual-based monitoring to disentangle how environmental and biological factors interact to shape their reproductive and population dynamics.

Morphometric differences and effects of admixture in *Caretta caretta* hatchlings in the emerging population of the Western Mediterranean

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The increase in nesting activity in the Western Mediterranean of the loggerhead turtle (*z*) is considered to be a response to changing environmental conditions resulting from global warming. In this context, it is important to trace the origin of individuals nesting in the Western Mediterranean and to evaluate the associated possible fitness consequences. To do so, we analysed 87 samples of hatchlings belonging to 21 nests laid along the Spanish eastern coast in 2023. Samples were processed using the 2bRAD genotyping method, obtaining a total of 5,925 curated SNPs. First, we inferred the population of origin of the samples using Individual Assignments and a previously built baseline including nesting individuals from several populations in three regional management units (Northwest Atlantic, Northeast Atlantic and Mediterranean). The hatchlings of almost all nests (19) were assigned to the eastern Mediterranean region (predominantly Greece or the Levantine region), one nest associated to the Northwest Atlantic (indicating that both parents had the same Atlantic origin), and one was classified as an admixture of Northwest Atlantic and the Mediterranean regions. Second, we tested whether hatchlings had morphometric differences according to the origin of their parents and whether admixed individuals had higher bilateral asymmetry, indicative of potential outbreeding depression. We also confirmed that there is no sexual dimorphism regarding the carapace of hatchlings for the three types of nests, to guarantee the absence of sex bias. The effects of different types of incubation (beach or artificial incubator) within the same nests were also assessed. We found statistically different carapace morphologies: the Atlantic group had a more hydrodynamic shape, the Mediterranean group had a rounder shape (without apparent differences among subRMU regions), and the RMU admixed group showed an intermediate morphology. Additionally, higher levels of admixture reduced the shape differentiation, being lower in the RMU admixed nest than in a subRMU admixed. These findings suggest that the size differences detected in adults from natural populations may have a genetic basis, as we detected shape differences already in hatchlings from different origins laid in the same region. Furthermore, the RMU admixed nest presented higher values of fluctuating asymmetry (FA), which could be associated with outbreeding and potentially negatively affecting fitness. Finally, half of the nests exhibited shape differences depending on the incubation method, while asymmetry remained consistent across both types. This study provides a foundation for future research concerning the effect of admixture on reproductive fitness and highlights the need to evaluate the vulnerability of the rising establishment of a resident population in the Western Mediterranean.

Unravelling the effects of expansions. How glacial cycles and natural expansions influence *Testudo graeca* genomics on both sides of the Mediterranean

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Throughout the Mediterranean Basin, glacial-interglacial dynamics, geographical barriers, and multiple episodes of faunal exchange across the sea have influenced the current distribution and population genetics of species. As a result of this wide variety of biogeographical processes, contrasting patterns of genetic diversity and demographic trajectories are observed on both sides of the Mediterranean. Here, we focus on Testudo graeca, the most widely distributed tortoise species of the Palearctic region that also shows an intricate evolutionary history. Western Mediterranean subspecies of *Testudo graeca* form a monophyletic clade that diverged from the eastern lineages during the Late Miocene to Early Pliocene, following a westward expansion from the Caucasus. Among them, *Testudo graeca whitei* is native to Algeria and eastern Morocco, but it also occurs in more recent populations at the Iberian Peninsula. During the Last Glacial Maximum (21 kya), the subspecies populations in North Africa experienced population fragmentation and were confined to climate-suitable refugia, followed by a postglacial range expansion. Iberian Southeast population (Murcia and Almería regions, in Spain) has its origin around 20–30 kya. Although in this case the role of humans as dispersal agents across the Mediterranean remains unclear, patterns of isolation by distance and genetic surfing suggest a natural expansion within its current range.

We use Whole Genome Sequencing (Illumina paired-end reads) to assess the genetic consequences of these range dynamics. We sequenced four individuals: two from Algeria, located inside and outside glacial refugia, and two from the Iberian Southeast—one from the origin of the population and another from the northern periphery of its distribution, located at the expansion edge. Dated demographic inferences match with the species' phylogeny and the two different suggested expansions. Additionally, we report genetic erosion in peripheral areas, supporting the natural expansion of the Iberian population and the role of glacial refugia as genetic reservoirs. This study underscores how Pleistocene climatic fluctuations had a deep influence on the genetic structure of North African populations and provides a framework to address the genomic consequences of the Iberian expansion.

Combining genomics and paleoclimatic modelling to assess the evolutionary history of Peringueyi's adder (*Bitis peringueyi*)

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The evolutionary knowledge on the sidewinder or Peringueyi's adder (*Bitis peringueyi*), a small, dune-dwelling, endemic species to the coastal deserts of Namibia, has been limited to phylogenetic inferences focused on the entire genus Bitis, and based only on few loci. In this work, we investigate the evolutionary history of B. peringueyi by combining genome-wide population genomic and paleoclimatic modelling inferences. We have sequenced a total of 41 samples spanning across its distributional range and provided an evolutionary context by including some samples from other species of dwarf adders (i.e. *Bitis caudalis* and *Bitis schneideri*). We built an SNP dataset containing 12,480 unique SNPs, revealing a pronounced genetic structure across *B. peringueyi* populations, indicating limited gene flow and potential historical isolation. Phylogenetic reconstructions consistently identified two major genetic clusters within the species: one comprising the majority of populations, located in the Namib-Naukluft and Dorob regions, and a second distinct group restricted to the Skeleton Coast region. Paleoclimatic modelling confirmed that suitable climatic conditions for the species are restricted to the Namibian coast. A pattern of population expansion during cold periods (LGM) and retraction/isolation in warmer periods (LIG/current) is inferred, with the southern region acting as a climatic refugia. The major intraspecific genetic discontinuity seems to be driven by climatic events, although habitat restrictions (i.e. absence of dune habitats) are likely involved too. Furthermore, future landscape studies will address putative effects on the observed limited gene flow between populations. This study provides essential baseline data for future evolutionary, taxonomic and conservation research on this species and underscores the importance of combining genomics and climate modelling into the study of desert biodiversity.

Introduced populations of the Ibiza wall lizard in different areas of Spain

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The Ibiza wall lizard (*Podarcis pityusensis*) is an endemic species to Ibiza and Formentera, currently threatened by several Iberian invasive snakes (mainly the horseshoe whip snake, *Hemorrhois hippocrepis*). The presence of ophidians has caused an alarming decrease in the lizards' main island population, and in just a few years, it has led to the extinction of at least one subspecies that inhabited an islet. This situation has caused an update of its conservation status on the UICN Red List, changing from Near Threatened to Endangered.

Nevertheless, this same endangered species inside its natural distribution, has been introduced to several areas across Spain, both mainland and islands, where it behaves as an invasive species in some cases. The most striking case is in San Juan de Gaztelugatxe peninsula, in Biscay, where *P. pityusensis* has completely excluded the autochthonous common wall lizard (*P. muralis*). There are also introduced populations in Monte Urgull (Donostia), Barcelona city, some localities on Mallorca, Oliva (Valencia) and Denia (Alicante), although their invasive character in these areas is less clear.

In the case of the populations in northern Spain, primarily in Gaztelugatxe, management measures have been implemented, including monitoring and distribution studies, as well as control actions (eradication is considered unfeasible) through capture and culling. However, within the scientific community, there has been debate about whether some of these introduced populations should be safeguarded as a repository for the Pityusic Islands, given the accelerated decline of the native populations. In this case, genetic evidence about their origin, population assessments, and the identification of potential threats will be decisive factors for future management.

Selection of streams and monitoring of newly created populations of the Montseny Brook newt (*Calotriton arnoldi*)

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Since 2010, eight new populations of Montseny brook newt (*Calotriton arnoldi*) have been opened in streams in areas of the Montseny Natural Park considered potential habitats for the species. The first four populations were created before the Life Tritó Montseny project, which began in 2016. Subsequently, stream selection has been guided by habitat modelling based on the species' known natural occurrence sites. Habitat models resulted in a proposal to create populations in seventeen new streams where the species was not previously present. The comparison of biotic and abiotic factors between streams where the species was present and those where it was absent revealed that, in many cases, there were no significant differences between them. Once the candidate streams were selected and validated by field visits, we developed a release programme combining demographic models for each new population and realistic cost and management constraints. Of the 17 potential streams, new populations have been created in four streams: one for *C. a. arnoldi* and three for *C. a. laietanus*. The number of newly created populations was determined based on the environmental factors of the streams and the availability of specimens in ex-situ breeding centres. Of these eight streams, adult individuals have been confirmed to remain in five streams over time, and reproduction has been observed in two of them. The specimens released were adults and sub-adults. Only in one stream larvae were released as an experiment. To date, a total of 4,231 specimens from breeding centres have been released. These newly created populations are subject to continuous monitoring to assess their persistence. Updated data on the monitoring of the new populations up to 2024 are presented.

Assessing Climate Change Impacts and Future Population Trends of Iberian Amphibians and Reptiles

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Understanding how climate change may alter species distributions is critical for the conservation of vulnerable taxa. This study evaluates the potential impacts of climate change on all native amphibian and reptile species in mainland Spain through the development of ensemble species distribution models (SDMs). Contemporary occurrence data were combined with climatic predictors to build models using multiple algorithms, including GLM, GBM and RF.

Models at 10 km resolution were projected under future 4 climate scenarios from CMIP6 (SSP 126, 245, 370 and 585) and for 4 future periods: 2021-2040, 2041-2060, 2061-2080, 2081-2100. Changes in climatic suitability over time were analysed across each species' known range. Species were then aggregated at the community level to identify areas projected to experience greater losses in climatic suitability and to assess whether these areas would also experience declines in species richness. In addition, standardized differences in climatic suitability were used as proxies for estimating potential population trends that were also aggregated in multi-species indicators.

Preliminary results suggest heterogeneous responses across taxa, with some species showing projected increases in suitable habitat, potentially leading to population expansions, while others—particularly habitat specialists or montane species, especially in the Mediterranean region—are expected to face significant reductions in climatic suitability, indicating likely population declines. These trends become more pronounced the more pessimistic the scenario.

The integration of SDMs with suitability-based population trend assessment provides a powerful tool for anticipating biodiversity responses to climate change. This work highlights spatial and taxonomic priorities for conservation planning and may inform proactive management strategies for Iberian herpetofauna under future climate trajectories.

Could habitat variability influence neotropical lizards distribution? Evaluation of microhabitat ecology of *Gymnodactylus geckoides* Spix, 1825 (Squamata, Phyllodactylidae) in the Caatinga domain in Brazil Northeastern

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Environmental conditions of conservation, with areas containing absence or presence of native vegetation, could influence animals' behavior, mainly regarding ectotherms, with thermoregulation led by a contingent of biotic as well as abiotic factors, including habitat quality. Therefore, in the present study, we aimed to analyze the microhabitat use ecology of the neotropical lizard *Gymnodactylus geckoides* in Catimbau National Park, in Pernambuco state, Brazil, considering different landscape conditions (anthropic and conserved). We classified anthropic conditions as areas with a wide lack of native vegetation, mainly regarding *Encholirium spectabile*, also comprising human activity like housing and grazing areas. Related to conserved conditions, in turn, we classified as places of natural trail locations, those areas where it is possible to record a wide range of native vegetation like *E. spectabile* (20 ± 5.48 specimens/m^2). We captured in those areas individuals manually by active search, totalizing 100 samples. We performed a Principal Component Analysis (pPCA), generated through ecological variables, considering the following variables: environmental conditions, altitude, substrate and soil type. We recorded bromeliads, leaf litter, as well as rocky outcrops, fallen trunks, and rocks, with the use of microhabitats differing due to the environmental conditions for G. geckoides.

The distribution model, performed using Principal Component Analysis (pPCA), allowed us to observe *G. geckoides* influenced by microhabitat availability, revealing the plasticity of the species in response to environmental changes. On the other hand, the preference for native vegetation (*E. spectabile*) is evident, while this specie is available in the environment. Caatinga domain provides *G. geckoides* with a thermally optimal and stable microclimate, maintaining its optimal body temperature, requiring low thermoregulatory effort. For both environmental conditions, *G. geckoides* exhibited a clear preference for shaded areas. Considering the lack of native vegetative species, with the removal of preferred microhabitat, which possibly display better conditions of thermoregulation, as well as feeding source and protection, the diversity of microhabitats used tendsto increase, with individuals foraging in several microhabitats, according to availability. Our results indicate that *G. geckoides* could respond effectively to landscape conformations, particularly given their habits encompassing feeding, thermoregulation and reproduction.

15 years of amphibian monitoring and creation of fluvial micro-wetlands in the XN2000 “Riberes del baix Ter” area

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The Ter River is the most important river axis of the internal basins of Catalonia. Its flow is regulated by large dams such as the Sau and Susqueda reservoirs, among others, which came into operation during the 1960s. Because of this, the river dynamics have been seriously altered, and large floods, which would naturally generate microhabitats for amphibians and other aquatic fauna on the banks, have been greatly reduced. The Ter riverbed has become more stable and, consequently, many river ponds have disappeared since the construction of the dams.

Within the framework of several European projects (LIFE Riparia-Ter, LIFE PotamoFauna, HORIZON 2020 TTFS), the Consorci del Ter has created 45 small ponds on the banks of the Ter between 2010 and 2024. Most of these ponds have been excavated on old lateral branches of the river, reaching the water table. In parallel, amphibian populations have been monitored in the newly created ponds and other existing river ponds, with the aim of understanding their current situation. Daytime and nighttime sampling has been carried out in 15 locations, mainly distributed along 50 km, in the middle and lower reaches of the Ter. Surveys of 23 transects were also covered walking along the riverbank. The methodology consisted of conducting auditory, visual and dip net censuses, both diurnal and nocturnal until 2021, and only nocturnal from 2022, adapting the methodology of the Monitoring of Common Amphibians of Catalonia (SACC). A total of 10 species were detected. The most recorded species was the Iberian green frog (*Pelophylax perezi*), followed by almogavar midwife toad (*Alytes almogavarii*). To analyse population trends, only data from nocturnal samplings between 2014 and 2024 were considered. The results of the colonization of newly created river ponds by amphibians are presented. Amphibian communities have also been compared between the different river stretches. Finally, a comparison is made of population trends in the Ter River with amphibian population trends in Catalonia, calculated by the Living Planet Index (LPI) report for the year 2024.

Complex factors shaping European Pond Turtle demography: an insular-mainland study

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Natural environments, and especially freshwater ones, face drastic simplification due several concerns such as habitat degradation or even destruction, invasive species, and water abstraction. For this reason, it is important to understand how habitat characteristics shape population demography, especially in the case of threatened species and vulnerable ecosystems. We sampled 46 sites to assess the effects of habitat characteristics at two levels (i.e., landscape and pond features) on the demographic status, including abundance, sex ratio, juvenile ratio, body weight and body condition, of the semi-aquatic turtle *Emys orbicularis*. To evaluate potential regional effects, we also considered two different regions, an insular (11 sites) and a continental one (35 sites). The land cover effect differed between insular and continental populations, but with a crucial importance of shrub and tree cover further than pond margins in both cases. Presence of logs was a consistent positive variable between the two regions in species demographic status, whereas pond depth resulted in antagonistic outcomes between the island and the continent. We observed a significant decline in E. orbicularis abundance and male biases in sex ratios in sites with presence of *Procambatus clarkii* and *Gambusia holbrooki*. Protecting terrestrial and aquatic ecosystems' complexity at a larger scale is crucial to preserve *E. orbicularis* populations.

Status of amphibian and reptile populations in Catalonia within the framework of the Living Planet Index (LPI-Cat) and the EU directives' six-year reporting cycle

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Among the key goals for biodiversity restoration is the need for long-term, standardized monitoring indicators to guide conservation policies. In this context, and as part of the coordinated effort led by the Natural Heritage and Biodiversity Observatory, recent analyses have been carried out on available data regarding the distribution and population trends of amphibians and reptiles in Catalonia. The aim is to assess the conservation status of species and identify knowledge gaps. This work is framed within the Catalonia Living Planet Index (LPI-Cat) and the six-year reporting cycle of the European directives. The LPI-Cat is a regional indicator that reflects long-term population trends of a broad range of faunal groups, including herpetofauna. Its most recent update (2024) involved a major effort to unify and refine nearly all existing datasets from amphibian and reptile monitoring programs in Catalonia (SARE, SACC, surveys led by the Barcelona Provincial Council, protected areas, etc.). Population trends were analysed using TRIM models. Regarding the EU directives' report, spatial distribution data were also included. For this purpose, databases from the Spanish Herpetological Association (AHE), the Catalan Herpetological Society (SCH), the citizen science portal Ornitho.cat, and other local institutions and platforms were integrated. A comparative analysis was conducted across three time periods: the 1995 Herpetofauna Atlas, 1996–2013, and 2014–2023. The results highlight, on one hand, a worrying lack of data for many species, preventing reliable detection of population or distributional changes. On the other hand, while trends are unclear for amphibians or reptiles as a group, for a limited number of species with robust datasets, significant population declines were detected - such as *Pelophylax perezi* (~70% decrease), *Hyla meridionalis* and *Alytes spp.* (~50%). These trends, often obscured by wide confidence intervals, serve as a warning about potentially severe and unnoticed declines in Catalonia's herpetofauna. Only through improved and sustained monitoring systems will we be able to quantify this silent disappearance.

Distributional gradient in reproductive traits of the spur-thighed tortoise (*Testudo graeca*) in southeastern Iberia

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The life-history traits of species are crucial for understanding their ecology and their evolutionary trajectories. Among these life-history traits, reproduction directly reflects fitness and is influenced by both exogenous (environmental) and endogenous (maternal) factors. In long-lived species with slow life histories, such as chelonians, vital rates are buffered, reducing the trade offs between reproduction, survival and growth. In oviparous species, maternal traits and environmental conditions critically influence reproductive output and success.

Using long-term monitoring data, we investigated how individual (maternal) and population level factors influence clutch size and egg size in the spur-thighed tortoise (Testudo graeca) in southeastern Iberia. This Iberian lineage is the result of a historical south-to-north expansion and genetic drift, and exhibits a latitudinal gradient in adult body size. A total of 18 populations from southeastern Spain (Almería and Murcia) were surveyed between 2005 and 2023, during which 645 radiographs were taken. Egg size was estimated through digital radiograph analysis, and maternal traitssuch as body size and age were recorded in the field. Latitude was used as a proxy for population-level variation.

We found a positive relationship between female size and both egg size (significant) and clutch size (marginally significant). In contrast, female age was positively related to egg size but not related to clutch size. No relationship was observed between clutch size and egg size. At the population level, egg size decreased with latitude (eggs were smaller in northern population nuclei); however, this pattern was primarily explained by a corresponding latitudinal gradient in female body size.

These findings highlight maternal body size as a key determinant of egg size in *T. graeca* and suggest that latitudinal variation in reproductive traits is mediated by underlying female size differences associated with historical population expansion.

Status conservation assessment of ponds and amphibian populations in the city of Girona (NE Iberian Peninsula) in the framework of the GiroNAT project)

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Girona is a city built on an alluvial plain, between the Ter and Onyar rivers. It is surrounded by the natural protected area of the "Massís de les Gavarres, to the east. To the north and south it borders the Empordà plain and the Selva plain, respectively, agricultural lands through which Mediterranean streams of high interest for herpetofauna flow, and where historically there was a good density of wetlands and natural ponds, currently drained to gain farmland. To the west it borders the valleys of the Ter and Llémena rivers, that play a relevant role as biological corridors.

Within the framework of the GiroNat project (2022 – 2025), part of Fundación Biodiversidad call for city renaturalization and financed by European funds "Next Generation", an assessment of the conservation status of Girona's ponds has been made. For this purpose, the standardized ECELS index has been used to evaluated pond condition by means of various characteristics such as pond morphology, water quality, human activity, and aquatic vegetation. In parallel, daytime and nighttime amphibian samplings have been carried out in a total of 62 ponds with the aim of carrying out an analysis of the current amphibian community in the municipality. An adaptation of the methodology of the Monitoring of Common Amphibians of Catalonia (SACC) has been used to perfom out the sampling, carrying out auditory, visual and water censuses at all sampling points. A total of nine amphibian species has been detected in Girona.

In the city of Girona, the increase in global temperatures and increasingly severe droughts, as well as other anthropogenic impacts, have contributed to the fragmentation of habitats for herpetofauna. Given this situation, the creation and restoration of water points is an effective tool for the conservation of of amphibians and aquatic reptiles, providing adequate sites for reproduction, feeding and refuge, improving ecological connectivity and promoting the resilience of local ecosystems, such as streams and ponds.

Within the framework of the GiroNat project, a total of 18 silted river pools in Mediterranean streams of the Sant Daniel Valley in Girona have been recovered, creating refuges for the aquatic fauna and flora of the area. At the same time, a total of 20 new ponds of different types (urban/periurban, fluvial and agroforestry) have been created, and a total of 24 other ponds have been restored or improved. The processes of creation and restoration of water points carried out during the 3 years of the GiroNat project are described, one of the objectives of which is to increase and improve the availability of these habitats, suitable for amphibians and aquatic reptiles.

The painted frog (*Discoglossus pictus*), a species with a pioneering character, has been the one that has colonized the most recovered and newly created water points, regardless of the pond location. The midwife toad (*Alytes almogavarii*) has colonized mainly periurban and agroforestry ponds and, on the other hand, the Iberian green frog (*Pelophylax perezi*) has colonized a good part of the fluvial ponds.

Using Fuzzy Logic to Integrate Expert Knowledge and Field Records in Predicting Suitable Areas for Amphibians in Uruguay

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In species distribution modelling, expert knowledge and field records are often used independently to predict where species are likely to be found. Expert inferences are often based on assumptions about the relationship between species and their environment. These can be formally expressed using fuzzy logic, a framework that assigns continuous truth values to propositions and allows uncertainty to be modelled. Fuzzy logic also allows estimation of environmental favourability from species presence data and, more importantly, allows direct comparison and integration of the two sources of knowledge.

We applied fuzzy logic models to amphibian species in Uruguay using two data sources:

Expert-based knowledge and species presence/absence records. Transforming both sources into comparable favourability models, we explored their predictive capacity for three species categories: threatened, ubiquitous and the rest (neither threatened nor ubiquitous species). We further obtained fuzzy intersections from the favourability models of both sources to generate consensus maps of favourable areas.

Expert-based models incorporated more environmental variables and were less sensitive to sampling biases. Expert models equalled or outperformed those based on records in predicting the distribution of threatened species, delimiting more conservative favourable zones. In contrast, models from field records provide better results for ubiquitous species.
Our results highlight the strengths and limitations of each data source. Expert knowledge proved especially valuable for modelling threatened, and thus deeply studied, species, whereas presence data proved more reliable for species that experts consider ubiquitous, and thus of less interest. Fuzzy logic provides a robust framework for integrating diverse sources of knowledge and improving species distribution modelling with important implications for conservation planning and biodiversity assessment.

Habitat characterization of *Podarcis muralis* in the Baix Ter riparian forests

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The common wall lizard (*Podarcis muralis*) is a lacertid of meso-european distribution, occupying mostly mountain areas with high pluviometry across its range in Catalunya. However, the particular environmental conditions and microhabitats found in riparian forests allow some extralimital populations to thrive in low altitude and fully mediterranean areas. The establishment of several reptile survey plots in the Ter river lower basin has led to obtaining data about these singular populations.

Based on this information, a habitat characterization has been conducted across 12 km of the Ter river in the Selva and Gironès regions, paying special attention to vegetation structure. We present the first results of those surveys to define the relation between extralimital *P. muralis* populations and structure, composition or conservation status of the riparian forest.

We highlight the potential of reptiles as bioindicators in certain situations and the importance of establishing and maintaining populational surveys at medium and long term.

Estimating age from body size in amphibians: a demographic perspective

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Estimating the age of individuals in wild populations is an issue of transversal interest for research in ecology, evolution and conservation. In amphibians, age estimation is nevertheless challenging due to the difficulty of individual lifetime tracking, especially during the terrestrial juvenile stage, and to the uncertainty associated with alternative methods like skeleto-chronology. Due to the broad documented variation in body size and growth patterns across age classes, estimating age from body size has been largely disregarded. However, population monitoring programs addressing comprehensive individual marking and repeated biometric measures of marked individuals can shed light on the relationship between age and body size across different species, sexes, and even populations, proving useful for age estimation. We present results of the combined analysis of datasets of multi-year population monitoring programs in 10 amphibian species (*Alytes cisternasii*, *A. obstetricans*, *Bufo spinosus*, *Discoglossus galganoi*, *Epidalea calamita*, *Hyla molleri*, *Pelobates cultripes*, *Pelophylax perezi*, *Pleurodeles waltl* and *Triturus marmoratus*) in central Spain. We compiled repeated body size measures of marked individuals of unknown age throughout their adult life and growth records of individuals marked as postmetamorphic juveniles and recaptured years later as sexually mature adults. These datasets allowed fitting growth models that provided reliable estimates of size-at-age for all the study species except for *D. galganoi* and *T. marmoratus*, for which data were insufficient to support model validation. The consensus estimates of size-at-age inferred for each species contributed a comprehensive insight into key demographic parameters, including age at maturity and population-specific patterns of recruitment. Our demographic approach provides multi-evidence information to address age-at-size estimation in amphibians, highlighting the usefulness of long-term mark-recapture programs to fill pervasive gaps in our knowledge about amphibian demographic dynamics.

Comparative analysis of six techniques for capturing exotic aquatic turtles

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The capture of aquatic turtles for scientific or management purposes has been carried out using various techniques, mainly manual capture or using different models of traps, but occasionally also using electrofishing among other techniques. The use of traps is clearly the most widely used group of techniques for the capture of aquatic turtles. Two main types of traps are usually used: 1) fyke nets, generally bited, and 2) fall or closing traps. Both types of traps are based on the spontaneous activity of the animals, either by attraction when there is bait, or by passive fall in circulation areas or in basking sites. Traps based on passive capture can be very efficient in some types of specific environments (e.g. narrow passages, or open waters without natural insolation surfaces), but on the other hand they are little or not at all effective in other environments.

Over the last 15 years, within the framework of several projects aimed at the intensive control of exotic aquatic fauna in lentic and lotic systems, throughout Catalonia, up to 6 alternative models of aquatic turtle capture traps have been designed or adapted. We have tested large and medium-sized rigid baited traps, insolation traps, large open traps, large and medium fyke nets, among others. The results are uneven between techniques and sites, but all the tested modalities are effective in at least some specific situation.

The comparative results of these experiences are presented, which range from large coastal wetlands to small, isolated ponds, or rivers of various types. Large and medium-sized rigid baited traps are useful everywhere, but their performance is very variable. Insolation traps are only effective in open water bodies without basking sites. Large open traps are especially useful in lentic systems with little helophytic vegetation. Large and medium fyke nets are also useful in a wide variety of situations, but always in shallow water bodies (depth <1.5m, approx.).

Costs and benefits to be an omnivorous species in a burned landscape: the case study of *Gallotia galloti* in La Palma

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In disturbed landscapes, omnivorous species benefit from their ability to exploit a diversity of resources available in both disturbed and undisturbed patches. However, disturbance may pose a threat if resources are unavailable after disturbance. We examine the ecological impact of fire on the endemic lizard *Gallotia galloti* following a fire that occurred on La Palma in the summer of 2023. The fire burned 2.925 ha of Canary pine forest and summit scrubland in the northwestern part of the island. In 2024 and 2025, we conducted censuses and collected lizard pellets to respectively compare lizard abundance and identify main food consumed in burned and unburned areas. The censuses confirmed that lizards survived the fire, and that only the burned summit scrubland had lower lizard abundances than the unburned areas. Moreover, two years after the fire, the burned summit scrubland, and several patches of the burned pine forest, showed a lack of plant regeneration, with the Canary pine being the only exception. We speculate that the lack of vegetation, a fundamental resource for the omnivorous G. galloti, could affect its reproduction. In support of this view, there were no immature lizards in the burned plots in September 2024 and Spring 2025, suggesting a lack of reproduction in areas with low plant resources after the fire. Our next steps are to describe the species diet (using metabarcoding), identify environmental stress in lizard populations living in burned areas, and finally, assess the impact of fire on several traits including their body condition.

Macroevolution of head sexual dimorphism on island and mainland *Podarcis* wall lizards

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Sexual dimorphism (SD) has long been of interest for evolutionary biologists. Nevertheless, how it varies across different species and environments remains poorly understood. In this study, we analysed head morphology (size and shape) and functional performance (bite force, BF) in major insular and mainland lineages across the genus *Podarcis* wall lizards to assess how shared evolutionary history and varying ecological pressures related to insularity affect SD. To do so, a geometric morphometric and bite force analysis was performed on 15 island and 20 mainland lineages. We analysed differences in both mean trait values and variances between ecosystems, with and without taking phylogeny into account. Additionally, we explored the main shape variance across lineages (PCA) and the phylogenetic signal for all traits. Our results confirmed the existence of significant differences in the degree of SD across the studied *Podarcis* lineages in all traits. Remarkably, when comparing island and mainland lineages, we found that distinct selective pressures might be acting on morphological and functional SD as SD in head morphology and BF showed opposite evolutionary trends. Moreover, while morphological differentiation between islands and the mainland was strongly influenced by evolutionary history of *Podarcis*, BF revealed no phylogenetic signal, highlighting its ecological importance. Furthermore, we detected that insularity may promote increased sexual size dimorphism variance, potentially due to different intensity of constraints caused by the different islands' conditions. Finally, females from the mainland showed higher evolutionary rates compared to those from islands, while such differences did not exist in males, suggesting that sexual selective pressures acting on males might be constraining their evolutionary variance. Our findings improve the knowledge on the effect of insularity on SD and highlight the necessity of future research to disentangle the relative contributions of phylogeny and selective pressures in shaping the evolution of SD in Podarcis wall lizards.

Non-parallel biomarker responses in lizards from agroenvironments suggest complex interactions between management and ecosystem services

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Agrochemicals constitute an important tool to maximise harvesting, although their intense use can pose direct and indirect ecotoxicological risks to non-target organisms, such as reptiles. Lacertid lizards are pervasive in agricultural landscapes where they play a key functional role, yet the extent of their exposure to pesticides and their mechanisms for coping with these chemicals remain poorly understood. Here we determine whether and how agricultural practices can influence and interfere with lizard fitness, ultimately affecting the quality of their ecosystem services. Wall lizards, *Podacis bocagei*, were sampled from seven vineyard sites in N Portugal undergoing a gradient of intensity in pesticide application. As no vineyard in the area could be considered realistically as a control (pesticide-free), the studied fields were classified according to a management range using an exposure toxicity ratio (ETR) approach. It calculates risk by comparing environmental exposure (PECsoil) with toxicity to organisms (LD_{50}) for rats (no toxicological data available for reptiles). To assess environmental stress on lizard health status, we measured the following biomarkers: body condition, fluctuating asymmetry (femoral pores), and blood parasite load. Results revealed a positive signal of increasing pesticide intensity on fluctuating asymmetry and parasitisation, no variation in body condition was recovered. Although some associations remain unclear due to the complexity of natural systems, the observed trends provide valuable insights and warrant further investigation for the conservation of reptiles in agricultural environments. While sending a word of caution to other environmental studies of terrestrial organisms in agroenvironments, the outcomes of this study contribute significantly to both functional ecology and management by providing quantitative evidence to inform decision-making.

Rapid adaptation in an island endemic lizard in response to an invasive predator

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Evolution is most often envisaged as a slow-paced phenomenon, and its study is therefore usually restricted to long time-scale comparisons. However, research on evolutionary biology has witnessed a recent paradigm shift: the Anthropocene has shown us that evolution is not only a gradual, slow process, as Darwin had hypothesized. Instead, human-induced rapid environmental changes have helped us understand that evolution can in fact happen in contemporary timescales, with biological invasions being one of the major drivers of evolutionary shifts.

Whereas the rapid adaptation of invasive species to new environments has received increasing attention, the extent to which native species may adapt to their invasive predators remains largely unexplored. By leveraging an ongoing invasion of horseshoe whip snakes (*Hemorrhois hippocrepis*) on the island of Ibiza (Spain), we investigated the evolutionary response of their most common native prey, the Ibiza wall lizard (*Podarcis pityusensis*), a well-known example of island tameness. First, using X-rays and newly designed behavioral assays, we assessed the phenotypic changes throughout the invasion, finding that lizards from invaded localities are significantly shorter-legged, smaller in body size, and more cautious. Coupled with Whole Genome Sequencing data from over 335 individuals of this endangered lizard, we examined the genomic basis of those phenotypic traits, finding promising candidate genes for both morphological and behavioural changes. Finally, we detected signatures of selection in our candidate genes, confirming a rapid adaptation event as a consequence of the snake invasion. Our study provides valuable insights into how island endemic species can adapt when facing dramatic predation regime shifts, but also underscores that rapid adaptation does not seem to be enough to prevent extirpation in the Ibiza wall lizard.

Temperature and precipitation mismatches increase infection risk in amphibians

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The thermal mismatch hypothesis (TMH), the notion that cool and warm-adapted hosts have higher infection risk during unusually warm and cool spells, respectively, was recently proposed to explain how temperature shifts driven by climate change influence host susceptibility to infections at a global scale. Despite substantial support for the TMH in the chytrid fungus (*Batrachochytrium dendrobatidis*; Bd), it remains unknown whether precipitation mismatches affect infection risk, in addition to temperature ones. Here we introduce the thermal-hydric mismatch hypothesis (THMH) which proposes that infection risk is shaped by mismatches resulting from the combined effects of temperature and precipitation. We tested this hypothesis using a large-scale survey of Bd and *Ranavirus* (Rv)—for which the original TMH has not yet been tested—in more than 5,800 adult amphibians across the Iberian Peninsula, a European climate-change hotspot heavily affected by both pathogens. We found that the combined effect of thermal and precipitation mismatches increased infection risk for both pathogens. Cool and wet-adapted amphibians were more infected with Bd during warm and dry spells, while warm and dry-adapted hosts showed higher Bd infection during cool and wet spells. For Rv, mismatches occurred under opposite climatic conditions to those of Bd; specifically, cool and dry-adapted amphibians were more infected with Rv during warm and wet spells, while warm and wet-adapted amphibians showed higher Rv infection during cool and dry spells. This result is consistent with the limited temporal overlap between the two pathogens, despite their frequent geographical co-occurrence. Finally, the fact that thermal mismatches alone did not predict Bd infection and precipitation mismatches alone did not predict Rv infection, suggests that infection risk in the study region is driven by their combined effects, supporting the THMH proposed here.

Monitoring the Hermann's tortoise (*Testudo hermanni hermanni*) in the Albera Range (NE Catalonia, Spain): A dose of optimism for the conservation of the last natural population in the Iberian Peninsula

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The Hermann's tortoise (*Testudo hermanni hermanni*) population in the Albera Range, unlike the rest of the Iberian populations, has survived discreetly confined to a few valleys in the Albera mountains, NE Catalonia (Spain). Since its discovery in the 1980s, significant efforts have been made to preserve this relict population. Among the identified threats are wildfires, predation of eggs and juveniles, habitat loss, and poaching. Together with the population's isolation, these threats are believed to have brought the species to a critical state: an aging population, very low densities (<1 tortoise per hectare), and demographic traits typical of a declining population. Until a few years ago, this was the prevailing view, supported by several studies.

The establishment of intensive and sustained monitoring from 2019 to the present (2025), across 15 plots ranging from 20 to 30 hectares, has provided new data suggesting a more optimistic view of the population's conservation status. Results have revealed the existence of population nuclei with medium to high densities (4–11 tortoises per hectare) and show demographic characteristics typical of a viable population, including balanced sex ratios and evidence of recruitment. Initial trend calculations indicate signs of stability in the main nucleus, which could mean that the population has reached its maximum possible size under current ecological pressures. Additionally, the identification of dense population nuclei in areas far from the main clusters—areas that were uninhabitable for the species just a few decades ago—as well as the detection of sporadic individuals beyond the known population limits, suggest that the population is undergoing a process of expansion. Despite this dose of optimism, it must be kept in mind that the population occupies, irregularly, a rather limited area (<8000 ha), and that known threats—especially the risk of a major wildfire—could quickly reverse this situation and cause local extinctions, once again putting the population's viability at risk.

In any case, this demonstrates the importance and value of conducting standardized, intensive, and long-term monitoring, which is essential for planning conservation strategies based on scientific knowledge.

Unleashing The Secrets Of Iberian Snakes: Exploring Their Venom Evolution Through Multi-Omics

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Venom is a complex and fascinating evolutionary trait that has independently emerged multiple times across the animal kingdom. In snakes, venom is synthesized in specialized glands – venom glands – and serves primarily for predation or self-defensive purposes, reflecting intense ecological pressures and offering a unique window into evolutionary innovation. Despite advances in molecular analyses, many phylogenetic relationships – particularly among colubroid snakes – remain ambiguous or contested, limiting our understanding of venom evolution in its broader genomic context.

The overall aim of the project is to investigate the evolution and diversity of venom in Iberian snakes through an integrative multi-omics approach. Specifically, we are generating and analysing high-quality reference genomes, venom-gland transcriptomes, and proteomic profiles for all snake genera native to the Iberian Peninsula. This effort will allow us to compile comprehensive catalogues of venom-gland-specific toxin genes -the so-called venom-ome- representing the functional core effector proteins of envenomation.

Simultaneously, population genomic analyses will be carried out using whole-genome resequencing data to explore phylogenetic relationships, demographic history, inbreeding, and population structure across species and subspecies. These analyses will help resolve long-standing taxonomic uncertainties and provide new insight into the evolutionary processes shaping snake diversity in the region.

Here, we present the assembly of five high-quality genomes encompassing *Coronella girondica*, *Hierophis viridiflavus*, *Macroprotodon brevis*, *Macroprotodon mauritanicus*, *Zamenis scalaris*; and preliminary results from a small survey of the population genomics of the genus Malpolon utilising Whole Genome Sequencing data, delving into their structure, demographic history and inbreeding status. Ultimately, this project will produce valuable genomic resources, refine the phylogenetic framework of Iberian snakes, and deepen our understanding of venom evolution—contributing to both biodiversity conservation and potential biomedical applications.

Genomic characterization of the contact zone between *Triturus marmoratus* and *Triturus pygmaeus* in the Sierra de Guadarrama

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Triturus newts represent a good model system for the study of evolutionary mechanisms involved in speciation, because they comprise a monophyletic group with species displaying varying degrees of evolutionary divergence and numerous well-documented contact zones. We focused on *T. marmoratus* and *T. pygmaeus*, related species with parapatric distributions in the Iberian Peninsula, which meet in a contact zone of approximately 600 km, extending along the Sistema Central mountains. Hybridization appears to be rare, but certain sections of the contact zone in central Portugal and Sierra de Gata (Spain) host populations with intermediate phenotypes and some degree of genetic admixture. However, other areas have been little studied so far, including the Guadarrama mountains at the eastern end of the Sistema Central. We used genomic markers to characterize this section of the contact zone between *T. marmoratus* and *T. pygmaeus*, at a fine spatial scale, quantifying genetic admixture and assessing potential factors explaining observed patterns of hybridization (or lack thereof). A total of 543 individuals from 113 populations across the Comunidad de Madrid and neighbouring regions were genotyped using 4086 independent SNP markers, and fundamental niche models were constructed based on remote-sensing derived vegetation indices (NDVI). Patterns of genetic diversity differed between species, with *T. pygmaeus* showing values of nucleotide diversity and observed and expected heterozygosity over 3 times higher than those in T. marmoratus. Both species displayed population structure driven by isolation by distance and seem to have colonized the study area in relatively recent times. Bayesian clustering (STRUCTURE) and cline analyses (HZAR) revealed the existence of a steep genomic transition in the vicinities of the locality of Soto del Real, in the foothills of Sierra de Guadarrama, delineating a narrow hybrid zone (4-11 km wide) suggestive of strong reproductive isolation and selection against hybrids, which are rare (only 5 individuals display signs of introgression) and largely confined to the centre of the hybrid zone. Species distribution models using NDVI-based predictors and niche overlap analyses suggest broad species overlap with potential for syntopy, whereas the steep genomic transition in the absence of ecological or geographic barriers to hybridization points to a major role of pre- (behavioural) or post-zygotic (accumulation of genetic incompatibilities) reproductive isolation mechanisms in maintaining species boundaries.

Monitoring and assessment of *Lacerta agilis* populations in the Catalan Pyrenees: foundations for management and conservation

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The Pyrenean sand lizard (Lacerta agilis garzoni) is an almost exclusively Catalan endemic subspecies, restricted to the eastern Pyrenees, where it forms an isolated population of high biogeographic interest. It inhabits subalpine and alpine shrublands and grasslands and has a highly fragmented distribution that makes it especially vulnerable. For this reason, it is listed as "Endangered" in the Catalan Catalogue of Threatened Fauna and is also protected at the European level under Annex IV of the Habitats Directive.

Despite its conservation status, knowledge of its precise distribution and the conservation status of its populations has been, until recently, very limited. There have been no recent intensive surveys, few estimates of abundance or density, and no updated diagnosis of local threats.

To address this gap and provide useful indicators for its conservation, the Catalan Herpetological Society launched a more systematic and comprehensive monitoring programme in the Catalan Pyrenees in 2022. The objectives were: (1) to update the species' distribution through intensive surveys in areas with historical records or favourable potential habitat; (2) to assess the status of populations through density estimates using the distance sampling method, selected for its non-intrusiveness and comparability with earlier studies; and (3) to detect potential threats, improving understanding of habitat use and identifying recent changes or transformations.

As a result, 14 populations or stable presence sites have been identified and mapped. This has expanded the known distribution area from approximately 19 hectares to around 423 hectares, highlighting the previous lack of knowledge. In addition, density estimates of active individuals in seven representative populations have yielded values around 5 individuals per hectare in most cases. Comparisons with previous data indicate a worrying trend, although some populations still maintain significantly higher densities.

Finally, cases of decline or disappearance of "classical" populations have been detected, raising further concern for the species' future in the Pyrenees. We consider ongoing monitoring to be essential to guide management and conservation actions aimed at improving the long-term viability of Lacerta agilis in the Catalan Pyrenees.

Revealing the origin of loggerhead turtles (*Caretta caretta*) in Atlanto-Mediterranean foraging areas using individual genomic assignments

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Sea turtles are highly migratory species, with nesting sites and foraging areas often separated by vast distances. Individuals from the same population likely use different feeding areas, making it essential to determine their natal origin for effective conservation. Genetic tools offer high-resolution insights to address this challenge. Over the years, population genetic studies on loggerhead sea turtles (Caretta caretta) have predominantly relied on sequences of the D-loop control region (mtDNA). Although this approach can estimate the maternal lineage of individuals in a foraging area originating from different nesting sites, it lacks the capacity for individual-level assignments. In contrast, methods based on genomic data, such as 2bRAD, have proven particularly effective for individual assignments, offering a more detailed understanding of population structure. In this study, we used the 2bRAD technique to genotype 232 individuals from nine foraging grounds: two in the Atlantic, one at the confluence of the Atlantic and Mediterranean, and six within the Mediterranean. We performed individual assignment tests using genomic baseline data from established nesting sites. We used a hierarchical approach, first assigning individuals to one of the three major regional management units (RMUs) for the species: West Atlantic (WAT), East Atlantic (EAT), and Mediterranean (MED), and then narrowing down assignments within the Mediterranean to the subregional level. Our results show that most individuals originate from the Mediterranean RMU, with few exceptions coming from the Atlantic foraging area and the confluence region around the Strait of Gibraltar. At the Mediterranean subregional level, fewer individuals were assigned Atlantic origins, while most were linked to Mediterranean nesting populations, especially Levantine rookeries contributing to Western Mediterranean foraging areas. Furthermore, we compared our newly assigned samples using 2bRAD with previous assignments of foraging grounds derived from Mixed Stock Analysis (MSA) using mtDNA to study potential shifts in the foraging ground composition. While some differences in individual assignments may reflect methodological issues, some significant discrepancies observed suggest potential temporal and spatial shifts in the composition of Mediterranean foraging grounds. Additional research is needed to fully understand the causes of these shifts and their implications for management.

Alternative approaches to challenge the performance of species distribution models: a case study with the gold-striped salamander (*Chioglossa lusitanica*)

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Species distribution models (SDMs) have become widely used tools for addressing various questions in both theoretical and applied biogeography. In conservation biology, they are particularly valuable in contexts such as biological invasions, the identification of suitable habitats, reserve design, species translocations, and, especially, in assessing climate change scenarios. However, SDMs present several limitations that stem from assumptions rarely met in dynamic natural systems, such as the equilibrium between current species distributions and climate. These limitations arise from the correlative nature of SDMs, making it challenging to establish robust causal relationships and to reliably characterize potential distributions. In this context, the main objective of this study is to explore the extent to which these limitations may affect the implementation of SDMs. To this end, we used the well-documented case of the translocation of *Chioglossa lusitanica*, an amphibian species with an introduced population in Sintra (Portugal) since 1943, as a "natural experiment" to assess how the inclusion of occurrence records from this artificial expansion of the realized distribution influences model performance, the importance of predictor variables, and climate suitability maps. In addition, the availability of sufficiently long empirical climatic time series allows us to contrast future projections of climate suitability with recent trends in observed climatic conditions. We applied three modeling algorithms using 13 environmental covariates, two general circulation models, two shared socio-economic pathways and two future periods. The modeling process was done with and without occurrence records from the introduced population in Sintra. We used univariate linear regressions to detect monotonic trends in climate variables across the grid cells where climatic favorability was identified. For each of these cells, we ran autoregressive models on two relevant variables: (i) mean temperature of the warmest month (July) and (ii) annual accumulated precipitation. We found climatic range expansion through the introduced populations, which resulted in differences in model outcomes depending on the algorithm used for model building. Besides, recent temporal trends in climate do not necessarily converge with the interpretations arising from future predictions from SDMs.

Spatial sorting as a driver of behavioral divergence during an accelerating biological invasion

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For decades, evolution was considered a slow process governed primarily by natural selection. However, recent research has revealed that evolutionary change can occur over much shorter timescales, and that mechanisms beyond natural selection can also shape phenotypic variation. One such mechanism is spatial sorting, where traits associated with dispersal become non-randomly distributed across an expanding range. As individuals with greater dispersal ability reach and reproduce at the invasion front, traits that enhance movement tend to accumulate there, potentially accelerating the pace of the invasion itself.

The ongoing invasion of the horseshoe whip snake (*Hemorrhois hippocrepis*) on the Mediterranean island of Ibiza provides a unique opportunity to test this evolutionary process in real time. Since its introduction 20 years ago, this species has spread rapidly across the island, advancing year after year and severely impacting native species and ecosystems. Could behavioral traits that facilitate dispersal be accumulating at the expanding front, thereby promoting the invasion?

To explore this question, we quantified exploratory behavior in snakes captured at both the invasion front and the invasion core, using standardized behavioral arenas in the field. Females from the front maintained higher exploratory activity throughout the trial, whereas core females reduced exploration over time and shifted towards hiding. Males showed no significant differences between zones, and their behavior resembled that of front females, remaining consistently exploratory. These results suggest the emergence of non-random trait distributions consistent with a spatial sorting process.

Our findings highlight spatial sorting as an evolutionary mechanism capable of accelerating biological invasions through behavioral change. This has major implications for island biodiversity, where invasive predators can rapidly disrupt fragile native ecosystems. Understanding how invasions progress (and the evolutionary processes driving them) provides essential tools for designing more effective, stage-specific management strategies to mitigate their impact.

Context-dependent body size evolution in lacertid lizards: differential role of structural habitat and climate across radiations

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Body size plays a pivotal role in organismal performance, physiology, and ecology, making its evolution a key focus in biology. This study investigates the effects of structural habitat use (climbing vs. ground-dwelling) and climatic variables on body size evolution within the diverse Lacertidae lizard family and across phylogenetic scales. Our results reveal how structural habitat drives diversification rather than convergence toward specific morphological optima, with evolutionary rates varying substantially among phylogenetic groups. Gallotinae exhibits the highest evolutionary rates, likely due to island-driven dynamics, while Eremiadini and Lacertini display contrasting patterns linked to habitat use and evolutionary history. Similarly, climatic variables also influence body size variation by group. In Eremiadini, significant associations with temperature align with the heat conservation hypothesis. Lacertini body size negatively correlates with precipitation seasonality, supporting the seasonality hypothesis, while Gallotinae remains unaffected by climate, reflecting the unique pressures of insular evolution. This study highlights the importance of phylogenetic scale in understanding macroevolutionary patterns, revealing how broad-scale analyses may obscure context-specific eco-evolutionary dynamics. By focusing on coherent taxonomic groups, this research provides critical insights into how structural and climatic factors shape morphological diversity within Lacertidae.

An overview of the Miocene amphibians and reptiles from the Vallès-Penedès Basin (Catalonia, Iberian Peninsula)

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First reports of fossil amphibians and reptiles from the Vallès-Penedès Basin (VPB) in Catalonia date back to the early-mid 20th Century. Since then, new material from multiple sites has been added to the record, and now hundreds of sites spanning from the Early to the Late Miocene (MN3 to MN12; c. 20 to ~7 Ma) within the basin have yielded palaeoherpetological remains. The large amount of fossils and the well-dated, chronostratigraphic framework in a well-delimited area triggered a renewed interest on the palaeoherpetological assemblages from the VPB in the last two decades, with a series of articles published by researchers linked to the Institut Català de Paleontologia Miquel Crusafont. We present an updated overview of the amphibians and reptiles from the VPB, including both published and unpublished material. Amphibians from the VPB include urodeles and anurans. The former are represented only by two salamandrids, whereas the latter are more diverse, with pelobatids, potential pelodytids, bufonids, ranids, and discoglossids. A larger number of reptile taxa were identified, belonging to chelonians, crocodylians, and squamates. Chelonians include members of the Geoemydidae, Testudinidae, and Trionychidae. *Diplocynodon* is the only crocodylian genus recovered up to now. Among squamates, we report the presence of gekkotan, scincid, lacertid, chamaeleonid, anguid, and varanid lizards. Amphisbaenians are represented only by blanids. Snakes include scolecophidians, erycids, pythonids, "colubrines", viperids, elapids, and natricids. Often, the remains from the VPB could not be identified to the species or even genus rank based on the current knowledge, even though further investigation will likely be of help in refining the identification of at least some of the groups. Specific identification was possible for a few taxa, including species with a wide distribution in Europe (*Latonia seyfriedi*, *Varanus marathonensis*) and others currently known only from the VPB (Testudo catalaunica, Blanus mendezi). Further new taxa are currently under study. Some of the specimens are particularly well preserved, offering significant opportunities to study their phylogenetic relationships and the evolution of their respective clades during the Neogene. Thus, the palaeoherpetological record of the VPB is a very important asset for better understanding the Cenozoic evolutionary history of amphibians and reptiles not only at a local scale, but also for Europe and the whole Mediterranean.

Pòsters

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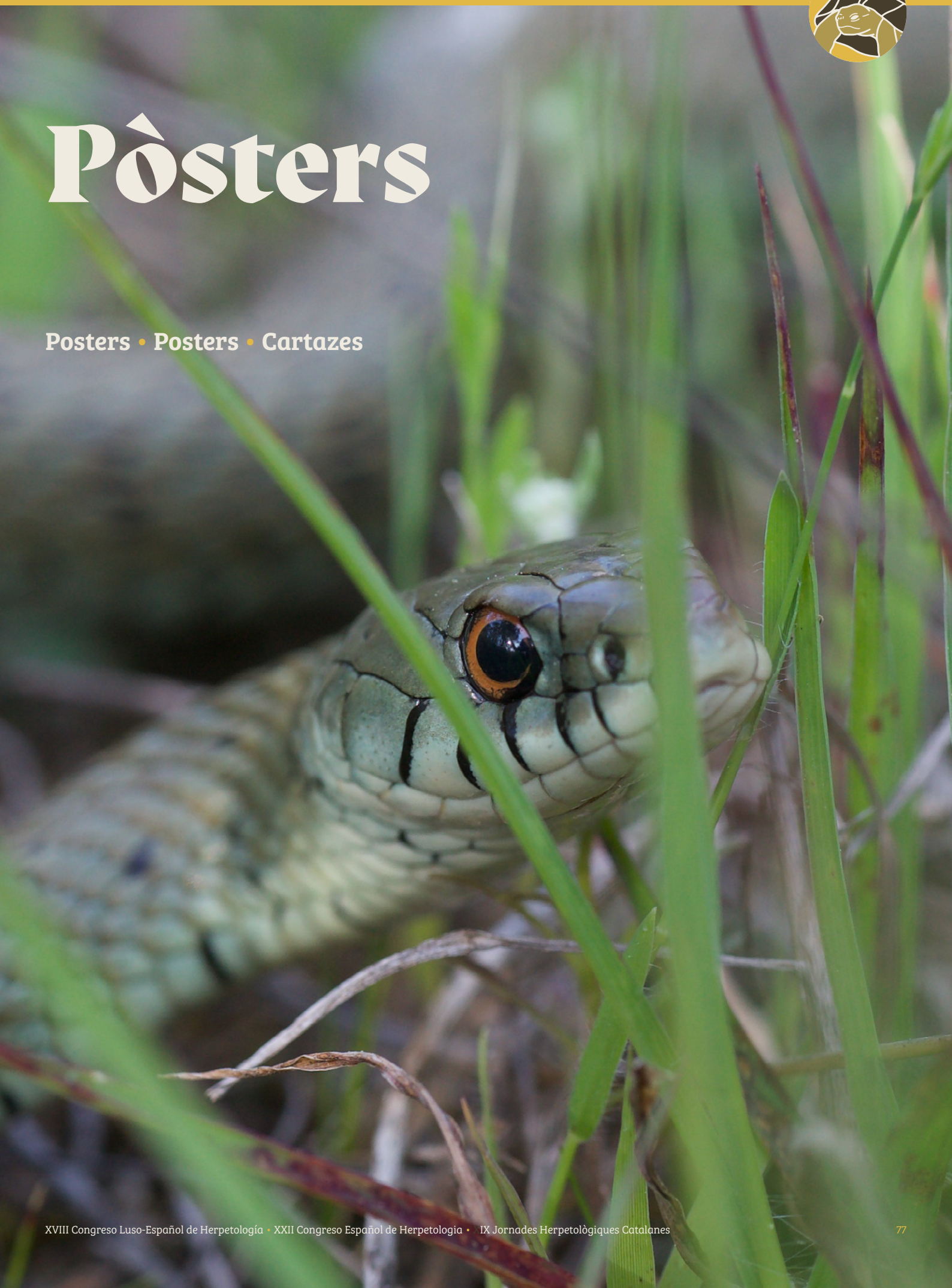

Caretta caretta bycatch by surface longline in the Alboran Sea

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The adjacent areas to the Strait of Gibraltar—in particular, the Gulf of Cadiz and the Western Mediterranean Sea—serve as transit zones for juvenile and sub-adult Atlantic loggerhead turtles (*Caretta caretta*), which overlap with the Mediterranean population in the westernmost areas of its distribution. Although these same areas are also surface longline fishing grounds, traditionally associated with a high risk of bycatch, the fishing effort recorded in the Alboran Sea is markedly lower than in the Gulf of Cadiz and the Algerian basin.

In the Alboran Sea, characterised by its complex oceanography, previous studies have suggested that the differences in the high number of strandings and low accidental catches of immature individuals are due to the Alboran Sea not functioning as a neritic area for this species.

A total of 343 surface longline sets monitored by the IEO-CSIC onboard observed program between 2000 and 2024 were analysed to examine these patterns in greater detail. Loggerhead turtles were recorded in only 20 of those sets, yielding 29 captures, of which full biometric data were available for 22 individuals. Mean straight carapace length (SCL) was 56.3 ± 12.7 cm (range 35–90 cm; median 60 cm). 41 % of turtles did not exceed 50 cm SCL, 36% measured around 60 cm, and only 23% exceeded 65 cm. The age of the captured turtles has been estimated based on biological parameters from both populations, as the origin of the individuals is unknown, confirming that most of them are immature individuals.

These results reinforce the hypothesis that the Alboran Sea is not an effective feeding ground for juveniles of this species, but rather a migratory corridor between different areas of the Atlantic Ocean and the Mediterranean Sea.

Ex-situ conservation of the Montseny brook newt

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Montseny brook newt is a species endemic to Catalonia that is found only in the Montseny Natural Park and is catalogued as endangered under Catalan and Spanish legislation, as well as a critically endangered according to the IUCN. It has two clearly differentiated subspecies, recently described from multiple lines of evidence, including genetic, genomic, ecological and morphological data: *Calotriton arnoldi laietanus*, located on the western part of the upper Tordera basin (Montseny massif), and *Calotriton arnoldi arnoldi*, located on the eastern slopes of the upper Tordera basin. Its total distribution area is about 4 km2 and there are an estimated 1000-1500 adult specimens.

Due to its endangered status, in 2007 a captive breeding programme was started at the Centre fauna Torreferrussa. The initial objectives of this programme were to assess the viability of captive breeding and to broaden knowledge of the species' biology. Today, the main objectives of captive breeding of the Montseny brook newt are, on the one hand, to maintain a genetic reserve as representative as possible of the variability existing in the natural environment, and on the other hand, to obtain specimens to extend the area of distribution of the species by means of releases in the natural environment. In order to achieve the first objective, it is essential to strictly control the pedigree of all the individuals kept in captivity, a fact that is achieved through the use of Studbook software that collects, manages and updates the genealogical and reproductive information of all the specimens. Through Barcelona Zoo, the program became an EEP program under EAZA, incorporating the standards, planning, and guidance of these European breeding programs . This system makes it possible to plan targeted releases in order to maximize genetic diversity and minimize inbreeding in future generations. With regard to the releases, it should be noted that they are not carried out in streams where wild populations are already found, but in streams that have been previously studied and validated and present the optimum conditions using natural streams as a model.

The breeding program was expanded to new centers: in 2012 to Pont de Suert and Barcelona Zoo, in 2017 to Chester Zoo, to increase the insurance population.

This poster presents the results obtained from the captive breeding of the Montseny brook newt since 2007, as well as an explanation of the beginnings of the breeding programme, the centres that participate in it, some of the veterinary details and a summary of the releases carried out.

Darkness Under Threat: First Assessment of Light Pollution on Catalan Beaches in an Emerging Context of Loggerhead Turtle Nesting

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Artificial light at night (ALAN) is a growing environmental concern for sea turtles, as it can disrupt nesting behavior in adult females and disorient hatchlings, significantly reducing their survival rates. With global warming driving a northward expansion of loggerhead turtle (*Caretta caretta*) nesting in the Mediterranean—particularly along the coasts of Italy, France, and Spain—there is an urgent need to assess and manage light pollution on beaches that may become increasingly important nesting sites.

This study provides a first approximation of ALAN levels along the Catalan coast (northeastern Spain), conducted between 2023 and 2025, with the aim of identifying both high-impact areas where light pollution may pose a risk and more favorable zones with low light levels that could support future nesting. The Catalan coastline, which spans approximately 280 km, is densely urbanized and heavily frequented by tourists during summer, coinciding with the nesting season. This overlap creates a potentially critical conservation challenge.

In recent years, Catalonia has experienced a notable rise in nesting activity, accounting for 31 of the 80 loggerhead turtle nests recorded in Spain over the past decade, including a record 10 nests in 2023. Given the expectation of increased nesting in coming years, understanding the current light environment is essential for guiding beach management and conservation planning.

Measurements were carried out on a selection of representative beaches using two tools: a Sky Quality Meter (SQM), which measures night sky brightness in magnitudes per square arcsecond (mag/arcsec^2), and a lux meter, which measures light intensity at ground level, relevant to hatchling vision. Some beaches, such as those within the Ebro Delta Natural Park, recorded SQM values above 21 mag/arcsec^2—indicative of excellent night sky quality—within Catalonia's highest light protection category (E1). In contrast, urban beaches showed values below 17 mag/arcsec^2, reflecting poor conditions. Lux levels typically ranged from 0 to 0.3 lux at most sites but exceeded 3 lux in some locations.

This preliminary assessment offers valuable baseline data on the current state of ALAN along the Catalan coast. It forms part of the national InGeNi-Caretta project, which evaluates the suitability of Spanish Mediterranean beaches for loggerhead nesting. Conducted in collaboration with light pollution specialists from the Government of Catalonia, the findings will support evidence-based conservation strategies and guide future mitigation efforts to protect this vulnerable species as nesting increases in the western Mediterranean.

Current distribution of grass snake (*Natrix astreptophora*) in the Region of Murcia and the potential role of the Tajo-Segura water transfer as a dispersal pathway in semi-arid environments

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The Mediterranean grass snake (*Natrix astreptophora*) is a semi-aquatic snake closely associated with humid environments, whose distribution in the southeastern Iberian Peninsula is highly restricted and fragmented due to the limited availability of humid ecosystems. In the Region of Murcia, the species is considered rare, with only a few known localities and isolated records. In the arid landscapes of southern Spain, *N. astreptophora* shows a strong dependence on aquatic habitats both for foraging and dispersal. While it occupies natural wetlands such as ponds, rivers, and marshes, it is also capable of exploiting artificial water bodies such as canals, ditches and irrigation ponds, sometimes acting as deadly traps. Based on the compilation and spatial analysis of regional records in databases, citizen science platforms, and field sampling in the study area, we propose the hypothesis of an association between the recent local presence of the species and its proximity to the canal, which probably acts as a functional corridor for it. This possible relationship suggests that hydraulic infrastructures may play an unexpected role in maintaining the ecological connectivity of water-dependent species in arid environments. Implications for regional conservation are discussed, and additional specific studies are recommended to assess the actual use of such structures by local herpetofauna.

Assessment and monitoring of isolated european pond turtle (*Emys orbicularis*) populations in eastern Castilla La Mancha

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The European pond turtle (*Emys orbicularis*) has widespread but strongly fragmented populations across the Iberian Peninsula. In the region of Castilla-La Mancha, there are no recent updates on the status of the species, but its range seems to have decreased considerably. In the two western provinces, Toledo and Ciudad Real, populations display higher spatial continuity, but in the eastern provinces of Albacete, Cuenca and Guadalajara the situation is very different, with just a single, isolated population in each. We present results from the assessment and monitoring of these populations: 1) Monumento Natural Lagunas de Cañada del Hoyo (Cuenca), monitored for 16 years; 2) an isolated meander in the Jarama river in Alpedrete de la Sierra (Guadalajara); and 3) Reserva Natural Laguna de los Ojos de Villaverde (Albacete), with virtually no information on its demography and conservation status. We used capture-mark-recapture methods in the three populations to estimate age structure, sex ratio and population abundance using software MARK. Additionally, two females in the reference population Cañada del Hoyo were equipped with GPS trackers, to monitor their spatial displacements and detect nests. We also genotyped a sample of 33 individuals from two populations (Cuenca, n=14, and Guadalajara, n=19) with a set of 17 polymorphic microsatellite markers to characterize their genetic diversity and test for potential inbreeding effects due to their isolation. We found moderate levels of genetic diversity, with an average number of three alleles / locus in each population and values of observed and expected heterozygosity (H_O/H_E) of 0,52/0,50 and 0,39/0,39, respectively, but no evidence for inbreeding based on estimated GIS values. Finally, we assessed the health status of the Cañada del Hoyo population by testing for the presence of pathogens by PCR (targeting herpesvirus, ranavirus and Mycoplasma as well as Spirorchids). Notably, Mycoplasma was detected in 75% of the 20 sampled individuals, a remarkably high prevalence compared with reports in other freshwater or terrestrial turtles. We discuss the main threats faced by these populations in view of the results of this monitoring study and their genetic and geographic isolation and propose management actions to improve their conservation status.

Amphibians and Reptiles of the Huancabamba Mountain Range: 45 Years Later

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The Huancabamba Mountain Range is in northwestern Peru, nestled between a series of arid valleys and humid ridges that form one of the most striking biogeographic complexes in the Andes. This unique setting has facilitated the presence of distinctive amphibian and reptile species.

With the goal of filling key knowledge gaps in this region, we conducted several herpetological expeditions to different locations in the Huancabamba Mountain Range between 2020 and 2024. We found 67 species (43 amphibians and 24 reptiles). Comparing our results with expeditions from the 1970s, 1990s, and the beginning of the 20th century, our findings represent an increase of 7 amphibian and 8 reptile species. Among these species, we identified new records for Peru. To determine the species, we relied on morphology and genetic analysis, using the 16S mitochondrial gene rRNA to examine relationships with the most closely related species. Currently, the ecosystems of the Huancabamba Mountain Range are threatened by the growth of agricultural and livestock activities, which actively promote and cause wildfires that often spiral out of control. The latter has caused the loss of 5,000 hectares of wild ecosystems in recent years (Global Forest Watch, 2025).

Our work provides previously unpublished and updated data that reveal the current status of many species (most of them endemic) that inhabit this region. This information is crucial not only for accuratetely assessing their diversity, but also for decision-making regarding their conservation.

Using detection dogs in monitoring Mediterranean tortoises (*Testudo hermanni*) in Catalonia (NE Spain)

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The use of detection dogs for wildlife monitoring has increased across Europe in recent years. While most commonly used for mammals and birds, trained dogs have also been employed to detect other faunal groups, as well as plants, fungi, and even bacteria. In the case of Chelonians, dogs have been successfully used to locate both terrestrial and aquatic species, as well as their nests.

In Catalonia, wildlife detection dogs have been regularly used in population monitoring of the Mediterranean tortoise (*Testudo hermanni hermanni*) since 2011. They are currently employed in monitoring reintroduction programs in the Parc Natural del Delta de l'Ebre, Parc Natural dels Ports, Parc Natural del Cap de Creus, and Vall Major de Bovera, as well as in the natural population of l'Albera. Unlike human observers, who rely primarily on sight (and to a lesser extent on sound), dogs use their highly developed sense of smell, allowing them to detect tortoises beyond the range of human perception.

This work presents the experience of the four authors who have worked with six different dogs in tortoise monitoring between 2011 and 2025. Detection efficiency in teams consisting of one handler and one dog, varies depending on multiple factors. In their first year (dogs under one year old), individuals detect between 43% and 84% of tortoises found by the team (handler plus dog), increasing to 65–95% from the second year onward.

Seasonality and daily weather conditions (temperature, humidity, wind) directly affect both tortoise activity and the scent trails used by dogs. These conditions also impact the dogs' physical performance; in hot weather, panting reduces olfactory efficiency and may pose health risks. While detection dogs significantly improve tortoise detection, especially in areas with low tortoise density or dense vegetation, their long-term involvement must be carefully considered, as they become part of field teams for many years—even beyond retirement.

Reintroduction of the Mediterranean Tortoise (*Testudo hermanni*) in the Parc Natural dels Ports (Catalonia, NE Spain)

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The Mediterranean Hermann's tortoise (*Testudo hermanni*) reintroduction project began in 2021 in the Parc Natural dels Ports. During the first year, two sites were selected, a monitoring and evaluation protocol was established, and 715 individuals (82.2% juveniles) were released. In 2022, other 933 tortoises were released (68.5% juveniles). Based on initial results, a Reintroduction Viability Plan was drafted in 2023, assessing additional release sites. This plan was approved by the Catalan government, authorizing releases for five years.

Between 2023 and 2025, 1,392 tortoises (64.7% juveniles) were released across five sites. Monitoring had been carried out through capture-recapture surveys aided by trained dogs, and up to 46 adults had been tracked via radio telemetry and GPS. Individuals released in 2021–2022 had been recaptured annually at rates ranging from 0.3% to 12.9%. Some of these radio-tracked tortoises had dispersed and their movements had helped to assess the connectivity of the reintroduction areas. Predators identified include wild boar, small carnivores, and golden eagle. Between 2022 and 2024, eleven hatchlings born in the wild were detected. GPS data show daily movements ranging from 0 to 1,478 m. In the initial sites, densities range from 5.8 to 12.3 tortoises/ha. Body condition improved over time but slightly declined in 2024, likely due to low spring rainfall.

Preliminary results during these first four years are encouraging, since reintroduced individuals survive, settle, locate necessary resources, and reproduce. However, it is too soon to determine the long-term viability of these populations.

The *Second Herpetological Atlas of the Valencian Community*, a Citizen Science Study with Conservation Implications: Preliminary Results

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The Second Herpetological Atlas of the Valencian Community is a citizen science project aimed at providing updated and reliable information on the distribution of various species of amphibians and reptiles, both native and exotic, present in the Valencian Country. Its fieldwork spans the last fifteen years (2010–2025). Two and a half decades have passed since the publication of the first Valencian herpetological atlas by Sancho and Lacomba (1999), and during this time numerous changes have occurred due to human pressure—most notably massive urban development along the coastline, agricultural intensification, persistent droughts, and large forest fires. It was to be expected that all these factors have affected local amphibian and reptile populations, which makes it necessary to update our knowledge about the distribution and status of the Valencian herpetofauna in order to determine their conservation status and implement the appropriate protection measures.

The compilation of this work has involved the collaboration of numerous volunteers, who have submitted records via a specific online form using smartphones in the field. Public sampling activities have also been carried out, and databases from official organisations and partner entities have been consulted. As a result, records have been obtained for all 30 native species in the region, as well as for 17 introduced species. The Atlas project has led to the discovery of populations of rare or threatened species, although it has also confirmed the disappearance of many historical populations cited in the first publication. An interesting case has been the determination of the distribution of the two species of ocellated lizards (Timon lepidus and Timon nevadensis), which has led to an extension of the known distribution range of the latter species, as well as the rediscovery of historical populations of Discoglossus galganoi and the identification of new localities for this species. Furthermore, conservation-relevant data have been gathered, such as the distribution of roadkill incidents or mortality associated with accidental pitfall traps. The project produces a list of important areas for herpetofauna and a catalogue of water points of interest for amphibians, which will be submitted to the Valencian Ministry for the Environment of the Generalitat Valenciana to support the creation of new protected areas.

Amphibians and reptiles from an exceptional avian pellet assemblage from El Mirador de Atapuerca (Burgos, Spain) of the middle-late Holocene: palaeoecology, climate change, landscape anthropization and predation behaviour

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The cave of El Mirador de Atapuerca (Burgos, Spain) has provided an unusual record of twenty preserved avian pellets from the Chalcolithic/Copper Age (MIR5 level, 4,530-4,417 cal BP) and Bronze Age (MIR4 level, 3,730-3,530 cal BP). In most cases, these types of accumulations appear disintegrated and scattered in the archaeological sediment, but the special conditions of El Mirador as human burial site during this period have made their conservation possible. These pellets are characterized by their high content of herpetological remains, 7,482 identified bone specimens (NISP) and a minimum number of individuals (MNI) of 350, including *Lissotriton helveticus* (431 NISP, 34 MNI), *Triturus marmoratus* (156 NISP, 15 MNI), *Alytes obstetricans* (5 NISP, 2 MNI), *Pelobates cultripes* (21 NISP, 6 MNI), *Hyla molleri* (2,877 NISP, 136 MNI), *Epidalea calamita* (28 NISP, 6 MNI), *Bufo spinosus* (31 NISP, 5 MNI), *Rana temporaria* (163 NISP, 15 MNI), *Anguis fragilis* (186 NISP, 12 MNI), *Chalcides striatus* (1,241 NISP, 42 MNI), *Lacerta bilineata* (127 NISP, 7 MNI), *Timon lepidus* (16 NISP, 4 MNI), *Coronella austriaca* (115 NISP, 6 MNI), and *Vipera aspis/seoanei* (3 NISP, 1 MNI), as well as more remains of undetermined herpetofauna, along with small-mammals and birds, but in much smaller amounts.

Taphonomic analyses of the largest pellet from MIR4 identified a medium-to-large size owl as the predator, most likely the eagle owl *Bubo bubo*. A comprehensive analysis of all pellets content, focusing on their taxonomic composition and inter-sample variability, reveals notable differences in prey species richness and composition among the MIR4 pellets, reflecting seasonal variations in owl predation behaviour and the phenological cycles of local herpetofauna. These results contribute to the evaluation of different hypotheses concerning seasonal hunting patterns, climate change and the anthropogenic impact on the middle-late Holocene landscape, as well as how ecological and behavioural factors —such as seasonal prey availability, predator foraging strategies, and prey activity cycles— can introduce interpretive biases into palaeoenvironmental and palaeoclimatic reconstructions.

Palaeoenvironmental reconstruction based on seasonal assemblage data indicates dynamic shifts in habitat distribution: wetter conditions prevailed from late winter to mid-spring, followed by increased aridity from mid-spring through summer. Conversely, palaeoclimatic reconstructions do not indicate substantial variation in annual or monthly temperature parameters. The distinctive faunal composition of these pellet accumulations is interpreted as consequence of intensified human impact in a drier context during the Copper–Bronze Age transition in the Atapuerca area. Higher aridity, likely increased by anthropogenic pressures, may have compelled owls to hunt suboptimal but seasonally abundant prey resources.

On the presence of an introduced population of *Blanus oxyurus* at La Roca del Vallès (Catalonia)

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Blanus, the only amphisbaenian (Squamata, Amphisbaenia) in Europe, is distributed, besides other circum-mediterranean territories like Turkey or Morocco, throughout most of the Iberian Peninsula, except for its northernmost regions. In Catalonia, despite confirmed fossil evidence from the Miocene to the Pleistocene, native populations are considered extinct, with the possible exception of southernmost Tarragona, south of the Ebro river. In the last decades, unconfirmed sightings and the recovery of two specimens have suggested the possibility of the presence of extant *Blanus* populations of unknown origin in Catalonia. We report the discovery of a population of *Blanus* at La Roca del Vallès (Barcelona, Catalonia), putatively linked to an import of olive trees from Seville (southern Spain) more than 20 years ago. Evidence for the presence of a well-established population in the area includes: 1) an unconfirmed sighting at the mentioned olive grove, situated in the outskirts of the town, in 2004, when the trees were imported; 2) a dead specimen found in 2023 in a private garden of the same town, hosting a tree that was transplanted from this grove around 2006; 3) a live specimen, captured in 2025 in the same garden; and 4) a confirmed additional sighting just a few days later, corresponding to a different specimen which was not captured. Specimens corresponding to observations 2 and 3 are currently deposited at CRARC (Masquefa). We extracted DNA from the only live specimen captured to amplify a fragment of the mitochondrial gene ND4 and adjacent tRNAs for species assignment and to assess the origin of this population. Comparison with published sequences confirms its assignment to *Blanus oxyurus* (the current species name for the Central Iberian clade) and shows highest similarity with samples from southern Iberia, from Alentejo (Portugal) to Andalusia (Spain). These results are thus consistent with an allochthonous origin of the *B. oxyurus* population at La Roca del Vallès, in an additional example of unintentional reptile introductions associated with the trade of ornamental olive trees. Such translocations have previously been identified in the Iberian Peninsula, involving different origins (e.g. Italy) or destinations (e.g. Balearic Islands), and/or implying different taxa (snakes, lizards), with the particularity that in the case reported here it represents the return of an extirpated species to a territory where it was once present.

Behavioral differences in confrontations between phenotypes of *Podarcis muralis* in the italian peninsula

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Visual signals are often used by animals to assess potential rivals in agonistic confrontations. These visual signals, such as movements or coloration, convey useful information about the opponent, for example, before a fight between rivals over territory or females. Italian populations of the common wall lizard (*Podarcis muralis*) exhibit striking variability in body coloration, which allows to disentangle the effect of different visual traits on contest outcome. There is a brown-colored phenotype with an ancestral origin, and a green and black phenotype that displays masculinized traits (such as a larger head, more robust body, larger testes, or larger melanic spots). Adult males were collected from three locations in southern Italy (green and black phenotype) and from three locations around L'Aquila (brown phenotype). From each lizard we obtained morphometrics and spectral color measurements of five body areas (throat, belly, back, flanks, and outer ventral scales). Finally, we recorded interactions between pairs of males subjected to interactions of 10 minutes in a controlled terrarium setting between non-familiar individuals of similar size, both between and within phenotypes. Lab-staged contests took place between April and May. The videos were analyzed using the BORIS software, generating an ethogram of aggressive, submissive, and neutral behaviors. The results were analyzed using Bradley Terry models where dependent variables are considered. We will examine the possible dominance of green-black phenotype males over males showing the ancestral brown phenotype, potential differences in overall aggression levels in within-phenotype contests, as well as differential reliance on static UV-blue and melanin-based colour patches.

Modelling the current potential habitat distribution of endemic species: the case of the Cantabrian viper (*Vipera seoanei*)

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Species Distribution Models (SDMs), also known as Ecological Niche Models (ENMs), are useful tools to predict the potential ecological niche of a species. This study aims to develop a current potential habitat distribution model for Vipera seoanei, a species endemic to the northwestern Iberian Peninsula and southwestern France, and to interpret the environmental constraints shaping its current potential distribution. Presence records of the species were compiled, both from specific field studies, as well as from the Global Biodiversity Information Facility (GBIF) public database. These data were combined with potentially relevant abiotic variables, downloaded from CHELSA database version 2.1, to model the species' distribution using MaxEnt v. 3.4.4, an algorithm based on the principle of maximum entropy using presence-background data. To evaluate model performance, we used the area under the receiver-operating characteristic (ROC) curve, known as AUC. The resulting model and habitat suitability map indicate that the potential distribution of *V. seoanei* is primarily influenced by air temperature and its seasonality, with a lower but significant contribution from summer rainfall and surface humidity. In conclusion, robust predictive models are now fundamental for conducting more efficient fieldwork, ultimately improving conservation and management plans endemic species such as V. seoanei

Amphibians and mosquito control in micro-wetlands: experimental evidence and underlying mechanisms

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Micro-wetlands are increasingly recognized for their role in biodiversity conservation, although concerns persist regarding their potential contribution to mosquito proliferation. This study explores the hypothesis that higher amphibian abundance -resulting from the good conservation status of natural wetlands or the naturalization of artificial ones- correlates with lower mosquito presence.

We conducted a field study to examine the relationship between mosquito presence and amphibian presence (species diversity and abundance) in 24 ponds in the Basque Country, as well as a mesocosm experiment in a suburban environment. The experimental setup included three treatments: a) presence of adult palmate newts (*Lissotriton helveticus*), b) common midwife toad tadpoles (*Alytes obstetricans*) -the most common species observed in the field study- and c) controls without amphibians. Natural mosquito colonization was allowed over three weeks, after which egg clutches and larvae were counted. Although field data did not show a clear relationship between amphibians and mosquito larvae, the experiment revealed a marked reduction in larval density in the presence of amphibians, especially newts.

To determine whether this effect was due to predation or to avoidance by mosquitoes, a second experiment was carried out with five treatments, including chemical and visual cues from both amphibian species, as well as a control. The results suggest that female mosquitoes -at least those present in the study area- were able to detect water containing chemical cues from both amphibians.

We discuss the differences between field and experimental results and the potential of promoting amphibian presence as a nature-based solution to reduce mosquito populations, highlighting their unexpected relevance for public health.

Integrating Reduced-Representation and Whole Genome Sequencing for sea turtle conservation genomics

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With falling costs of Whole Genome Sequencing (WGS) and increased computing resources, large-scale sea turtle resequencing is becoming feasible. However, due to current budget constraints, genome-reduced representation techniques like RADseq are still widely used to study population structure, the origin of individuals, and evaluating new nesting areas. The use of varied genomic methods across labs complicates cross-study comparisons, which motivated our study. Here, we sequenced 11 *Caretta caretta* individuals belonging to four Regional Management Units (two from the Pacific, one from North West Atlantic, five from North East Atlantic and three from Mediterranean) using both 2b-RAD and WGS strategies, and evaluated how data from different techniques can be combined. As a control, we genotyped and filtered each methodology separately (2b-RAD: 4,523 SNPs; WGS: 8,062,514 SNPs), and observed the same geographic structure pattern in the two cases, consistent with genetic differentiation driven by RMUs. We then tested three data integration strategies. First, we joined the raw reads from both methodologies, genotyped and filtered (16,877 SNPs). Analyses of genetic structure separated Pacific individuals from the rest along the first axis of genetic differentiation, but the second axis showed strong differences according to the methodology used. Second, we genotyped and filtered separately both types of data and kept the 2bRAD SNPs in the WGS dataset (3,669 SNPs) for downstream analyses. Despite the reduced number of SNPs kept we observed an overlap of the individual genotypes obtained with both methodologies, and the two first axes separated individuals according to their RMU. Third, we jointly genotyped the two datasets and kept the 2bRAD SNPs in the WGS dataset (4,492 SNPs). We observed the expected clustering pattern but retaining a higher number of SNPs, demonstrating that it is possible to combine RADseq and WGS data. In all cases we evaluated the percentage of concordant and discordant loci and discuss the possible nature of the discrepancies. We provide guidelines for future genomic investigations relying in different types of sequencing data.

Assessing the origin of Spanish leatherback turtles through the analysis of the pangenome

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The leatherback turtle (*Dermochelys coriacea*) is the largest extant sea turtle species, listed as Vulnerable by the IUCN, with populations undergoing rapid declines. Traditionally, mitochondrial DNA (mtDNA) has been used to investigate population structure and connectivity between nesting and foraging areas in marine turtles, but leatherbacks exhibit exceptionally low mtDNA variation globally, undermining reliable analysis. Advances in High-Throughput Sequencing (HTS) and the availability of a reference genome now enable genome-wide analyses using millions of markers, allowing the study of genetic diversity and population structure, as well as the assignment of individuals to their populations of origin. We first determined the genomic structure of the species across its geographical range by building a pangenome using Whole Genome Sequencing (30Gb output) on individuals taken from nesting populations in three different Regional Management Units (RMUs): Northwest Atlantic (Colombia, Dominican Republic), Southeast Atlantic (Gabon) and East Pacific (Costa Rica). We also sequenced individuals from foraging areas of Spain: Andalusia, Catalonia, Galicia, Valencian Community and Canary Islands to test the potential of genomics to assign individuals in foraging areas. We genotyped all samples by mapping their reads against a reference genome to produce a set of more than 12 million nuclear single-nucleotide polymorphisms (SNPs) across the individuals. We found a deep genetic structuring across RMUs, as indicated by a multidimensional scaling analysis and Fst analyses. This genetic structuring enabled the assignment of most individuals from Spanish foraging areas to one of the RMUs. We also analyzed runs of homozygosity, genomic regions where identical haplotypes are inherited from each parent, to assess the level of inbreeding across populations, as inbreeding can generally increase the presence of rare deleterious variants in homozygous form. We found that populations have different degrees of inbreeding. Our study demonstrates that whole-genome data can provide valuable insights that guide conservation strategies aimed at preserving the genetic integrity and adaptive potential of sea turtles in response to multiple pressures.

Territorial colonization progress of the invasive snake *Hemorrhois hippocrepis* on the island of Ibiza

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Maps of the colonization process carried out by the horseshoe whip snake (*Hemorrhois hippocrepis*), an invasive species on Ibiza island, are presented. The maps have been made using capture data with live mouse traps obtained by countryside volunteers. The traps were installed throughout the island between April 2021 and October 2024. The results from these captures show how some trapping stations in the west had no captures until spring 2024. At the eastern stations, on the other hand, captures decreased during the study period. Those in the center of the island experienced an increase between 2021 and 2022, and remained stable or decreased in 2024.

The progression of territorial occupation from the northeast to the southwest is observed. Thus, the presence of *Hemorrhois hippocrepis* is confirmed throughout the island, over a very short colonization period, from the first sighting in 2003 until 2024.

Swipe right or swipe left? Assessment of photo identification methods in Iberian anuran species

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Amphibians are currently facing a global extinction crisis, with over 40 % of species at risk. Addressing this crisis requires the implementation of accurate conservation actions, which depend on a solid understanding of population dynamics. However, monitoring amphibians over the long term can be challenging, due to their sensitivity, complex life cycle and small body size. Traditionally, Capture-Mark-Recapture (CMR) studies have relied on invasive tools, but emerging techniques such as photo-identification (photo-ID) offer a promising alternative, minimizing the physical impact of marking individuals and reducing the economic costs. Photo-ID software uses artificial intelligence and computer vision to analyse images and identify individuals, being especially useful for amphibian identification in CMR studies based on their unique skin patterns. In this study, we compare the effectiveness, performance and efficiency of two photo-ID software programs, WildID and Hotspotter, by analysing images of different body regions (a square located behind the eyes, a rectangle extending from the eyes to the legs and a rectangle enclosing the whole individual) in four species of Iberian anurans: *Alytes obstetricans*, *Discoglossus galganoi*, *Bufo spinosus*, and *Rana dalmatina*. A blind researcher carried out the photo-ID procedure on previously identified individuals, and we subsequently conducted statistical analyses to test for differences in processing time, image ranking and identification success (i.e., correct assignments) across software programmes, body regions and species. Our results demonstrate the effectiveness of photo-ID; however, performance and efficiency varied considerably depending on species and body region. These findings highlight the importance of evaluating different software tools and carefully selecting specific regions of the amphibian body in order to optimize monitoring efforts.

Mediterranean rivers without hydromorphological alterations constitute a refuge for native fish and amphibians, in front of the expansion of exotic species: the case of various Catalan basins

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Recurrent sampling was carried out in lowland rivers (<500m) of several river basins in northeastern Catalonia between 2006 and 2025. These rivers include a wide variety of hydromorphological situations, from pristine conditions to highly degraded states due to severe alterations of the hydrological regime, the river bed and channel, or the riparian forest, among other causes.

In this area, nearly 400 stations have been sampled at least three times each, although at a significant proportion of these (180 stations) recurrent sampling has also been carried out (>10 cumulative samplings). Sampling has been carried out using a passive capture technique, using small-mesh fyke net traps (5 mm). At each station and sampling occasion, between three and eight traps have been set for at least one full day, obtaining relative density estimates (CPUE) for each species detected. This technique is effective not only for sampling fish, but also for other aquatic macrofauna species, especially herpetofauna and large crustaceans. In the study area, up to 30 species of fish have been detected, at least 15 of which are exotic, as well as 17 species of herpetofauna, at least 4 of which are exotic, and finally 5 species of decapod crustaceans, 2 of which are exotic.

River stretches with few hydromorphological alterations constitute the main refuge for native species, where until recently exotic species have barely managed to penetrate or establish themselves. These courses mainly have order between 3 and 4. In the large alluvial plains, under current conditions, these stretches are typically intermittent during low water levels, when a large part of the riverbed dries up, leaving only isolated pools. In the rest of the river courses in the area, including the large river axes, with medium or high hydromorphological alterations, exotic species of aquatic fauna dominate, with native species often even absent. In this context, preserving the good ecological status, and especially the hydromorphological quality, of these few little-altered lowland courses and river stretches is a priority strategy for the conservation of native aquatic macrofauna, especially in the face of the progressive penetration and establishment of exotic species. Unfortunately, these few river refuges for riverine fauna are isolated within extensively modified basins and are also threatened by the dramatic reduction in their flow due to climate change.

Recovery of lacustrine populations of palmate newt (Lissotriton helveticus) and common midwife toad (Alytes obstetricans) in several high mountain lakes of the Pyrenees (Alt Pallars), within the framework of two major ecological restoration projects – LIFE LIMNOPIRINEUS and LIFE RESQUE ALPY

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In the high mountains, above 2000 meters above sea level, the palmate newt (*Lissotriton helveticus*) is a rare species, which only appears in some headwaters of Pallars. In the Cardós Valley, within the Alt Pirineu Natural Park, there are some of the main Pyrenean populations of this species.

Life Resque Alpyr, currently underway, aims to restore mountain aquatic habitats by improving the conservation of several target habitats and species in four Natura 2000 sites within the Alpine biogeographical regions of the Pyrenees (NE Spain) and the Alps (NW Italy). The target habitats include two aquatic habitats (HIC 3110 and 3130) in high mountain ponds. The target species include several species of amphibians and mammals. Previously, Life Limnopirineus also had similar objectives.

The introduction of fish into most alpine lakes has led to the disappearance of amphibians. Consequently, the ecological restoration of these lakes is being carried out through a strategy aimed at eradicating the introduced fish, mainly through intensive and continuous fishing. Specifically, in two lakes at the head of the Vall de Cardós, Closell and Rovinets, the definitive eradication of the fish present was already achieved, between 2019 and 2020. In the Naorte lake, also located in this area, technical fishing work to achieve this goal is still ongoing. The species present in these lakes was the minnow (*Phoxinus dragarum*). In the Muntanyó lake, technical fishing work to eradicate the fish began in 2022. In this case, we are currently close to achieving the eradication of the minnow, and the brown trout population (*Salmo trutta*) present has already been significantly reduced.

To know the status and evolution of amphibian populations in the ponds of the Life Resque Alpyr project, the results of the accumulated catches in small fish traps, permanently installed in the ponds, are available. Subsequently, when the eradication of the fish has been achieved, sampling campaigns are carried out with these traps every summer. At the same time, and since 2022, a detection and quantification method based on environmental DNA has been developed. The results of this monitoring are presented, which demonstrate the recovery of the palmate newt population. The response of the palmate newt and the common midwife toad populations, and of some of the other amphibians present, has been rapid, with an increase in populations observed from the first year of intensive fishing. Their density has continued to increase gradually until now.

Ecological factors associated with body size and sexual size dimorphism in the Spiny footed lizard (*Acanthodactylus erythrurus*)

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Body size and sexual size dimorphism are fundamental life history traits that vary widely among populations, influenced by environmental factors and sexual selection. In this study, we analyze how climate, primary productivity, and the intensity of sexual selection, relate to body size and sexual size dimorphism in the Spiny-footed lizard (*Acanthodactylus erythrurus*). Lizards were sampled in 19 populations across Spain during the spring and early summer of 2010, 2011, and 2013, with a total capture of 358 adult individuals (194 males and 164 females). Morphological measurements and microhabitat were characterized from each individual, and climatic and productivity variables were obtained for each population using geographic information systems. Phylogenetic Generalized Least Squares (PGLS) models were used to examine the influence of these variables incorporating the phylogenetic structure among populations. The results showed that male body size was greater in populations with higher seasonality (greater ranges of temperature and precipitation), lower precipitation in spring-summer, and higher maximum temperatures. In contrast, female body size was positively associated with the Enhanced Vegetation Index (EVI), an indicator of primary productivity. This suggests that the body sizes of males and females respond to distinct selective pressures, environmental in both cases, but possibly related to different aspects of the life cycle. Males were significantly larger than females, and sexual size dimorphism was greater in populations with higher average temperatures, taller vegetation in the microhabitat, and males with proportionally larger heads, a trait linked to intrasexual competition. These findings indicate that both sexual selection and environmental factors play a combined role in the evolution of sexual size dimorphism in this species.

Outsmarting the enemy: do lizards in dangerous environments show enhanced spatial cognition?

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Being eaten is a fatal outcome, eliminating the possibility for any future fitness. Predation is generally considered one of the strongest evolutionary forces, and has shaped a broad diversity of morphological and behavioural adaptations. One key trait that has received surprisingly little attention in this context, is cognition. Through learning, individuals can increase the efficiency of their antipredator behaviour and thus their chances of survival. Hence, it can be assumed that animals in more dangerous environments should exhibit enhanced cognitive abilities. However, there is very little data on whether and how predation pressure shapes cognitive variation in the wild, and the few empirical studies have yielded contradicting results. In this study, we address these questions by using an ongoing biological invasion on the island of Ibiza, which was snake-free up until the introduction of the horseshoe whip snake (*Hemorrhois hippocrepsis*) in the early 2000s. Local wall lizards (*Podarcis pityusensis*) have therefore experienced a drastic shift from a relatively safe to a dangerous environment, allowing us to experimentally test how predation shapes cognitive variation. We captured lizards from both invaded and uninvaded areas, and compared their performance in a standard spatial learning task in which lizards needed to navigate towards a safe refuge. While lizards showed clear signs of learning over time, learning performance, in terms of speed and accuracy, did not differ between lizards from sites with or without snakes. Surprisingly, we found no speed-accuracy trade-offs in either group. In conclusion, increased predation has not lead to enhanced cognition in this species. Our results are relevant both to answer broader questions regarding the evolution of animal cognition and its selective drivers, as well as having important implications for the future conservation of the Ibiza wall lizard in the face of this new challenge.

Bigger, bolder, and more bitten? Influence of size and sex on scarring patterns in an insular lizard

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Agonistic encounters between males, as well as copulatory bites on females, are well documented in lacertid lizards as a mechanism of sexual selection. Stronger bite force will ensure higher success in confronts with rivals and consequently increase their mating opportunities. These behaviours occur with higher intensity during the mating season, often resulting in body scars. Lizards often shed superficial scars during ecdysis, making these temporary marks disappear after the breeding season. The frequency and location of bite marks are expected to depend on population characteristics such as density, sex ratio, and habitat traits. Our model organism, the Madeira wall lizard (*Teira dugesii*), is an insular species native from Madeira and Selvagens archipelagos, and with an introduced range in Azores archipelago, Gran Canaria and two restricted areas in mainland Portugal. From scanner images, we counted the ventral scars of *Teira dugesii* individuals randomly sampled across the nine islands of Azores archipelago (589 individuals). Frequency and location of scars were compared between sexes, taking individual body size into account. Larger females are more likely to have more inguinal scars, as a result of more copulation attempts, since their bigger size might be able to produce larger or more viable progeny. Otherwise, head and chest scars in males may indicate male-male confrontations related to intrasexual aggression. In denser populations, such as urban areas, intraspecific competition may be more intense, translating into higher incidence of scarring in males. Therefore, these scars may represent a reliable proxy of the intensity of sexual selection across populations.

Challenges and positive outcomes after 38 years of *E. orbicularis* conservation in the Selva plain

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The European pond turtle (*Emys orbicularis*) is considered Vulnerable in Spain and Endangered in Catalonia. The primary threats to the species are habitat destruction, degradation, and fragmentation. However, over the last few years, it has faced other increasing threats, such as the mass release of invasive species and drastic water level declines due to water overexploitation.

In the Selva plain, Fundació Emys has developed a wide range of protection and restoration projects, with varying outcomes for *E. orbicularis* populations. In this presentation, we aim to share the obtained results, including both the successes and the most important challenges faced.

After a thorough diagnosis of population threats, we have detected several conservation strategies that seem to improve population status. Newly generated ponds are rapidly colonized by *E. orbicularis* when habitat is limited. Reducing the vegetation of terrestrial habitats increases the suitability of nesting sites. Headstarting of wild individuals also seems to positively impact the overall survival of the population. Traffic bans on secondary unpaved roads could decrease the number of road-killed turtles. In addition, increasing habitat complexity by adding wood debris or aquatic vegetation improves trophic networks and overall habitat suitability.

In contrast, several crucial challenges need to be addressed. Some populations occur in wetlands that are completely or partially unprotected, which limits the available funding and usually leads to a higher level of threat. *E. orbicularis* coexists with a wide range of stakeholders, including landowners, government, farmers, conservationists and the general public, with contrasting interests in a usually privately-owned landscape. Its high site fidelity requires focusing first on habitat preservation and threat mitigation. The long life cycle of the species makes it difficult to evaluate conservation outcomes, which requires careful long-term monitoring. Finally, the complex habitat requirements of *E. orbicularis* demand broad conservation strategies, preserving aquatic and terrestrial environments at a micro and meso habitat scale.

Overall, our experience suggests that, although complex, several conservation strategies are suitable for improving the status of *E. orbicularis*. However, threat mitigation, engagement with key stakeholders and combined strategies are needed to reverse declines in the populations of this species.

Blood parasite infection is associated with a lower thermoregulatory precision in the lizard *Podarcis lusitanicus*

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In a previous study, *Podarcis lusitanicus* (Lacertidae) lizards, when infected with blood parasites of the genus *Karyolysus* (order Adeleorina), were bolder and remained exposed for longer, with an identified trend for higher exploratory activity. As parasites have the potential to disrupt and induce changes in thermoregulation and behaviour in reptile hosts, possibly with deleterious effects, we sought to determine if this behavioural shift could be associated with the lizards' thermoregulation. For this, we recorded the temperatures of male lizards with varying degrees of blood parasite infection in a thermal gradient. We found that infected lizards had lower thermoregulatory precision, in line with the previously observed higher exploratory behaviour in infected individuals. However, the associated increased exposure under a light source in these same parasitized lizards did not translate into a higher median body temperature, suggesting this is not an adaptative behaviour of the lizard towards impeding the parasites through behavioural fever. Lowering host thermoregulatory precision did not provide advantage to the parasite against the lizards' cell-mediated immune response, as we identified no changes to this factor for impacted lizards. Nevertheless, there is a possibility these changes to host thermoregulation and behaviour might benefit the parasite beyond its infectious stage in the intermediate vertebrate host, as increasing the exploratory behaviour of the lizard might increase the chances of contact with haematophagous mites, the definitive hosts of *Karyolysus sp.*

Captive breeding project of the European pond turtle (*Emys orbicularis*) at the Canal Vell Biological Station, Ebro Delta Natural Park

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Due to the critical situation of the European pond turtle (*Emys orbicularis*) in the Ebro Delta at the end of the 20th century, the Ebro Delta Natural Park (*Parc Natural del Delta de l'Ebre*) launched a conservation program which, among other actions, included captive breeding at its facilities at the Canal Vell Biological Station (*Estació Biològica de Canal Vell*) starting in 1994. The objectives of the breeding program were to produce enough individuals to reinforce the remaining relict populations and to begin reintroducing the species into wetlands of the Delta where it had disappeared.

During the initial phase (1994–2005), the program operated with a small breeding group—one male and three females—in an outdoor enclosure. Breeding took place without nest manipulation or intervention in incubation. Hatchlings were collected after hatching and kept until they reached a suitable size for reintroduction (approximately 90–100 mm carapace length), skipping their final hibernation cycle prior to release. In this trial-and-error phase, reproductive success was limited, and there were no standardized protocols for breeding, health management, or the handling of different ontogenetic stages. Meanwhile, field studies detected a demographic collapse in wild populations, leading to the species' functional extinction in the area.

In response to this situation, in 2006—at the request of the Ebro Delta Natural Park's management—the program was redesigned, adopting an intensive production model focused on obtaining viable individuals for reintroduction into selected habitats. The number of breeding groups was increased to ten (each group with 3 females and 1 male), and specific facilities were built for adult breeders, hatchlings, and juveniles in the pre-release growth phase.

The implementation of the new protocol in 2007 resulted in a significant increase in productivity, with 217 hatchlings that year. In 2009, due to the increase in hatchling production, a greenhouse was built for their controlled housing, along with improvements to the adult breeding enclosures and the installation of outdoor pens for pre-release juveniles. In 2016, a major improvement to the breeding system was implemented: traditional aquariums were replaced with tanks equipped with mechanical and biological filtration, thermal climate control, and ultraviolet radiation disinfection systems. These innovations allowed for stricter environmental control within the greenhouse and significantly reduced mortality rates, which stabilized at around 5% annually. Between 2007 and 2023, the program achieved an average annual production of 227 ± 67 (SD) hatchlings and the reintroduction of up to 1,775 turtles into four wetlands of the Delta.

Over the years, a comprehensive protocol has been developed for all stages of captive breeding (breeder management, handling of a large number of hatchlings, individual identification, and development monitoring). The entire program design is aimed at maximizing reproductive efficiency, post-hatching survival, and achieving high individual growth rates within an *ex situ* conservation model. This intensive approach has enabled the sustainable production of individuals for population reinforcement purposes as part of the species reintroduction program of the Ebro Delta Natural Park. This report presents the results achieved and the main technical-operational improvements implemented over more than two decades, as well as future perspectives for the breeding and reintroduction program in a context of environmental change and ongoing adaptation.

Study of the colonization process of newly created ponds by amphibians in the Serra de Collserola Natural Park 2022–2025

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From 2022 to 2025, the Catalan Society of Herpetology (SCH) has monitored the colonization process of 14ponds located in the area of Les Llicorelles (Molins de Rei), located in the Serra de Collserola Natural Park. This site is included within the green spaces allocated by the Partial Plan of the industrial sector bearing the same name and is currently managed within the framework of a land stewardship agreement between the SCH, the Molins de Rei city council and the Serra de Collserola Natural Park Consortium. A reintroduction project has also been carried out there for the Iberian spadefoot toad (*Pelobates cultripes*), a species at risk of extinction in the Barcelona metropolitan area, which has been breeding naturally in several ponds at Les Llicorelles since 2024. Over these four years, monthly monitoring has confirmed significant quantitative and qualitative progress in the occupation of the various water bodies by different amphibian species potentially capable of colonizing the area. Since their construction, five out of a possible seven native amphibian species already present in Collserola Natural Park, and one non-native species which is also present here, have progressively and spontaneously colonized the ponds. Monitoring during the 2022–2025 period has highlighted both the vulnerability of many species to extreme climatic conditions and the rapid and positive response in species richness in relation to increased hydroperiods and the heterogeneity of the water bodies, particularly regarding the presence of helophytic and aquatic vegetation. In terms of colonization dynamics, during the first two years, the Natterjack toad (*Epidalea calamita*) was the dominant species, followed by the common parsley frog (*Pelodytes punctatus*) and, to a much lesser extent, the spiny toad (*Bufo spinosus*), the Mediterranean tree frog (*Hyla meridionalis*), and Perez's frog (*Pelophylax perezi*), which were present in only two or three of the ponds. However, in the past two years, the amphibian community has shifted toward a more stable assemblage. Currently, most species are present in nearly all ponds in relatively high numbers, with no clear dominance by any single species. This suggests a classic pattern of increasing species richness, with the later appearance of less opportunistic species. This project provides data regarding the effective ecological restoration of highly altered green spaces in order to promote amphibians, and underlines the value that well planned and co-managed actions can have for their conservation in protected natural areas.

Conservation translocations of the Betic midwife toad (*Alytes dickhilleni*) in its easternmost limit (Sierra Espuña, SE Spain): insights from four years of adaptive management

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The Betic midwife toad (*Alytes dickhilleni*) is an endangered species endemic to the Betic mountain ranges. In Sierra Espuña Regional Park (Murcia, SE Spain), this amphibian persists as a relict population confined to a single canyon, with limited breeding activity and long-term isolation. Historical records in Sierra Espuña are available, but breeding sites were not found until 2009. A conservation strategy was launched in 2016, revealing a declining trend due to the loss of functional waterbodies (abandonment, runoff-mediated sedimentation, drought) and suspected synergistic predation by *Natrix maura*. Consequently, ex-situ actions were initiated in 2019 through within-park translocations and head-starting. In 2022, a restocking plan was implemented with the aim of reducing the extinction risk by increasing the number of breeding sites and tadpole output.

Donor populations were selected based on their high tadpole densities (>500 individuals), with collections limited to less than 15% of the estimated abundance. All founder tadpoles belonged to the same genetic unit, where the presence of the chytrid fungus had been recently confirmed. Following successful antifungal treatment, between 50 and 150 individuals—depending on the characteristics of each waterbody—were translocated to Sierra Espuña, which remains chytrid-free. Four main geographic units were targeted: one within the canyon (with three consecutive years of releases), two outside the canyon (each with two years of releases), and one where the species had previously gone extinct (one year of releases).

A predator-exclusion experiment confirmed the impact of *N. maura* in small ponds, where survival increased from 2% for hard (free) release to 50% for soft (enclosed) release. Moreover, regular monitoring of breeding sites confirmed the impact of severe droughts in small ponds and highlighted the need to prioritize large and permanent waterbodies. First signs of population recovery were observed in 2025. Breeding was confirmed in four different sites within the canyon, surpassing the numbers recorded for the period 2016-2024 (mean number of breeding site = 1.7; range 0–3). Among these four sites, two of them corresponded to ponds where within-park tadpole translocations were conducted in 2019, 2021 and 2022. Total tadpole abundance in 2025 was 260, being this output notably higher than the recorded for the period 2016-2024 (mean 75.5; range 0–230). Half of this output was concentrated in the pond that had received tadpoles from three consecutive years of reinforcement.

Our results suggest a minimum 6-year interval for population response, though first signs of recovery appeared after 3 years. Future efforts will target within-park tadpole translocations to consolidate new breeding sites and expand the species' range into the natural park.

Loggerhead turtle bycatch estimates in the Western Mediterranean

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Loggerhead turtle bycatch constitutes a significant conservation concern along the eastern coast of Spain. Between 2022 and 2023, structured face-to-face interviews were conducted with at least 30% of the active fishing fleet registered at ports within each autonomous community to obtain a comprehensive and representative assessment of this threat across the western Mediterranean. Catch per unit effort (CPUE) for loggerhead turtles was estimated, along with 95% confidence intervals, both overall and for each of the 14 stratified areas, as well as for the different fisheries involved (bottom trawling, artisanal, purse seine, bottom longline, and surface longline). The overall CPUE was 0.106 individuals accidentally caught per vessel per year, corresponding to a global mean estimate of 1,085 turtles (95% CI: 858–1,312); however, mortality at the time of bycatch was relatively low, with only 12.7% of individuals found dead. Regarding the different fisheries, estimated annual bycatch was 323 turtles (95% CI: 217–430) for bottom trawling, 639 turtles (95% CI: 375–903) for artisanal fisheries, 21 turtles (95% CI: 3–42) for purse seine, 3 turtles (95% CI: 0–18) for bottom longline, and 99 turtles (95% CI: 0–439) for surface longline. In terms of spatial distribution, the highest bycatch estimate corresponded to Area 3 (Ebro Delta: Cambrils-Castelló), with approximately 461 turtles accidentally caught annually (95% CI: 274–647). These findings highlight the urgent need for targeted mitigation measures within high-risk fisheries and geographic areas to effectively reduce loggerhead turtle bycatch and support their conservation in the western Mediterranean.

Intraspecific variation in the agonistic behaviour of *Podarcis* lizards

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The finite nature of resources is the basis for widespread interactions in the animal kingdom, especially intra-specific conflict. Experience or body condition are highly influential factors in competitions, nevertheless, communication allows many of these scenarios to be solved without physical contact. Along these lines, the role of motivation signals (i.e., aggressive and appeasing signals) in clashes between *Podarcis* male lizards is critical as an assessment strategy to decide whether or not to remain in conflict. This study aims to evaluate the potential of motivation signals and previous experience as determinants of behavioral dynamics in combats between males of the catalan wall lizard (*Podarcis liolepis*). With this objective, we analysed male-male contests belonging to the same or different morphotype (i.e., brown and green morphotype) using the BORIS software. The specimens come from a polymorphic population located in the Valencian Community, allowing to analyze contests between individuals with brown-brown, green brown and green-green coloration, in order to examine whether the morphotypical variety is an influential factor. Combats were held in a neutral arena, following a tournament type design in which each lizard will face opponents of the two different morphotypes.

An ethogram was defined beforehand and an intra-observer reliability analysis was carried out with a corresponding number of observations. We applied a Bradley-Terry model to analyse the results, obtaining an interaction matrix and providing information about the relative importance of behavioral and morphological traits in the intensity and outcome of the contest. In this way, we observed a direct cause-effect relationship between the aggressive and appeasing patterns, as well as a clear impact on the intensity of confrontation by these signals. In addition, specimens of the green morphotype show greater aggressiveness in general terms and that previous experience play a major role in determining the individual and dynamic behaviour of the confrontation.

Demography, phenology and conservation of the Balearic green toad (*Bufotes viridis balearicus*) in Mondragó Natural Park (Mallorca, Balearic Islands)

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Understanding the population dynamics of amphibians is essential for their conservation under increasing environmental pressure. In this study, carried out over four years (2018–2021), we analysed the demographic and ecological parameters of the Balearic green toad (Bufotes viridis balearicus) in Mondragó Natural Park (Mallorca), using capture–mark–recapture techniques. A total of 515 captures corresponding to 204 unique individuals were recorded, showing a strong male bias. Although five water bodies were surveyed, demographic analyses focused on Pond 3, where the highest number of recaptures was obtained.

The results revealed a low annual apparent survival rate (mean = 0.38) and a fluctuating male population size, ranging from 32 to 108 individuals depending on the year. A positive correlation was found between the number of individuals and the cumulative rainfall over the previous 30 days, and a negative relationship with average temperature. Body condition index (BCI) was higher in individuals that arrived earlier at breeding sites and tended to increase during their stay, possibly related to food availability in the ponds. No movement of individuals between ponds was observed, suggesting very limited connectivity between adult populations, likely influenced by landscape fragmentation.

The observed phenological flexibility and the strong influence of environmental factors on reproductive activity highlight the need for conservation strategies that take into account both interannual climatic variability and the availability and stability of aquatic habitats. This study was made possible by the Biodibal project, within the framework of the collaboration agreement between the University of the Balearic Islands and Red Eléctrica de España, and received partial support from Mondragó Natural Park.

Trophic flexibility and morphological adaptation in an invasive predator: Insights from the horseshoe whip snake in Ibiza

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Biological invasions pose a major threat to biodiversity, particularly on islands, where native species often evolve in the absence of predators and display docile behaviors, a hallmark of the island tameness syndrome. This vulnerability is evident on the Mediterranean island of Ibiza, where the invasive horseshoe whip snake (*Hemorrhois hippocrepis*) has been expanding rapidly since its introduction around 20 years ago. The intense predation pressure exerted by the snake has led to the extirpation of *Podarcis pityusensis*, the island's only native terrestrial vertebrate, from the invasion core. These local extinctions coincide both spatially and temporally with the snake's expansion.

Interestingly, snakes persist in areas where lizards have already vanished, suggesting dietary shifts toward alternative prey such as small mammals, which are significantly larger than lizards. This contrast in prey availability between the invasion front (where lizards are still present) and the core (where they are not) raises the question of whether *H. hippocrepis* has undergone adaptive changes in cranial morphology to exploit these different prey types.

To investigate this, we analyzed X-ray images of over 300 snakes across the island and quantified fine-scale variation in cranial element dimensions, an exceptional sample size for a vertebrate predator. Our results reveal significant differences in cranial morphology between the invasion core and front, consistent with adaptive divergence driven by prey shifts. The observed morphological divergence suggests that invasive predators can rapidly adjust to local resource availability through phenotypic plasticity or selection. In insular ecosystems, this ecological flexibility is particularly concerning: it allows invaders to persist even after the depletion of their primary prey, potentially reshaping trophic interactions and driving long-term ecological disruption. These findings underscore the urgency of proactive management, as delayed intervention may lead to irreversible changes in community composition and ecosystem functioning.

Endangered lizards threatened by invasive black rats

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Despite the pernicious impacts that invasive black rats *Rattus rattus* have on island ecosystems, little is known about their effect upon insular reptiles, which are a highly vulnerable but pivotal element of island biota. To bring to light these effects, we evaluated the threat posed by *R. rattus* on the Critically Endangered Canarian spotted lizard *Gallotia intermedia* by analyzing its consumption by rats, estimating rat abundance and density, and correlating these parameters with previous lizard censuses. We genetically detected that almost a fifth of all rat excrements contained *G. intermedia*, with almost a third of individual *R. rattus* consuming this lizard. Complementarily, we found that *R. rattus* density in the studied locations was correlated with larger declines of *G. intermedia* between censuses conducted 15-20 years ago and those of 2019. These results confirm for the first time that *R. rattus* consumes and impacts this endemic and threatened lizard species. From a broader perspective, this is one of the first studies detecting rat impact on a large-sized reptile, which calls for further attention on the interaction between invasive rats and a highly vulnerable but essential component of island ecosystems.

Evaluating prey preference to Enhance Trapping Success of *Lampropeltis californiae* in Gran Canaria

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Trapping is a central but challenging tool in invasive species management, requiring adaptation to the target species' ecology. Effective traps must incorporate suitable baits, which are often unknown. Assessing prey preference is thus essential to enhance trapping success. We illustrate this with the invasion of the California kingsnake (*Lampropeltis californiae*) in Gran Canaria, where captures largely depend on traps baited with live mice. However, their effectiveness remains moderate relative to the resources invested in their deployment and maintenance. In this context, the main objective of this research was to delve in *L. californiae* prey preferences, tested under controlled conditions. We exposed a total of 60 adult individuals to three trials, each separated by 48 hours. In each trial, we randomly offered four attractants out of twelve (five live, five inert, a refuge, and water) to each individual. We recorded each trial to subsequently extract the number of contacts each individual made with each attractant, the total time spent in contact with each attractant, and the rate of tongue-flicking (RTF) during contact with each attractant. The total number of contacts did not vary significantly among attractants, whereas the total contact time was significantly higher for the refuge and *Gallotia stehlini*. We observed that *L. californiae* exhibited higher values of RTF during contact with Chalcides sexlineatus and the dead mouse. The attractants that simultaneously showed the highest values of total contact time and RTF were Tarentola boettgeri, refuge, dead mouse, *C. sexlineatus*, *G. stehlini*, and water. These results are essential to inform the selection of the most suitable attractants for integration into trapping efforts within the L. californiae control program in Gran Canaria. Our findings suggest that the baits currently used in traps could be replaced with scents derived from endemic reptiles, dead mouse, or water.

Host-gut microbiota coevolution in insular populations of the Balearic lizard *Podarcis lilfordi*

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Insular populations, due to their isolation, offer valuable natural systems to explore evolutionary processes between vertebrates and their gut microbes. Population-level studies in these systems allow us to investigate critical questions, such as how host genetics influence gut microbial community structure.

To address this, we studied multiple populations of the endemic Balearic lizard *Podarcis lilfordi*. Using full length 16S rRNA sequences (Oxford Nanopore Technology) from fecal samples, we generated gut microbial profiles from 212 individuals across five islets. To minimize the influence of environmental factors, we focused only on bacterial taxa present in at least 80% of individuals within each population (i.e., the core 80%) and compared gut microbiota composition with host population genetic distances based on the fixation index (FST) and single-nucleotide polymorphisms (SNPs).

Despite long-term isolation (4,000–9,000 years), all populations shared a highly conserved core gut microbiota, suggesting ancestral inheritance and a strong resilience of these bacterial communities. Moreover, relative distances among populations inferred from gut microbiota composition differences closely mirrored those based on host population genetics, indicating an important influence of the host phylogenetic history on gut microbial composition. Additionally, several bacterial genera were found to be significantly associated with this pattern and may represent essential components of the lizard gut microbiota. These taxa emerge as important candidates for future studies aimed at better understanding host-microbe coevolution and their role in insular adaptation.

Ecological parameters of *Natrix maura* in the karstic canyons of the Serra de Tramuntana (Mallorca, Balearic Islands)

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Natrix maura is a semi-aquatic colubrid widely distributed across the Iberian Peninsula and North Africa. Its presence in the Balearic Islands likely dates back to Roman times, as part of early anthropogenic introductions that have shaped the archipelago's herpetofauna. Although currently delisted from the Spanish Catalogue of Threatened Species in the Balearics, it remains the main threat to the endemic and endangered Mallorcan midwife toad (*Alytes muletensis*). In this context, the Government of the Balearic Islands carries out control campaigns targeting *N. maura* in karstic canyons inhabited by natural populations of *A. muletensis*.

This study is based on the analysis of 80 specimens captured, euthanised, and frozen by the regional government, and subsequently analysed by the Interdisciplinary Ecology Group of the University of the Balearic Islands. The captures were carried out in a steep, mountainous karstic environment, considered ecologically suboptimal for *N. maura* compared to wetter, lowland areas such as s'Albufera or s'Albufereta.

Of the total individuals, 43 were females, 29 males, and 8 undetermined. Females had a mean total length of 53.4 ± 14.2 cm (range: 21–74 cm), compared to 48.2 ± 8.7 cm in males (range: 27–63 cm). Only 8 females, representing 25% of those with reproductive status evaluated (n = 32), showed signs of ovulation. The total number of eggs per female (including calcified and non-calcified) ranged from 0 to 11 (mean ± SD: 2.25 ± 3.82), indicating significantly low reproductive potential under these mountainous conditions, especially when compared to continental populations where clutch sizes ranged from 2 to 27 (mean ± SD: 9.8 ± 2.9).

Age was estimated in 17 specimens using skeletochronology based on growth ring counts in the ectopterygoid. Males (n = 10) had a mean age of 8.3 years (range: 2–12), while females (n = 7) averaged 6.6 years (range: 1–11). These data indicate a relatively long lifespan in the island population, although maximum ages remain shorter than those documented in continental populations, where individuals may exceed 20 years.

These findings provide novel information on the biology of *N. maura* in marginal mountainous habitats, particularly within insular ecosystems, where studies on its life history are scarce. Comparative research involving populations from more favourable habitats would be particularly relevant to better understand the ecological plasticity of this species and its implications for the conservation of the endemic *A. muletensis*.

A series of unfortunate introductions: A Chronological Overview of the Introduction, Research, Management, and Regulation of Snakes in the Balearic Islands

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Biological invasions are a major driver of biodiversity loss, particularly in insular ecosystems. In the Balearic Islands, six alien snake species have been confirmed to date. Three of them are considered historical introductions: *Zamenis scalaris*, likely introduced to Menorca during the first human colonisation of the island in the Late Bronze Age; *Natrix maura*, associated with Roman occupation due to its frequent presence in archaeological sites from that period; and *Macroprotodon mauritanicus*, introduced during the Islamic period, as suggested by its current distribution and historical land-use patterns. These species are currently considered naturalised but remain non-native.

In recent decades, four additional introductions have taken place, including *Malpolon monspessulanus*, *Z. scalaris*, and *Hemorrhois hippocrepis* in Mallorca and Ibiza, with the latter two also recorded in Formentera. The most recent species, *Hierophis viridiflavus*, has so far only been detected in Mallorca. These contemporary introductions are primarily linked to the unintentional transport of snakes through the ornamental olive tree trade from mainland Spain. Currently, *H. hippocrepis* and *Z. scalaris* are legally recognised as invasive in both Ibiza and Formentera. In contrast, the Balearic population of N. maura was removed from the Spanish Catalogue of Endangered Species in 2003, where it had previously been listed as “of special interest”. Documented ecological impacts include predation on native and endemic fauna, as well as disruptions to local trophic networks.

This work aims to compile and organise, in chronological order, all key events related to the introduction, establishment, spread, research, management, and legal classification of introduced snakes in the Balearic Islands, from the earliest historical records to the present day. By presenting a comprehensive timeline, we aim to enhance understanding of the invasion process and provide a foundation for more effective strategies in biodiversity conservation and invasive reptile management in insular ecosystems.

Geographic variation and sexual dimorphism in the brown lizard (*Podarcis liolepis*)

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Catalonian wall lizard (Podarcis liolepis; Boulenger, 1905) is a lacertid species found in the east of the Iberian Peninsula. Despite ongoing uncertainty regarding its distributional limits, significant populations have been recorded throughout the Valencian Community. These populations display a remarkable intraspecific variability ranging from colorations with a brown background with black spots or stripes to colorations with a green dorsal background. This brown–green variation occurs quite frequently across most species of the genus *Podarcis*. Moreover, this species presents a clear sexual dimorphism in morphology and coloration. Previous studies in other lizards of the genus *Podarcis* indicate that different selective forces, often conflicting, act on these traits, with sexual selection playing a key role.

The aims of this study are: (1) to describe intraspecific variability in morphology and coloration of *Podarcis liolepis*, and (2) to relate such variability among populations to sexual dimorphism in order to explore the role of sexual selection in its maintenance. To this end, we analyzed a sample of 459 lizards captured across nine populations in the center and south of the Valencian Community (CV) within an area of 0.30 km² each one approximately. Using established herpetological methods, we obtained morphological measurements (i.e., body size, weight, head length) for each individual. In addition, multispectral photography techniques were used to obtain quantitative measures of coloration patterns (hue, brightness, and saturation, as well as the area and number of black and lateral blue-UV spots, which are involved in sexual dimorphism in many lacertids). We found that intraspecific variability among populations was mainly determined by dorsal coloration and to a lesser extent by the size and UV reflectance of UV-blue spots, which may play a role in male-male competition. Our findings contribute to a better understanding of phenotypic diversity and provide an approach to the evolutionary dynamics of coloration traits in *Podarcis liolepis*.

Temporal intra-individual colour variation in *Podarcis muralis*

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Animal colours can change in multiple ways. Within individuals, changes may be ontogenetic, seasonal, or condition-dependent. However, disentangling between these sources of variation is not easy and obtaining repeated measurements of the same individuals is required. Lacertid lizards (Lacertidae) are an ideal group to study animal coloration. Lacertids often exhibit complex colour patterns combining different types of colours: conspicuous short-wavelength-based patches (e.g. ultraviolet [UV]-blue), mainly based on structures (i.e. iridophores); conspicuous long-wavelength-based patches, often polymorphic (e.g. yellow, orange), mainly based on carotenoid and pteridine pigments; and cryptic dark patches (e.g. black, brown) explained from melanin deposition. Although seasonal variation in lacertid coloration is widely assumed, such as the brown-green dorsal colour shifts observed in some species, empirical evidence remains limited, and general patterns are poorly understood. Here we use an experimental population of *Podarcis muralis* from Penyagolosa mountain maintained in a 300 m2 mesocosm to obtain longitudinal colour data (i.e. reflectance spectrophotometry and standardized photography) and quantify intra-individual colour changes. From September 2023 to July 2025, we recaptured up to 43 individuals including both adults and juveniles born in the mesocosms. Although our preliminary results confirm that ventral morphs are fixed at maturity (i.e. no changes between morphs), they reveal many forms of variation involving all colour types. The appearance of ventral coloration may fluctuate drastically, but contrary to what is suggested in the literature, these changes seem to be condition-dependent rather than seasonal, with clear differences among both individuals and years. An ontogenetic trend can also be identified, mainly in females. The UV-blue patches are the most stable colour type, suggesting a unidirectional ontogenetic trend to a UV-biased aspect. Surprisingly, the ventral black patches change in size instead of colour, without a clear longitudinal pattern, suggesting some kind of condition-dependence too. Overall, our results suggest a complex scenario involving different types of intra-individual colour change in *P. muralis*.

Intensive control of exotic fish in a stretch of the Daró River (Girona) of high interest for amphibians

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The medium-upper course of the Daró River, located within the Natura 2000 Network, presents a high biotic integrity of its fish population, currently exceptional in the lowland rivers of Catalonia, located below 200m a.s.l. Currently, it still maintains populations of four native fish species along a stretch of about 10 km, although its trend is globally regressive for all of them. These are the eel (*Anguilla anguilla*), the stickleback (*Gasterosteus aculeatus*), the mediterranean barbel (*Barbus meridionalis*) and the chub (*Squalius laietanus*). At the same time, thanks to its good habitat quality, this river sector also hosts a notable assemblage of amphibians, made up of breeding populations of up to 11 species: marbled newt (*Triturus marmoratus*), palmate newt (*Lissotriton helveticus*), fire salamander (*Salamandra salamandra*), common toad (*Bufo spinosus*), natterjack toad (*Epidalea calamita*), Iberian spadefoot toad (*Pelobates cultripes*), Catalan midwife toad (*Alytes almogavarii*), Iberian green frog (*Pelophylax perezi*), Mediterranean painted frog (*Discoglossus pictus*), common parsley frog (*Pelodytes punctatus*), and Mediterranean tree frog (*Hyla meridionalis*). This is clearly one of the richest river amphibian assemblages in Catalonia.

On the other hand, in this section there are only current records of two exotic species, pumpkinseed (*Lepomis gibbosus*) and goldfish (*Carassius auratus*), concentrated in a small stretch of just 500m. Here, various intensive control campaigns for pumpkinseed and goldfish have been carried out in 2012, 2020 and 2022. The actions carried out and the results achieved are presented. Each year of action has achieved a global reduction in the population of adult pumpkinseed of more than 90%, but this species persists in the area. As for the goldfish, it only appeared in 2020, and in that year its eradication was possible, without it appearing again.

However, both species are still present in some private ponds located in the area, from where specimens can probably reach the river, even if only irregularly. Currently, within the framework of the Projecte Escanyagats, Sorellona is gradually acting on these ponds, to eliminate these nuclei of exotic species, and thus minimize their impact.

Design and installation of a gravel filter to prevent the penetration of fish and other exotic fauna in a pond located on the banks of the Ter River (Girona, NE Spain)

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The GiroNat project, financed with European Next Generation funds through Fundación Biodiversidad (MITECO), aims to change the city of Girona through renaturalization, making it a greener, more resilient, and healthier city. One of the objectives of this project is the ecological restoration of urban and peri-urban lagoons and ponds, for the recovery of biodiversity, including amphibian species. Among the various strategies for this restoration, different actions have been designed to eliminate exotic species of aquatic fauna that have colonized some of these bodies of water, compromising both ecological state and processes and avoiding the establishment of native species of interest. Those are, above all, fish such as goldfish (*Carassius auratus*) or common carp (*Cyprinus carpio*), to which other exotic aquatic fauna are often added, such as the Florida pond slider (*Trachemys scripta*) or the red swamp crayfish (*Procambarus clarkii*).

In the case of the lagoons of the Santa Eugènia orchards, located on the banks of the Ter river, the list of invasive fish present is significantly expanded: largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), roach (*Rutilus rutilus*), among others. This is because its hydrological operation involves a constant influx of water from the network of irrigation ditches in the area, which in turn are fed by a large ditch that takes part of the flow from the Ter river itself, where all these exotic species are present. Thus, in this case, simply eliminating the stock of exotic fish from these lagoons would not be enough to tackle the problem, since new colonization would immediately occur. For this reason, in the largest pond of the system (0.23ha), a gravel filter has been installed in the only water inlet channel, to prevent the entry, again, of exotic species of aquatic macrofauna (>15mm). The technical details of this action are presented, and images of the gravel filter. We also present first results related to the recovery of amphibian's assemblage in the lagoon, such as evidence of reproduction of midwife toad (Alytes almogavarii).

Restoration of aquatic ecosystems in protected areas of the Alps and Pyrenees LIFE RESQUE ALPYR

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In alpine biogeographic regions, aquatic and semiaquatic habitats are crucial biodiversity reservoirs and important habitats for species of community interest. However, they are often threatened by multiple factors. The conservation status of protected habitats and species in the EU is expected to worsen unless effective actions or conservation strategies are implemented.

LIFE RESQUE ALPYR aims to restore mountain aquatic habitats by improving the conservation of several target habitats and species in four Nature 2000 sites within the alpine biogeographical regions of the Pyrenees (NE Spain) and the Alps (NW Italy). The target habitats include two aquatic habitats (HCIs 3110 and 3130) in high mountain lakes. The target species include native amphibians found either in both areas (*Rana temporaria*) or solely in the Pyrenees (*Calotriton asper* and *Alytes obstetricans*); the semi-aquatic mammal Galemys pyrenaicus found in Pyrenean streams and lakes; and seven insectivorous bat species, including *Barbastella barbastellus*, *Myotis myotis*, and *Plecotus macrobullaris*, present in both the Pyrenees and the Alps, as well as *Rhinolophus hipposideros*, *Myotis blythii*, *Myotis bachsteinii*, and *Nyctalus lasiopterus*, all from the Pyrenees.

The target habitats and most of the target species are affected by anthropogenic pressures. The introduction of trout or minnows (*Phoxinus sp*) in most alpine lakes has led to the disappearance of native amphibians and invertebrates at local and landscape scales, indirectly affecting aquatic mammals and terrestrial species, such as bats, that rely on aquatic insects for feeding. Minnows can also cause severe eutrophication of lakes, leading to drastic habitat degradation.

The proposed actions and methods regarding fish species involve the experimental eradication of nonnative fish in high mountain lakes using both chemical (rotenone) and mechanical methods (traps, nets, and electrofishing). The project will provide data on replicable and exportable conservation actions and will increase awareness of key conservation issues among stakeholders and the public. Additionally, the project will promote the transfer of its background data and results to conservation authorities in other European high mountain areas.

First application of rotenone to eradicate fish in an alpine lake in the European Union, for its ecological restoration and the recovery of the amphibian population

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In the Alpine biogeographical regions, aquatic and semi-aquatic habitats are crucial reservoirs of biodiversity and important habitats for species of Community interest. However, they are often threatened by multiple factors. Life Resque Alpyr aims to restore mountain aquatic habitats by improving the conservation of several target habitats and species in four Natura 2000 sites within the Alpine biogeographical regions of the Pyrenees (NE Spain) and the Alps (NE Italy). The target habitats include two aquatic habitats (HIC 3110 and 3130) in high mountain lakes. The target species include native amphibians found in both areas (*Rana temporaria*) or only in the Pyrenees (*Calotriton asper* and *Alytes obstetricans*).

The introduction of fish into most alpine lakes has led to the local disappearance of amphibians, among other ecological effects. Some fish species can also cause serious eutrophication of lakes, which leads to a drastic degradation of the habitat. The actions proposed for fish within the Life Resque Alpyr involve their eradication using chemical (rotenone) or mechanical methods (traps, nets and electric fishing).

Therefore, within the framework of the Life Resque Alpyr project, in the summer of 2024 the first rotenone treatment in an alpine lake in the European Union, was carried out in the Estany Manhera, located in the Vall d'Aran, within the peripheral area of the Aigüestortes i Estany de Sant Maurici National Park. Two introduced species of fish coexisted in this lake, brown trout (*Salmo trutta*) and minnow (*Phoxinus dragarum*).

The action was successful. A year later, subsequent monitoring confirms that there are no longer any fish in the pond of action. The expected ecological recovery of the pond is also taking place, including the confirmed re-establishment of the population of Rana temporaria. On the other hand, the degradation of rotenone was progressive and rapid, reaching a value of less than 0.1% of the application dose two months later.

Possible extinction debt of *Chalcides striatus* populations in Catalonia: poor prospects for its conservation?

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Land-use changes over the past century have driven widespread forest expansion across the Mediterranean, mainly due to the abandonment of traditional small-scale agriculture and livestock grazing. This process has led to a gradual loss of open habitats and traditional landscape mosaics, causing the fragmentation and decline of natural grasslands. These changes pose a threat to species strictly dependent on low and dense vegetation, such as the western three-toed skink (*Chalcides striatus*), an endemic scincid of the Iberian Peninsula and Occitan region. To identify the factors shaping its occurrence, visual surveys were conducted between 2021 and 2022 in three contrasting Mediterranean landscapes in Catalonia: Les Gavarres (forest-dominated), Garraf (shrubland-dominated), and Moianès (mosaic landscape). A total of 130 grassland patches were surveyed, across 181 visits, recording presence or absence of the species and search effort. At each site, the current and historical patch size (from 1956 and 1993), habitat connectivity, and the surrounding landscape matrix were analysed. Hierarchical occupancy models were used to estimate detectability and probability of occurrence in relation to these variables. Results show that the presence of *C. striatus* is more strongly explained by historical rather than current landscape variables, suggesting both a potential extinction debt and the critical role of long-term habitat continuity in the persistence of the species in the study area. Additionally, grasslands surrounded by shrublands—rather than forests—provided more favourable conditions for population maintenance, likely due to better landscape connectivity. Overall, the species appears to have low colonization capacity and is therefore particularly vulnerable to habitat loss, isolation, and degradation if the current trend of landscape homogenization continues.

Towards a Coherent Monitoring Framework for Amphibians and Reptiles in Catalonia

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Improving our understanding of the conservation status of herpetofauna requires robust and widespread monitoring systems. At the Catalan Observatory of Natural Heritage and Biodiversity, we are developing the HARMON project, which aims to collect and harmonise information from biodiversity monitoring initiatives across Catalonia. This study presents an analysis of available data on amphibians and reptiles. We identified 26 active initiatives (12 focusing on amphibians and 14 on reptiles), which attempt to provide information on population trends for 42 herpetofauna species.

Using the known distributions of these species and the spatial coverage of existing monitoring programmes, we analysed the territorial representativeness of the available data. This analysis focuses on species included in the Catalan Catalogue of Threatened Fauna and in Annexes II and IV of the EU Habitats Directive, in order to ensure adequate monitoring coverage for those species with the greatest conservation responsibility. Cross-referencing species presence with existing monitoring revealed critical knowledge gaps in protected natural areas, either due to the absence of monitoring efforts or a lack of up-to-date distribution data. This territorial diagnosis provides an objective basis for prioritising improvements and guiding monitoring efforts more strategically.

In parallel, we have identified reference monitoring methodologies and initiatives for each priority species with the help of expert input from the Catalan Herpetological Society. These can serve as models for expanding monitoring into new areas or strengthening it where gaps exist. Based on this collaborative work, the HARMON project will produce technical reports for protected areas in Catalonia. These reports will include tailored protocol recommendations to help fill identified gaps and contribute to a more coherent, coordinated, and effective monitoring network for Catalonia's herpetofauna. Finally, it is important to highlight that the initiative is not only done for this group of animals but also for the rest of taxa, which provides a comprehensive understanding of the situation of biodiversity monitoring and priorities for the near future.

Biased protection for the threatened spur-thighed tortoise (*Testudo graeca*): evaluating Natura 2000 coverage in southeastern Iberia

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The Natura 2000 Network is the European Union's main strategy for biodiversity conservation. Despite the expansion of protected areas coverage, habitat loss and fragmentation persist, and many conservation goals remain unmet. The spur-thighed tortoise (*Testudo graeca*), a key species in arid and semi-arid scrublands, is mainly threatened by these pressures. This study evaluates the adequacy of Natura 2000 sites in southeastern Spain (Murcia and Almería) for the conservation of this species by analyzing population densities across 115 localities surveyed between 2005 and 2023. Distance sampling was used to estimate densities, and topographic variables (altitude and slope) were extracted for each locality.

Tortoise density ranged from 0.075 to 7.657 tort/ha, a range consistent with the distribution and abundance patterns in patches observed in previous studies. No significant differences in density were found between protected (1.38 ± 1.43 tort/ha) and unprotected areas (1.40 ± 1.25 tort/ha). However, protected localities in Murcia had significantly higher densities than those in Almería. High densities were also observed outside protected areas, especially in Almería, having important populations unprotected against habitat loss and fragmentation. Slope had a significant negative effect on density, and protected areas were biased toward higher altitudes and steeper slopes, which, given the effect of slope on density, may be inadequate for T. graeca conservation.

Our findings suggest that the current Natura 2000 network may not adequately meet the ecological and conservation requirements of *T. graeca*, especially in Almería. In this province, most protected areas were designated nearly 30 years ago, yet land-use changes have intensified in recent years, leading to significant habitat alteration. Consequently, several high-density populations remain unprotected in landscapes under threat. These results highlight the need to revise and update Natura 2000 coverage to better reflect current conservation priorities. Furthermore, landscape perception biases should be avoided to ensure that lowland habitats and key population nuclei are effectively protected.

Effect of Habitat Fragmentation of the Common Chameleon (*Chamaeleo chamaeleon*) by Road Infrastructures in Southern Spain

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In recent decades, the area of land covered by roads has increased, especially in more populated areas, such as coastal areas in Spain. Roads are structures that are among the main causes of habitat loss worldwide, because they fragment the habitat and generate isolated portions of land called vegetation islands. This poses a major threat to the integrity of numerous vertebrate species, especially those with terrestrial movements, such as amphibians, reptiles and some mammals. The number of roadkill incidents is also increased in the case of slow-moving animals, such as the common chameleon. In Málaga, there is a high-density population of common chameleon that occupies a high density population nucleus of national importance, being the province of Spain where specimens can be found at the farthest distance from the coast. The urban and periurban environment of the city of Málaga was selected as the study area, due to the boom in tourism, and because it is home to high-density populations of the species. Specifically, we chose the vegetation islands of a major road around a known population of the species.

The aim of the study was to evaluate the impact caused by habitat fragmentation due to first-order road structures (highways and freeways) on the populations of the common chameleon in Puerto de la Torre (Málaga). For this purpose, in 2024 and 2025, we sampled chameleons in the conditions of the vegetation islands (small natural patches surrounded by roads) and studied the use of these islands by the species. Numerous vegetation islands were sampled and characterized between 2024 and 2025. The results suggest that vegetation islands are not habitually used by the common chameleon, except for sporadic cases of specimens located during sampling. The sporadic cases could correspond to young specimens in dispersion, not yet established. The results seem to indicate that the vegetation islands, sometimes considered in the literature as potentially useful habitats for the species, are not really useful. This could be due to the negative effects associated with their activity around major road structures on common chameleon populations. To verify with future surveys that this effect is not local, it would mean assuming an increase in the area of habitat lost for this species around all roads that affect its distribution.

Stuck in the middle with you: fine-scale characterization of the contact zone of two *Podarcis* wall lizards in central Spain

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Of the ten native species of Podarcis lizards present in the Iberian Peninsula, six of them were previously regarded as belonging to a single, highly polymorphic, geographically widespread species, *Podarcis hispanicus* (*sensu lato*). Most of the recently split species in this complex are Iberian endemics or near-endemics, but their distributions and contact zones are still incompletely characterized. We focused on two of these species, which have parapatric distributions in central Spain: the Guadarrama wall lizard (*Podarcis guadarramae*), distributed predominantly from the southwest to northeast of the Community of Madrid, in mid to high elevations along the Guadarrama mountains, and Geniez's wall lizard (*Podarcis virescens*), largely occupying lower elevation habitats in central, eastern and southern Madrid, including major urban centres. Our main goal is to characterize the contact zone between both species using phenotypic (dorsal and ventral coloration patterns) and genetic data (partial sequences of the mtDNA gene ND4 and thousands of unlinked SNP markers). We delineated a 72 x 16 Km north-south transect from the Lozoya valley, in the Guadarrama mountains, to south of the city of Madrid, with high resolution sampling at the contact zone, to delimit the spatial distribution of each species along the transect, characterize general patterns of genetic diversity and structure, including the identification of possible human-mediated translocation events, and investigate the occurrence and extent of hybridization in a cline analysis framework. Preliminary mtDNA results locate the contact zone in the foothills of the Guadarrama mountains, between the localities of Colmenar Viejo in the south and Soto del Real in the north. The presence of individuals with intermediate phenotypic characteristics in this area, carrying *P. virescens* mtDNA, suggests interspecies hybridization, which extent will be delineated based on the analysis of SNPs. Patterns of concordance (or lack thereof) across sources of evidence will be discussed in terms of their potential underlying evolutionary mechanisms.

Management of invasive fish in Girona ponds: strategies, methods, and results

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For the past five years, Sorellona has been carrying out actions aimed at the ecological improvement of ponds, in the urban area, or in the natural landscape, of the Girona district. Within these actions, the eradication of invasive alien fish species is one of the most common actions, combined or not with other actions. The methodology used is detailed and the results obtained so far are presented, in a total of 14 ponds. In all of these, the eradication of the fish was achieved, although unfortunately in at least half of them fish populations have subsequently been reestablished, as a result of new introductions.

The management of invasive exotic fish in these environments is strategic for the conservation of these aquatic ecosystems, and especially for the reestablishment of viable amphibian populations. An essential part of planning actions is the selection and implementation of specific techniques adapted to each type of pond and the invasive species present. This can include various methods, such as complete drainage of ponds and fishing with various capture techniques. The actions carried out for extraction are described, and the challenges and opportunities associated with this activity are also analysed. Continuous monitoring of invasive exotic fish populations, and their effects on aquatic ecosystems, is also an essential part of these initiatives.

The management of invasive exotic fish in ponds requires an approach that considers the particularities of each site, and involves the participation of local communities, conservation experts and competent administrations. With a combination of control, prevention, and restoration, it is possible to mitigate the impacts of these invasive species, improve the ecological state of aquatic ecosystems, and increase the chances of recovery of certain protected native species.

These actions have been possible thanks to various projects promoted by Sorellona, framed in the GiroNat project, with financing from Biodiversidad Fundación (MITECO), and the Projecte Escanyagats, with financing from various Catalan administrations. On the other hand, the more than 40 agreements signed with the owners of the different ponds, whether private or local administrations, such as the Girona City Council, among many others, are key. The collaboration of citizens and other entities also plays a relevant role in this global strategy for ecological improvement of this type of ecosystems.

Proposal of catalan names for all amphibian species of the world: Part I, Caudata

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Although scientific names identify and distinguish all species, it is also essential for different languages to have unambiguous common names for all taxa. Languages like English have made significant progress in this regard, but when it comes to the Catalan language, there is still a long way to go in this area. However, in recent years the *Centre de terminologia de la llengua catalana* (TERMCAT) has promoted different online dictionaries on various topics that can be consulted for free, including five zoological dictionaries: *mamífers del món* (mammals of the world), *mamífers marins* (marine mammals), *ocells* (birds), *peixos* (fish) and *papallones* (butterflies).

To give a common name in Catalan to all amphibian species in the world following the standards of Catalan terminology, we started from a proposal studied and validated in a working group with representatives from the *Societat Catalana d'Herpetologia* (SCH) and the *Centre de Terminologia Catalana* (TERMCAT), with the aim of it being recognised and adopted by the scientific community.

We are currently in an advanced phase of validation of the names of caudate amphibians by TERMCAT. Regarding generic names, of the 835 species of Caudata amphibians with a proposed Catalan name, 362 species (43.35%) would be *salamandretes*; 319 (38.2%) would be *salamandres*; 127 (15.2%) would be *tritons* and the rest would be made up of 27 species (3.2% of the total of Caudata), with 1 species of *proteus*; 3 of *ofegabous*; 3 *amfiumes*; 5 *axolots*; 7 *sirenes* and 8 species of *necturs*.

This work will be published soon in an open-access online dictionary.

Thermal stability of body coloration in a polymorphic lacertid lizard

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Animal coloration plays a fundamental role in communication, camouflage, aposematism, mimicry, thermoregulation and protection from the environment, and has strong implications for adaptation and diversification. Phenotypic plasticity of color traits can thus affect social, reproductive, antipredator, or thermoregulatory behavior and determining the causes and consequences of color change helps us understand evolution. In contrast to seasonal or ontogenetic color changes, physiological color change in response to fine-scale changes in environmental conditions has received less attention. Temperature-driven, rapid changes in coloration can have profound implications for ecophysiology, particularly in ectotherms. Here, using a widespread color polymorphic lacertid, Podarcis muralis, we study the impact of temperature on the chromatic properties and perception of pigment- and structurally based body coloration of different body regions. We subjected male and female adult lizards from different color morphs to two different temperature regimes until they reached a target body temperature of 25°C (cold) or ≥34°C (hot), and quantified color change in the dorsum, belly, throat and ultraviolet (UV)-blue ventrolateral patches using a spectrophotometer. We then applied visual modeling to assess color variation from the perspective of a conspecific and two visual predators. We show that despite minor differences in spectral reflectance metrics, temperature had no significant effect on how color patches are perceived. Moreover, temperature did not affect existing sex and morph differences in color properties, suggesting that the minor changes we observed have little or no functional/adaptive consequences. Contrary to results reported in other lizard taxa (iguanians and geckos), our findings suggest that adaptive rapid color change is unlikely in this lacertid species.

Plastic Pollution in Potential Loggerhead Turtle Nesting Areas in the Alboran Sea

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Plastic pollution represents a growing environmental challenge for marine ecosystems, particularly for sea turtles, which often ingest plastic debris after mistaking it for prey. Beyond ingestion risks, plastic particles on nesting beaches may also compromise reproductive success by altering sediment composition and obstructing hatchlings' emergence. This is particularly concerning in the Mediterranean Sea, one of the world's most plastic-contaminated marine regions.

In recent years, climate change has contributed to the westward expansion of loggerhead turtle (*Caretta caretta*) nesting areas. The Alboran Sea, located at the westernmost edge of the Mediterranean, has seen up to five confirmed opportunistic nesting events, suggesting the emergence of new breeding habitats. Assessing environmental quality, particularly the degree of plastic contamination, is thus critical for conservation planning.

This study evaluates the typology and density of plastic pollution across 17 beaches in the Alboran Sea. Random sand samples were collected, and one kilogram subsamples were sieved through meshes ranging from 5 mm to 1 mm. Plastic debris was classified into six categories—industrial, laminated, filament, foamy, fragment, and others—then counted, weighed, and quantified per kilogram of sand.

In addition, spatial patterns of plastic concentration were analysed along longitudinal transects of each beach. Pollution levels from beaches with known loggerhead nesting activity were compared to those without such records to investigate potential correlations between plastic density and nesting site selection. The findings serve as a crucial reference for identifying suitable nesting habitats and for informing management strategies aimed at protecting sea turtles in the face of increasing anthropogenic pressures and shifting climatic conditions.

Climate drives year-to-year variability, not long-term trends, in a common frog population in Northern Spain

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Amphibian declines are a global concern, often attributed to disease, habitat loss, and increasingly, climate change. While rare or range-restricted species dominate conservation focus, widespread species are understudied, despite evidence of climate driven changes in their phenology and population dynamics. We present findings from monitoring a coastal population of *Rana temporaria* in Motondo (Basque Country, Spain) over 31 years (1991–2022). This population is especially interesting because it is located at the species' southern and low-elevation edge, while supporting year-round activity and a reproductive season from November to March. We analyzed long-term reproductive data using regression models (GLM, GAM, GLMM) to investigate (i) shifts in breeding phenology, (ii) climatic drivers of reproductive effort, and (iii) seasonal climate effects on clutch numbers. We found that breeding onset has advanced over the study period, consistent with rising temperatures, although breeding duration remains variable. Reproductive effort showed strong sensitivity to climatic conditions: higher temperatures and evaporation suppressed clutch numbers, while precipitation promoted them—particularly during the post-reproductive season, highlighting the importance of pre-breeding female condition. However, climate explains only short term variability, not the population's decline or recovery. Our findings challenge oversimplified narratives that attribute amphibian declines solely to climate. While climate is a key driver of annual fluctuations, long-term trends likely reflect the interaction of multiple pressures—climate, land use, habitat change, and potentially others. Disentangling the compound effects of global change, as needed to safeguard biodiversity, is only possible through sustained long-term monitoring.

Pilot experiences of intensive control of exotic aquatic fauna in the upwellings of the Ullals de Baltasar (Ebro Delta NP)

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The small wetland of Ullals de Baltasar (Ebro Delta), is made up of a complex of lagoons and ditches fed by spring waters, is a place of great strategic importance for the conservation of Iberian fish. Here, nuclei of several threatened species persist and coexist, such as the stickleback (*Gasterosteus aculeatus*), Valencia toothcarp (*Valencia hispanica*), big-scale sand smelt (*Atherina boyeri*), or South Iberian spined loach (*Cobitis paludica*), among other native species. All these species are currently threatened, and their local populations are clearly declining. Furthermore, this system and its surroundings constitute a potential habitat for at least four species of amphibians in the area, palmate newt (*Lissotriton helveticus*), Iberian green frog (*Pelophylax perezi*), common toad (*Bufo spinosus*), natterjack toad (*Epidalea calamita*). Unfortunately, these amphibians have now disappeared, or only small residual populations remain.

Numerous introduced invasive species have also common, such as wels catfish (*Silurus glanis*), oriental weatherloach (*Misgurnus anguillicaudatus*), topmouth gudgeon (*Pseudorasbora parva*), mosquitofish (*Gambusia holbrooki*) or common platy (*Xiphophorus maculatus*). The presence and proliferation of these exotic invasive fish species, and other aquatic fauna, such as the blue crab (*Callinectes sapidus*), represents the main threat to the conservation of the native fish and amphibian species of this small wetland.

To face the challenge of managing these exotic species, in a space as ecologically peculiar as the Ullals de Baltasar, various pilot experiences for intensive control of their populations have been designed. To this end, various models of traps and other selective capture gear are being methodically tested: large traps for capturing large fauna (for example wels catfish), bottom traps for capturing benthic fish (for example oriental weatherloach), surface traps for capture of small fish (for example mosquitofish), or pitfall traps for decapod crustaceans, among other techniques.

The first comparative results of these pilot experiences are presented. Only some of the techniques tested have been successful for some of the species. However, some of these techniques have proven to be effective tools for the management of invasive species of concern, such as topmouth gudgeon (*Pseudorasbora parva*) or common platy (*Xiphophorus maculatus*).

Population structure and Dynamics of *Testudo hermanni* In different populations of Mallorca (Balearic Islands)

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The Mediterranean tortoise (*Testudo hermanni*) is a long-lived reptile with low dispersal capacity, making it particularly vulnerable to habitat alteration. Despite its long-established presence and legal protection in Mallorca, ecological and demographic data on its populations remain scarce. This study evaluated the demographic traits of three populations in different regions of Mallorca: Cap Blanc and Sa Caseta (south), and Son Real (north). Fieldwork was conducted between 2016 and 2019, with a comparative demographic analysis for all sites during 2017–2018 and a multi-year capture–mark–recapture study at Cap Blanc.

A total of 1109 captures were recorded across the three sites. Of these, 628 captures correspond to the 2017–2018 period, allowing comparison between Son Real, Sa Caseta, and Cap Blanc. During this period, Son Real and Sa Caseta showed significantly female-biased sex ratios (1:2.28 and 1:2.24, respectively), while Cap Blanc exhibited a more balanced ratio. Females were consistently larger than males, and the highest body condition index (SMI) values were observed at Sa Caseta. Malformations were most frequent at Cap Blanc (42.6%), compared to 13.5% at Son Real and 10% at Sa Caseta.

POPAN model analyses revealed high apparent survival rates (0.871–1.000) and population densities ranging from 30.6 to 49.8 individuals/ha. At Cap Blanc, population size remained stable over the years, although significant interannual differences in body size and condition were detected. The consistently low detection of juveniles across all sites highlights the need for complementary monitoring methods to assess population recruitment.

This study provides a solid baseline for monitoring *T. hermanni* in Mallorca and underscores the value of integrating biometric data with capture–recapture models in long-term conservation programmes. The study was funded by the Direcció General de Biodiversitat i Espais Naturals and the Spanish Herpetological Society, and received support from Biodibal (UIB-CMB).

Genomics unveils the intricate evolutionary history of European vipers

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European vipers (*Vipera*) have been the subject of extensive research due to their phylogeographic and ecological diversification. However, phylogeography and systematics in this genus have primarily relied on biased information from mitochondrial genes, which fail to capture the likely effects of introgression and are prone to biases. In this study, we generated chromosome-level genome assemblies for three Vipera species and whole-genome sequencing data for 94 samples representing 15 Vipera lineages. This comprehensive dataset allowed us to disentangle the phylogenomic relationships of this genus, affected by mito-nuclear discordance and pervaded by ancestral introgression. Population-level analyses in the Iberian Peninsula, where the three oldest lineages within Vipera meet, revealed signals of recent adaptive introgression between old-diverged and ecologically dissimilar species, whereas chromosomal rearrangements isolate species occupying similar niches.

Does camera traps need contact lenses? The use of camera trapping for monitoring reptile community

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Camera trapping is a well-established method in mammal monitoring programs. Although these devices are primarily designed to detect medium to large terrestrial mammals, they also hold potential for monitoring smaller vertebrates such as reptiles and micromammals. As part of the "Iberian Vipers Population Monitoring Network," we are exploring complementary tools to enhance data collected through capture-recapture transects. In this poster, we present the opportunities and potential improvements of camera trapping for monitoring a population of *Vipera latastei* in Teruel Province (Central-Eastern Spain). In 2025, six camera traps were deployed at known viper hotspots to gather data on activity patterns, microhabitat use, intra- and interspecific interactions, and prey availability. Vipers were recorded at only one site during April; however, other species were observed in the remaining camera traps, including *Psammodromus algirus*, *Timon lepidus*, *Zamenis scalaris*, *Natrix maura*, and at least four micromammal species. Zoom lenses were later installed to improve image resolution in the foreground. This enhancement enabled accurate identification of small vertebrates and produced higher-quality images that may support individual photo-identification of vipers.

Assessment of the Conservation Status of Water Bodies and the Distribution of Associated Herpetofauna in the Garrotxa Volcanic Zone Natural Park

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The porosity of volcanic substrates within the Garrotxa Volcanic Zone Natural Park (PNZVG), which limits the formation of natural water bodies, combined with an increasingly irregular hydrological regime, makes the wetlands of this area critical refuges for amphibian conservation in Catalonia. To date, 13 amphibian species have been recorded within the Park, underscoring its notable herpetological richness.

This study, funded by the Diputació de Girona, aims to identify, assess, and propose conservation strategies for water points across the PNZVG. The results also provide an updated understanding of amphibian distribution and presence within the Natural Park, complementing previous vertebrate monitoring programs carried out as part of Minuartia's studies (2004) and the Vertebrate Catalogue of the Volcanic Zone (2020).

Field surveys, conducted between March and July 2024, covered the entire extent of the PNZVG. In total, 175 wetlands were identified and characterized, including natural and artificial ponds, springs, watering troughs, washbasins, and reservoirs. These sites were assessed based on key parameters: morphology, hydroperiod, substrate type, water input, hydrological connectivity, and ecological condition (using the ECELS index), as well as the presence of anthropogenic impacts or invasive species.

The results confirm the presence of 11 out of the 13 amphibian species historically recorded in the Natural Park: fire salamander (*Salamandra salamandra*), palmate newt (*Lissotriton helveticus*), marbled newt (*Triturus marmoratus*), mediterranean painted frog (*Discoglossus pictus*), parsley frog (Pelodytes punctatus), common toad (*Bufo spinosus*), natterjack toad (*Epidalea calamita*), Iberian spadefoot toad (*Pelobates cultripes*), common midwife toad (*Alytes obstetricans*), mediterranean tree frog (*Hyla meridionalis*), and iberian green frog (*Pelophylax perezi*).

Ultimately, this study will refine the current distribution map of anurans and urodeles in the PNZVG and generate potential distribution and probability maps for these species, providing a robust foundation for the sustainable management of amphibian populations and their habitats.

Eyes in the bush: studying vipers' activity and behaviour by camera traps

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Camera trapping is a useful tool to monitoring wildlife, particularly well-developed to get information on the activity patterns of medium size and large vertebrates. The use of camera traps to monitor small vertebrates remains largely overlooked, despite its potential to record the activity and behaviour of secretive animals such as vipers. Within the framework of the "Iberian Vipers Population Monitoring Network", we are testing alternative tools such as camera trapping to complement the information acquired during capture-recapture surveys. In autumn 2024 and spring 2025, we deployed five and three camera traps, respectively, to monitor a population of the asp viper (*Vipera aspis*) in an abandoned field surrounded by intensive agriculture fields in Santo Domingo de la Calzada (La Rioja, Northern Spain). Cameras were set at 1 m. above the ground and less than 1.5 m. of focal distance to the bushes and rock outcrops where vipers are known to come out. 30-second videos were recorded, exploring two shutter sensitivity settings (medium and high). Despite the amount of data obtained (2560 videos in 25 days of camera monitoring in autumn and 32 days in spring), the presence of vipers was only recorded in 14 % of the videos. Detailed visualization of video data suggests that the cameras were triggered by wind-induced movement of vegetation, rather than by movement of the animals. Videos did not allow individuals' recognition but it is worth noting that we recorded some rarely documented behaviours in Iberian vipers such as male fights (twice in autumn 2024) and caudal luring (once in spring 2025). While the setup requires significant optimization (improving viper detection capabilities and video resolution), our pilot study reinforces the usefulness of camera traps to acquire information on vipers' activity and behaviour, and complement capture-recapture surveys.

XVIII Congreso Luso-Español de Herpetología
XXII Congreso Español de Herpetología
XIX Jornades Herpetològiques Catalanes
SCH - AHE - APH • Barcelona 2025