16th ICZEGAR

International Congress on the Zoogeography and Ecology of Greece and Adjacent Regions

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Book of Abstracts

Athens 2025

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Prologue

The Hellenic Zoological Society and WWF Hellas are the organizers of the 16th International Congress on the Zoogeography and Ecology of Greece and Adjacent Regions (ICZEGAR) that is taking place in Athens, from July 3rd to 6th 2025, at the Eugenides Foundation. As always, the Congress hosts studies related to all aspects of animal biodiversity (terrestrial, subterranean, freshwater, and marine) within the geographical region that includes the Balkan and Italian peninsulas, Anatolia, as well as the Near East and the Mediterranean coasts of north-eastern Africa.

Climate crisis and biodiversity loss are recognized as two of the main threats of our times. The Mediterranean Basin, a global hotspot of biodiversity, lies on the frontline of the fight to protect the environment and wildlife. Located within three continents and home to ancient civilisations, the Mediterranean Sea accompanied human evolution from its early steps and witnessed anthropogenic effects on biodiversity. The ICZEGAR serves as a forum for contact and information exchange between scientists working with the Mediterranean fauna while offering the floor to creative discussions on the research and conservation of biodiversity. Participants have the chance to discuss, network and collaborate on all aspects of zoological studies such as conservation biology, biogeography, fisheries, population ecology, phylogenetics, phylogeography, as well as biological invasions.

The Organizing Committee announces three roundtables, one focused on Marine Protected Areas, one on Bird Migration in East Mediterranean and one on Animal Social Behaviour. Together with our four distinguished invited speakers, a total of 196 abstracts were submitted from which 70 were accepted as oral presentations and 126 as posters. Among them, two groups of young researchers will present their work: the recipients of the scholarships supported by WWF Greece, the Hellenic Zoological Society and the Hellenic Herpetological Society and the Margarita Metallinou fellows supported by the Hellenic Zoological Society.

We welcome all conference participants to Athens and wish them a productive conference with many wonderful moments!

On behalf of the Organizing Committee

Prof. Panayiotis Pafilis
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The organizers would like to thank the sponsors that generously supported the 16th ICZEGAR

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Contents

Invited Lecture

The importance of Long-Term monitoring for the conservation of Island arthropods

Paulo A. V. Borges

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Long-term monitoring of biodiversity in island ecosystems is crucial for comprehending ecological dynamics, identifying trends, and evaluating the impacts of human activities on natural environments. These efforts play a fundamental role in shaping informed conservation strategies and sustainable management practices. However, despite notable advancements in biodiversity research, monitoring programs often remain disjointed and underdeveloped, particularly for diverse and understudied groups such as arthropods.Recent initiatives in the Azores Archipelago (Portugal, Macaronesia) have highlighted the potential of employing standardized protocols and comprehensive frameworks for long-term arthropod monitoring. These methodologies facilitate consistent data collection and ensure accuracy in species identification, fostering more reliable biodiversity assessments. Furthermore, the integration of biodiversity indicators allows researchers to track ecological changes over time, offering critical insights into the health and stability of these island ecosystems. By providing actionable data on species distribution, population trends, and ecosystem resilience, these efforts contribute significantly to preserving the unique biodiversity of island habitats in the face of climate change, habitat loss, and other anthropogenic pressures.

Invited Lecture

Studying birds in the context of the full annual cycle

Peter P. Marra

The Earth Commons: Georgetown University's Institute for Environment and Sustainability; Laudato Si' Professor of Biology and the Environment & Professor McCourt School of Public Policy, Georgetown University, Washington, D.C.

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Migratory birds spend different parts of the annual cycle in geographically disparate places. The conditions and selective pressures during each period are likely to affect individual performance during subsequent periods. This simple fact presents us with considerable obstacles for understanding how agents of global change (i.e., climate, land-use) will influence the ecology, evolution, and conservation of migratory birds. Such inter-seasonal effects are poorly understood within most avian migration systems, in large part because it has been difficult to follow individuals and specific populations year-round. Here, I will show using long-term research from throughout the annual cycle how events on nonbreeding grounds have important consequences for breeding events and annual survival. Understanding how global change will influence migratory organisms requires the study of biological phenomena in the context of the entire annual cycle.

Invited Lecture

Towards Effective Conservation of Marine Mammals in the Mediterranean: Integrating Science, place-based approaches, and Policy

Simone Panigada

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The Mediterranean Sea, though semi-enclosed and relatively small, hosts an extraordinary diversity of marine life, including several species of whales and dolphins that are increasingly threatened by anthropogenic pressures. Over the past three decades, our research has focused on advancing the scientific understanding and conservation of cetaceans in this complex and heavily used marine environment, through robust science and cross-sectoral collaboration.This keynote will reflect on efforts to monitor and protect marine mammals through interdisciplinary approaches. It will highlight the role of satellite telemetry in revealing critical habitats and migration patterns, with a focus on how these data inform the identification of Important Marine Mammal Areas (IMMAs) and other place-based conservation effort. These spatial tools are increasingly integrated into marine spatial planning and international conservation frameworks.Emphasis will also be placed on vessel strikes, a leading cause of mortality for large whales in the region. I will discuss science-based mitigation strategies, including speed reduction zones and real-time vessel tracking, developed in collaboration with maritime authorities, international agreements, such as ACCOBAMS and the Pelagos Agreement, and NGOs.Through selected case studies, I will argue for the urgent need to translate science into policy, ensuring that conservation measures are not only guided by the best available data, but also implemented through binding, ecosystem-based frameworks. The Mediterranean can — and must — serve as a model for regional marine mammal protection.

Invited Lecture

Curbing the global threat of biological invasions

Helen E. Roy

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Invasive alien species are one of the major drivers of ongoing global biodiversity loss, adversely impacting people and nature in all regions of Earth. The recently published Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) thematic assessment report on invasive alien species and their control provides unequivocal evidence of the major and growing threat of invasive alien species; an increasing number of species are being transported beyond their natural ranges into new areas through a wide range of human activities. I will outline headline messages from the IPBES report including studies from the Mediterranean region which have provided rich insights on biological invasions in aquatic and terrestrial ecosystems. I will describe collaborative research documenting and predicting biological invasions on Cyprus to highlight the ways in which, by working together, we can make ambitious progress to address the threat of invasive alien species.

Roundtable

Marine Protected Areas: planning, current status, challenges, and effective management

Petros Varelidis[1], Antonis Mazaris[2], Dimitra Petza[3], Vangelis Paravas[4], Tasos Dimalexis[5]

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Moderator: Demetres Karavelas, WWF Greece

Marine Protected Areas (MPAs) are critical tools for conserving marine biodiversity and habitats, sustaining fisheries, and enhancing ecosystem resilience. They are central to the European Union's marine conservation strategy, particularly under the EU Biodiversity Strategy for 2030 and the global "30 by 30" goal—to protect 30% of land and sea by 2030, with 10% under strict protection. This includes protecting Areas Beyond National Jurisdiction (ABNJ), with the EU supporting global efforts such as the High Seas Treaty to enable the establishment of MPAs in international waters. Effective planning of MPAs requires a science-based, inclusive approach that balances ecological objectives with socio-economic needs. However, the effectiveness of these areas remains a major concern, since many MPAs lack proper management plans, enforcement mechanisms, and ecological coherence, which limit their ability to deliver meaningful conservation outcomes. Challenges such as climate change, overfishing, new and competing maritime interests further complicate management efforts.

To reach the "30 by 30" goal and ensure the long-term effectiveness of MPAs, stronger political will, increased funding, capacity building, cross-sectoral governance, and enhanced cooperation is needed. Additionally, it is vital to ensure that MPAs are representative, interconnected, and resilient. It is also crucial to align MPAs planning with broader marine spatial planning efforts and to actively engage stakeholders, particularly from fisheries and coastal communities. This round table will explore these issues, with a particular focus on the Eastern Mediterranean and Greek Seas, aiming to share insights, identify gaps, and highlight pathways toward more effective MPA management.

Roundtable

Social behaviour: New Research Avenues on Animal Societies in Greece and Adjacent Regions

Danai Papageorgiou[1,2], Nikolaos Smit[3], Fragkiskos Darmis[4], Alexandros Vezyrakis[4,5], Marina Papadopoulou[6], Dimitra G. Georgopoulou[7]

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Moderator: Dionisios Youlatos, Dept. of Biology, Aristotle University of Thessaloniki

Group-living has evolved in various animal species. As animals move and interact with others, they generate an ever-changing social web, where each individual both experiences a unique social environment and contributes to that of others. The characteristics of these social environments, e.g., the complex spatio-temporal variability of group formations, can have profound implications for individual reproduction and survival. Scaling out, social interactions can influence key ecological and evolutionary processes, such as seasonal collective migrations. However, identifying complex interactions in nature is challenging as it requires following most individuals in a population over extended periods of time. Thanks to a combination of recent technological advances and traditional observation techniques, a rich toolkit to monitor individual behaviour and track the movement of entire groups is available. Several social organisms, such as fish forming schools, rodents living in hierarchical societies, wolfs forming packs, and even colonial breeding birds, are already being studied in Greece and adjacent regions. This roundtable aims to form a network of support and collaboration among early-career and senior researchers, fostering studies on group-living and collective behaviour. The session will include talks on current socio-ecological questions and available methodologies, followed by a roundtable discussion and brainstorming on future prospects.

Roundtable

Bird migration along a Flyway: Challenges of Monitoring, Protection and upcoming priority areas of conservation and scientific focus in Greece.

Christos Barboutis[1], Savas Kazantzidis[2], Peter Marra[3], Anastasios Bounas[4]

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Moderator: Demetres Vavylis, NECCA

Every year, billions of migratory birds travel between Europe and Africa, moving to and from their breeding and wintering grounds. Although the study of bird migration dates back hundreds of years, the eastern part of the migration flyway remains understudied and relatively poorly understood. While monitoring projects exist, a comprehensive and collaborative network of transnational monitoring initiatives at the flyway level has not yet been established, at least in the eastern flyway and along the Mediterranean. This lack of coordination hinders a full understanding of the complexity of bird migration. Research and conservation efforts have traditionally focused on breeding grounds, followed by significant attention to wintering grounds, leaving a substantial knowledge gap concerning the biological processes and threats present at critical stopover sites and during the crossing of ecological barriers. Recent studies suggest that the migratory period is when birds experience their highest mortality rates, with human-induced threats playing a significant role in some taxonomic groups. Additionally, climate change, which is rapidly altering natural systems, poses new threats to migratory birds that extend beyond their breeding grounds. Advances in methodologies and new technologies now enable researchers to track the movements of even small migratory species, providing valuable insights into aspects of migration that influence demographic parameters. These tools hold great promise for improving our understanding of migration dynamics and informing effective conservation strategies.

Greece although placed on a very important location along the flyway, as new data have shown, lacks a coherent migration monitoring scheme that would support effective conservation and/or restoration strategies for the protection of migratory species. A fact that is also coupled with the scarcity of skilled technicians/field workers equipped to undertake these monitoring tasks. Moreover, the significance of bird migration is not effectively communicated to the wider public, particularly to those living in migration bottlenecks and key stopover sites. This lack of awareness limits local community engagement in conservation and protection efforts. The round table discussion will outline a framework for addressing gaps in bird migration monitoring and research in the region, the need for coordinated monitoring networks at both national and international levels, conservation challenges along the flyway, the capacity level and the need for training of relevant personnel, ways to enhance public awareness and local community engagement, technological and methodological advances in migration studies, future steps and collaborative solutions and experiences from applied monitoring efforts abroad.

Abstracts

Wing shape and size variation in migratory *Sylvia* warblers: links to ecology and migration

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Morphometric studies conducted within the class of Aves have indicated a strong correlation between morphological traits, behaviors and ecology. Wing shape, being one of the primary aerodynamic structures of birds, seems to reflect the complex interplay of biotic, abiotic and phylogenetic factors. Especially in migratory birds, the selective pressures exerted appear to be much more intense. In this study, we investigated interspecifc variation in wing morphology among three migratory species of the genus Sylvia (*Sylvia borin*, *Sylvia atricapilla*, *Sylvia communis*) using biometric and geometric morphometric analyses. We compared variation in five morphometric traits (weight, wing length, 9th and 5th primary length, wing area) and three functional aerodynamic indices (wing loading, aspect ratio, Kipp's index), as well as in the overall wing shape using landmark-based morphometric analysis. Fieldwork was conducted during the autumn migration period on the island of Antikythera, a stopover site in the Mediterranean Sea. We found that among the three *Sylvia* species, *Sylvia borin* exhibited a more aerodynamic wing profile with longer and more pointed wings suited for long-distance and energy-efficient flights. In contrast, *Sylvia atricapilla* had wider and more rounded wings, features that indicate enhanced maneuverability and quicker takeoffs, favoring birds living and foraging in cluttered habitats. Finally, *Sylvia communis* displayed an intermediate wing morphology, combining traits that support both aerodynamic efficiency and maneuverability. Overall, our results could possibly suggest the influence of various selective pressures on the shape of the wing, including migratory distance, habitat structure, foraging strategy and predation risk.

Keywords: *wing morphology, geometric morphometry, shape variation, migration, Sylvia.*

First record of *Zootoca vivipara panonnica (Lac & Kluch, 1968)* in Serbia and Republic of Srpska: An insight into distribution and habitat preferences

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Field surveys in the Bosut Forest and nearby areas found 52 individuals of *Zootoca vivipara pannonica* (Lac & Kluch, 1968), which is the first time this subspecies has been confirmed in Serbia. Furthermore, two individuals were located in Gromiželj (Republic of Srpska), and three others were discovered in the forest near the village of Glušci, adjacent to Sremska Mitrovica. Specimens were predominantly observed in densely vegetated habitats, including grasslands, meadows, and deforested areas, while they were notably absent from intensively cultivated agricultural lands. The findings indicate that contemporary agricultural practices, especially the widespread application of pesticides, may adversely affect the availability of appropriate habitats. The discovery expands the documented southern range of *Z. v. panonnica*, suggesting that this species' range may extend further into the mentioned territories than previously recorded. The habitats are characterized by their diverse wetlands, meadows, and transitional forest-grassland ecosystems, functions as an essential habitat for the subspecies. The geographic proximity to other Central European populations underscores the necessity of examining potential ecological corridors and genetic connectivity among these populations. This finding highlights the ecological and conservation significance of the Bosut Forest and comparable habitats in Serbia and neighboring countries. Given that *Z. v. panonnica* may serve as an indicator species for the health of the ecosystems, it is crucial to implement ongoing monitoring and habitat management strategies. Conserving these environments is essential for maintaining viable lizard populations. The records significantly enhance the biogeographical understanding of this subspecies and necessitate updated distribution assessments and focused conservation planning.

Keywords: *Zootoca vivipara pannonica, distribution, habitat, Serbia, Republic of Srpska*

Eight years of monitoring the Dalmatian Pelican (*Pelecanus crispus*) colony at Lake Chimaditida, Greece

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The Dalmatian pelican (*Pelecanus crispus*) colony at Lake Chimaditida was discovered in 2017, making it the sixth nesting colony in Greece of this species. The lake lies at a straight-line distance of 40 km from Lesser (Mikri) Prespa Lake, where the species' largest colony on Earth is located. It is a eutrophic shallow lake and its importance for pelicans, as a feeding and resting site, has been known for decades. Number of nests, productivity and nesting habitat quality are systematically monitored monthly during the breeding period, providing valuable insights into the dynamics of this vulnerable species' breeding efforts. Over eight years (2017-2024), the colony has shown fluctuating breeding success, influenced by changes in lake water regime, erosion of nesting islets, and disease outbreaks. The colony has hosted between 50 and 160 nests annually, distributed across 3 to 6 reed islets formed by *Phragmites australis* and *Typha spp*. Breeding success varied, peaking at 1.15 young/nest in 2017 and dropping to 0.03 in 2022, following a devastating avian influenza outbreak, which resulted in the death of ca. 65% of the colony's breeders. Habitat challenges include flooding, erosion, and nesting islet instability. Drone-based monitoring has proven invaluable for breeding data collection. Moreover, telemetry data, obtained over the last years from patagial transmitters fitted to adult birds, have shed light into Chimaditida nesters' activity and use of adjacent wetlands. Our findings emphasize the importance of hydrological management aligned with pelican requirements, and the need to consider artificial nesting rafts to support this population.

Keywords: *drone monitoring, breeding success, nesting habitat quality, adaptive management.*

A system in flux: how is the Prespa wetland landscape responding to climate change?

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Forming a unique ecosystem of global importance for biodiversity, with many endemic species and rare habitats, the Prespa lakes are shared between Albania, Greece and North Macedonia, and largely safeguarded by national protection designations and the transboundary "Prespa Park". The area has seen many changes, from flourishing communities maintaining diversified wetlands, to intensified human impacts and climate change effects. Evidence is presented on how biodiversity in Greek Prespa is responding to climate changes, underlining the urgent need for mitigation measures and adaptation strategies to ensure ecosystem resilience. Long-term data reveal prolonged drought conditions and a dramatic 8-metre water level drop in Great Prespa Lake since the 1960s, directly affecting Lesser Prespa water levels. Exacerbated by low water supply from streams and evapotranspiration due to high temperatures, water loss affects water quality, increasing the possibility of algal blooms and eutrophication. These conditions dictate wetland ecosystem functionality through: (a) changes in wetland habitats (expansion of riparian forests, pannonic steppes) (b) dry conditions exposing reedbeds to rapid wildfire spread; (c) fragmentated waterbird colonies (herons, pygmy cormorants, pelicans) and increased predation/disturbance from mammals; (d) shrinking ichthyofauna spawning habitats (low quantity/quality of water, higher temperatures); (e) earlier arrival of breeding birds like Dalmatian pelicans (*Pelecanus crispus*), earlier breeding attempts and increased exposure to avian influenza. Local communities suffer economic losses from frequent hail-/windstorms and reduced production due to heatwaves. Considering these changes, diversified management practices mitigating adverse climate change effects, continuous monitoring, and measures to prevent cascading effects and larger-scale biodiversity loss are much needed.

Keywords: *Prespa Lakes, climate change, biodiversity, wetland conservation, adaptive management*

Ecoepidemiology of avian influenza and other diseases in Dalmatian pelicans

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In spring 2022, an outbreak of highly pathogenic avian influenza (HPAI) H5N1 caused the loss of 60% of the Mikri Prespa Dalmatian pelican (DP) *Pelecanus crispus* colony, the species' largest colony on Earth. Great white pelicans (GWP) *Pelecanus onocrotalus* that share the same breeding grounds were not affected. A multidisciplinary study was conducted with the contribution of veterinarians specializing in avian infectious diseases and avian ecologists, from 2022 to 2024. The aim was to investigate DP exposure to HPAI and the health status of Greek pelican populations, to help understand DP susceptibility to HPAI. A sampling protocol was designed, which involved the collection of live bird samples from all Greek pelican colonies, including blood, feathers, oral/cloacal swabs, as well as a small number of environmental samples. Although HPAI was not detected in any of the pelicans sampled, 24% of DP adults and 10% of DP nestlings were seropositive for HPAI, which demonstrates likely survival of some infected breeders. The data collected seem to preclude HPAI persistence in the long term, as none of the seropositive DP was shedding the virus, and no signs of persistence in the environment were detected. Regarding the presence of other potential immunosuppressive pathogens, the analyses detected an unusually high carriage of *Staphylococcus aureus*, and very high prevalence of *Escherichia coli* in nestlings from three out of five pelican colonies inspected. None of the results provided clear evidence for concomitant pathogens that could mediate a higher susceptibility of DP to HPAI in comparison to GWP.

Keywords: Dalmatian pelican, highly pathogenic avian influenza, breeding colonies, live bird samples, immunosuppressive pathogens.

Reviving a traditional practice: stone check dams boost biodiversity on Paros Island

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Traditional stone check dams on ephemeral streams represent an ancient water management practice in Mediterranean regions. Historically constructed for flood mitigation and groundwater recharge, these structures also create small ponds that serve as "oases" during the arid Mediterranean summers of the Greek islands. In 2022, WWF Greece in collaboration with MedINA, the Hellenic Institute of Speleological Research, Paros Water Supply and Sewerage Company and the Municipality of Paros, constructed 34 stone check dams along 1300 m of the ephemeral stream of Kavouropotamos on Paros Island. This initiative aimed to support aquifer recharge and enhance biodiversity. Since before their construction, systematic biodiversity monitoring has been conducted to assess the effect of the check dams on local biodiversity through fieldwork and remote sensing indicators. This poster presents the preliminary findings on observed changes in vegetation and selected fauna taxa. The present case study illustrates the potential of integrating traditional ecological knowledge with modern scientific data-driven approaches to enhance ecosystem resilience and biodiversity in arid Mediterranean ecosystems.

Keywords: *adaptation, water scarcity, drought, nature-based solutions, green infrastructure*

Dietary ecology of the Lesser Kestrel (*Falco naumanni*) in Lechaina area, NW Peloponnese

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The Lesser Kestrel is a small, gregarious, insectivorous falcon, found mainly in farmland, and which is classified as Vulnerable (VU) in Greece and globally. In Greece, the species is a summer visitor and passage migrant. This study focuses on the dietary ecology of the species in the Lechaina area, Ilia Prefecture, where an important colony of the species (at least 50 pairs) is found. The diet of the Lesser Kestrel was studied through pellet and prey remain analysis, which were collected from nest boxes, installed for the species, mainly during ringing of the chicks, in the years 2021-2023. In total, 6,981 prey items were identified. The most important prey by far were insects, making up 98% by numbers and 83% by biomass. The most important insect orders were Coleoptera (68% by number and 51% by biomass), with main families Scarabaeidae (26% and 23% respectively), Geotrupidae (22% and 19%) and Carabidae (11% and 5%), and Orthoptera (29% by number and 31% by biomass), with main families Gryllotalpidae (10% and 17% respectively), Tettigoniidae (12% and 10%) and Acrididae (8% and 3%). Mammals were secondarily important (1% by number but 12% by biomass), represented mainly by small rodents (*Mus* spp.). Other prey groups (mollusks, millipedes, centipedes, amphibians, reptiles and birds) were of limited importance. These findings confirm that, consistent with studies from other regions, the Lesser Kestrel in Lechaina is a predominantly insectivorous species, relying heavily on Coleoptera and Orthoptera for sustenance during the breeding season.

Keywords: *Falco naumanni, prey composition, insectivory, Greece*

Bird ringing in Rhodopi National Park

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Long-term bird ringing efforts can provide important knowledge in understanding the composition of avifauna of an area. In Rhodopi Range National Park, bird ringing expeditions have taken place for several years. In the years 2022-2023, four weekly ringing expeditions took place during the NECCA project "Bird ringing in Rhodopi national park". More specifically, ringing took place in Frakto forest and Melissorema area and was targeting migratory as well as breeding bird species, mainly passerines. Birds were caught with mist nets. At each site 6-8 mist nets of total length 90-100 meters were set. In total, 637 birds of 46 species were ringed. There were many retraps of birds in Melissorema, with the most interesting being: a grey-headed woodpecker (*Picus canus*) ringed in July 2021, and was caught at the same area at September 2023. A sombre tit (*Poecile lugubris*) ringed in June 2022 was retrapped in April 2023 at the same spot and many long-tailed tits (*Aegithalos caudatus*) that were ringed in April 2023 were retrapped in September 2023. The importance of bird ringing in the area and particularly for forest species, is substantial. The continuation of the effort for the following years is important.

Keywords: *migration, passerines, monitoring, mist nets, retraps*

Molecular phylogeny of *Helops* s.st. Fabricius, 1775 (Coleoptera, Tenebrionidae)

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Helops s. st.Fabricius, 1775 constitutes a relatively small group with 7 species and 4 subspecies distributed in the Western Palearctic. A significant part of the species diversity of *Helops* is observed in Türkiye. The morphological species delimitations and monophyly of the current species and subspecies of *Helops* are not clear and need revision. Extensively sampled specimens from Türkiye and specimens from neighboring countries were studied using molecular and morphological characters. Five molecular markers were sequenced and analyzed with various species delimitation algorithms to infer their historical diversification patterns in Türkiye and neighboring areas. We also studied their type materials and examined the key characters traditionally used for discerning species in this group including genitalia structures under SEM. Phylogenetic analyses revealed that the genus *Helops* has a wide diversity that partially supports the existing morphological species boundaries. In addition to the previously recorded species, seven new lineages with specific morphological characters and geographic distribution were obtained. Our analyses show that the divergence and diversification of the main clades dated back approximately 20-25 Ma ago.

Keywords: *Helops, species delimitation, morphology*

Digital transformation journey of the National Museum of Natural History Goulandris as part of the Distributed System of Scientific Collections (DiSSCo)

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The National Museum of Natural History Goulandris houses a great number of scientific specimens, with approximately 267,000 lots, primarily acquired through scientific research and donations. The Museum's digitization journey began 25 years ago under the Info Society Project, resulting in the creation of 92,431 collection's records and 7,000 digitized specimens across botany, hydrobiology, terrestrial zoology, geology, and paleontology, using an Oracle database. Today, through participation in the DiSSCo project, the Museum aims to complete and expand this recording and digitization process using the Specify database. DiSSCo seeks to empower the Natural Science Collections community by addressing current challenges and supporting growth in an increasingly digital and interconnected environment. In Greece, a national consortium comprising 15 institutions has been established, adhering to DiSSCo's core guidelines and formalized through a signed Memorandum of Understanding (MoU). The digitization of museum specimens provides the scientific community with comprehensive and sustainable knowledge resources. To date, we count 23,950 records (Annelida, Arthropoda, Bryozoa, Chordota, Cnidaria, Echinodermata, Mollusca, Porifera, and Brachiopoda) and 1,500 photographs from the Hydrobiology Department, as well as 14,124 records (9,743 Arthropoda and 4,381 Chordata) and 9,407 photographs (9,062 Arthropoda and 345 Chordata) from the Terrestrial Zoology Department. All data have been documented in accordance with the Darwin Core standard. Specimens were digitized and photographed using Nikon D7500 and Canon EOS R8 cameras. The digitization initiative at GNHM under the DiSSCo framework ensures the long-term preservation and accessibility of its collections, significantly enhancing its contribution to scientific research and global biodiversity knowledge.

Keywords: *Digitization, Natural History Collections, DiSSCo, Darwin Core*

Distribution and population status of the Bonelli's eagle (*Aquila fasciata*) in Greece

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As part of a seven-year (2018-2025) conservation project for the Bonelli's eagle (*Aquila fasciata*) in the East Mediterranean, a comprehensive study aiming at the assessment of the current species population status and distribution in Greece was undertaken. The study focused on conducting field monitoring surveys on species breeding territories across southeast Peloponnese, Attica, Aegean archipelago and Crete, while also incorporating historical data on previously documented breeding sites across the whole country. In total, 200-220 territories were located during the study period, though breeding activity was detected in ca. 50% of them primarily concentrated in the aforementioned regions. Notable population hotspots were identified in the Aegean archipelago, specifically among the Dodecanese and Cyclades islands, suggesting that the species is currently occupying mainly insular rather than continental regions. The study highlights the contribution of ongoing conservation efforts to the stabilization of the species population status while emphasizing the need of further conservation and management actions across the species breeding territories as well as juvenile dispersal areas. These include habitat protection, mitigation of anthropogenic threats as well as continuous monitoring for indicating species population or distribution changes. The results underscore the significance of certain areas as critical strongholds for the Bonelli's eagle population and emphasize the need of conservation measures in order to ensure the long-term viability of the species in the country.

Keywords: *breeding territories, assessment, LIFE Bonelli eastMed*

An Improved Mathematical Model Predicting the Number of Butterfly Species on Greek Islands

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Various mathematical models have been proposed in the literature for the prediction of the number of butterfly species on islands. Usually the number of species is assumed to be an increasing function of the island area A, and simultaneously a decreasing function of the minimum distance d from the neighbouring mainland. The simplest functions fulfilling these requirements are positive powers of A and negative powers of d. Based on the already known number of species on a few islands, the respective power constants are computed and a regression line is derived. These models tend to be inaccurate in several cases, either because they are too generic, trying to model exceedingly large geographical areas, or because the proposed function fails for very small d, since the denominator of the ratio approaches zero. In this paper, a simple mathematical model based on elementary linear algebra concepts is proposed for the special case of particular groups of Greek islands. Based on the data for three islands only, judiciously chosen, a 3X3 linear system of equations is formed, the solution of which yields the power constants required by the model. Furthermore, negative exponential functions instead of negative powers are tested for the d dependence, to avoid the function singularity at zero. Prediction results show very good agreement with actual data, demonstrating the accuracy and versatility of the model.

Keywords: Prediction model, linear algebra, monotonic functions, exponentials

Defence and Personality: The Antipredator Behaviour of two Western Mediterranean vipers

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Snakes are a highly diverse group of reptiles with a good biological knowledge in many disciplines. However, defensive behaviour and factors that make some venomous snakes more defensive than others remain unclear. Knowledge on these topics is of utmost importance in light of human-snake conflict. Here, we characterised and compared the defensive behaviour of two medium-sized Western Mediterranean vipers, *Vipera aspis* and *Vipera latastei*. In a controlled arena, we examined the response of 28 vipers to human stimuli, assessing (1) the existence of personality, and (2) the influence of species and sex on them. We recorded six behavioural traits which captured the snakes' tendency for exploring chemical signals of the attacker, escaping, or defending itself. Statistical analyses were conducted using hurdle regression and generalized linear mixed-effect models. Individual behavioural tendencies were consistent over time, indicating the presence of personality traits related to escape and attack responses. We found significant differences in defensive behaviour between species, but not between the sexes. Both species primarily relied on escape rather than aggression when threatened by humans, with *V. aspis* showing a higher propensity to escape than *V. latastei*. This research provides foundation for future studies on venomous snake's behaviour and highlights the need for additional research on the broader ecological implications of personality traits in them.

Eleonora's Falcon's Insect-Based Diet During Pre-Breeding and Breeding: A Systematic Review of Trophic Interactions

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Eleonora's falcon (*Falco eleonorae*) presents a distinctive seasonal diet, making it a valuable model for understanding predator-prey relationships. Insects dominate its diet during the non-breeding and pre-laying periods, while birds become the primary prey during chick-rearing. This systematic review focuses on the falcon's insect-based foraging behavior during its pre-breeding and breeding phases. Using the PRISMA framework, the review examined data from ten Mediterranean countries and the Canary Islands, drawing from peer-reviewed and grey literature sourced via Web of Science, Google Scholar, PubMed, and Scopus, up to September 2024.A total of 18 studies, along with personal field observations, revealed 120 insect species and morphospecies across 47 families as part of the falcon's diet. The most common insect orders included Coleoptera, Hymenoptera, and Hemiptera. Migratory insects such as *Acherontia atropos*, *Anax parthenope*, and *Anax ephippiger* were also noted. The studies varied in methodology, sample size, and identification techniques. Most relied on direct observations, pellet analysis, and stomach-content examination, with pellet analysis yielding the broadest diversity of insect prey.
Greece emerged as the most thoroughly studied breeding site regarding the falcon's insect diet, incorporating all four major dietary analysis methods. This review offers a consolidated resource for future research on Eleonora's falcon and similar insectivorous raptors. It also underscores the species' potential as a bioindicator for monitoring insect diversity shifts across its breeding range, particularly in the context of environmental change and land-use impacts.

Keywords: *Eleonora's falcon, Falco eleonorae, foraging behaviour, insect-prey, pre-breeding and breeding period*

First record of *Phantia subquadrata (Herrich-Schäffer, 1838)* (Hemiptera: Auchenorrhyncha: Flatidae) from Crete: a new planthopper family for the island

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Crete is distinguished by a remarkably diverse biota, a phenomenon that can be attributed to a combination of factors, including its prolonged geographic isolation, the heterogeneity of its topography, and the influence of its mild Mediterranean climate. The island's position at a biogeographic crossroads between Europe, Asia, and Africa has resulted in the development of a rich endemic fauna. To date, 145 species of Auchenorrhyncha have been recorded from Crete, belonging to several superfamilies within Cicadoidea, Membracoidea, Cercopoidea (infraorder Cicadomorpha), and Fulgoroidea (infraorder Fulgoromorpha). A total of 57 species of the infraorder Fulgoromorpha belonging to seven distinct families have been recorded on the Cretan island. These families are Cixiidae, Delphacidae, Achilidae, Issidae, Meenoplidae, Ricaniidae, and Tettigometridae. The present study records the inaugural occurrence of the family Flatidae in Crete, exemplified by the species *Phantia subquadrata* (Herrich-Schäffer, 1838). This species was collected through sweep netting in the vicinity of Sisarcha village (Rethymno), at an altitude of 574 metres, during a field survey conducted in September 2023. This record serves to extend the known geographical distribution of Flatidae in the eastern Mediterranean, thereby underscoring the potential for further discoveries, particularly among phytophagous Fulgoromorpha and Cicadomorpha taxa. In order to achieve a comprehensive understanding of the subject, further faunistic studies are required.

Keywords: *Crete, Flatidae, planthoppers, Fulgoromorpha, biodiversity, Greece*

Population Genomics and Demography of an Endemic Lizard Within an Isolated Island

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The genetic structure of a population is influenced by landscape features and the demographic and genetic attributes of the organisms. Analysing population structure and demography in island systems can shed light on the evolutionary trends in organisms at a local scale, as islands are considered model systems for studying biogeography and evolution. In this work, we investigated the genetic structuring of the starred agama, *Laudakia cypriaca*, an endemic lizard of Cyprus, based on genome-wide SNPs retrieved through ddRADseq. Population structure analyses revealed two clusters, which are in alignment with the island's palaeogeography and exhibited relatively low levels of differentiation (F_{ST} values ranged between 0.03-0.50). Gene flow between populations was restricted, and habitat diversity appeared to promote their isolation. Additionally, landscape genomic analyses indicated that temperature and precipitation are the main environmental drivers of genetic diversity in the two starred agama clusters on the island. Our analysis hence suggests that the landscape has a significant influence on the structuring of the population.

Keywords: *Laudakia cypriaca*, Cyprus, ddRADseq, genomic structure, landscape genomics, palaeogeography

Antipredatory responses of two lizard populations to a saurophagous snake

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Antipredatory responses of prey species constitute a major trait of their evolutionary and behavioral biology. The Aegean wall lizard (*Podarcis erhardii*) is an ideal model – species to investigate this behavior, as it is widely distributed in the Greek region and has been extensively studied. Snakes are the primary predators of lizards in Greek ecosystems, and as such the common viper (*Vipera ammodytes*) was chosen to test the antipredatory responses of these lizards. The experiments consisted of two different lizard populations, one mainland from a high predation environment (Parnitha) and one insular from a low predation environment (Anafi). By comparing these two distinct populations, this study aims to highlight the lizards' ability to detect their predators and the effect of the predation regime on their behavioral adaptations. The experiments were carried out in controlled setups that allowed us to test the lizards' ability to recognize optical and chemosensory cues of the snake. Each trial was recorded in video and the lizards' behavior was assessed using a predetermined ethogram comprised of the main antipredatory responses. Moreover, we used tracking software to conduct a spatial analysis of the lizards' movement across the arena during each trial. Preliminary results suggest that mainland lizards are better adapted to the presence of predators than their island counterparts. By demonstrating fewer reactive behaviors and limiting their movement in the arena, they remain less conspicuous and avoid predators.

Understanding the effects of isolation and predation on the behavior of an island endemic species: the case study of the Milos wall lizard (*Podarcis milensis*)

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Understanding how ecological factors shape behavioral variation is crucial to evolutionary biology and conservation science. This study examined how isolation and predation pressure influence personality traits and antipredator responses in the Milos wall lizard (*Podarcis milensis*) across four islands of the Milos Archipelago. We assessed exploratory behavior, neophobia, and antipredator responses in lizards from Milos, Kimolos, Polyaigos, and Antimilos, using standardized behavioral experiments under controlled conditions. Exploration was assessed by introducing individuals into a novel environment and recording their movement patterns. Neophobia was measured by recording latency to approach a familiar food item in the presence of different novel objects. Antipredator responses were tested by exposing lizards to visual and chemical cues of a snake predator within a divided arena. Principal component analyses and mixed-effects models revealed that lizards from the isolated, predator-free islet of Antimilos displayed higher exploratory behavior, lower neophobia, and reduced antipredator responses compared to those from larger, predator-rich islands such as Milos. Both exploration and neophobia showed moderate to high repeatability, indicating stable personality traits. Morphological variables such as body size, sex, and tail condition did not significantly influence behavior. Our findings support the role of ecological release and environmental unpredictability in shaping behavioral strategies in insular populations. Furthermore, the observed behavioral naivety highlights potential conservation concerns, as predator-naive populations may be particularly vulnerable to invasive species and human disturbances. These results emphasize the importance of integrating behavioral ecology into conservation strategies, particularly for endemic island species facing rapid ecological changes.

Keywords: *animal personality, exploration, neophobia, island syndrome, ecological release*

From snake island to a hub of research and education: who learned what on Golem Grad Island?

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Besides allowing for the rare intimate insight into the ecology of populations, and by extent, species, long-term studies also offer incredible platforms to develop future ecological and conservation capacities. We present the results of an 18-year-long continuous and ongoing ecological study on three reptile populations inhabiting Golem Grad Island in Prespa Lake, North Macedonia, and explore the research journeys of ≈60 students and trainees that transcend political borders. As most tangible testaments to the significance of such systems we highlight capture-recapture datasets of >29,000 entries and collaborative outputs, so far in the shape of five PhD and five master theses, contributions to countless bachelor theses, and 29 published research papers. Most notable population-specific results concluding 2024 follow. We marked ≈6,700 dice snakes, but unfortunately, over the years the yield from sustained capture effort dropped, marking the negative effect of illegal fishing practices around the island. The dataset has shed light on the selective forces that have shaped the plethora of antipredator behaviours practiced by this snake. From 631 marked nose-horned vipers we estimate a female-biased population (≈2:1) of 79 (CI 48-147) vipers with survival and capture probabilities favouring females. Mammals do not constitute the island vipers' diet, which likely resulted in their dwarfism and lower fecundity (compared to the mainland). Finally, 1,982 marked Hermann's tortoises inform of an extremely male-biased population (≈17:1). Males sexually coerce females to the extent of lowering their survival, body condition and body size, and precluding them from regular breeding, initiating an extinction vortex.

Keywords: *ecology, Prespa, PrespaNet, reptiles, training*

PelicanWatch: A citizen science tool for pelican monitoring and wetland conservation

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PelicanWatch is a smartphone application developed by the Society for the Protection of Prespa. It is an innovative tool designed to facilitate the collection of scientific data by citizens. The application enables users to record observations of pelican feeding activity, assess their feeding efficiency and report resightings of ringed individuals. These data are used to evaluate the quality and relative importance of feeding sites across different wetlands, identify previously unknown areas of significance for pelican foraging, and assess the ecological value of each wetland. By combining these insights with monitoring data on biotic and abiotic wetland characteristics, PelicanWatch supports targeted efforts to protect and manage wetlands and their resources effectively, safeguarding them from threats. The application has already been deployed in various regions, contributing to a deeper understanding of pelican ecology and wetland dynamics. PelicanWatch integrates citizen science into conservation efforts by providing real-world data to support the effective management and protection of wetlands, fostering collaboration among scientists, organizations, and local communities.

Keywords: *mobile app, feeding performance, collaborative networks, fish availability, ringing recoveries*

A potential new migration bootless of European importance for European honey buzzards in southwestern Greece

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Despite significant advances in our understanding of raptor migration in eastern central Mediterranean over the past 25 years, a key potential migration hotspot has only recently been identified in southern Greece. During a 15-day period in the post-breeding migration season of 2024, a total of 11,790 raptors were observed, including 11,606 European honey buzzards (*Pernis apivorus*). Existing satellite tracking data from north and central European and populations of the species highlight the strategic importance of this site for a broad range of the species breeding range, suggesting it may serve as the third major Mediterranean bottleneck for honey buzzards, alongside the Straits of Gibraltar and Messina. However, the site's conservation value is threatened by planned wind farm developments, as it marks a crucial launch point for the species' sea crossing to Libya.

Keywords: *avian migration, soaring birds*

Connectivity and metapopulation dynamics of Dalmatian pelicans (*Pelecanus crispus*) in Greece

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Understanding how long-lived colonial waterbirds persist in rapidly changing landscapes is fundamental for their conservation. We combined four decades of colony counts, extensive ring re-sightings, GPS tracking, and multilocus genetic data to explore demographic trends and connectivity among five breeding colonies of Dalmatian pelicans in Greece. Bayesian integrated population models (IPMs) showed that every colony has increased over the study period, however colony-specific vulnerabilities were detected: some colonies are limited by adult survival, others by low fledgling recruitment or breeding output. Transient life-table response experiments highlighted adult survival as the chief driver of annual growth, whereas productivity and immature survival were more influential in more recently established colonies. Forward projections suggest that, under current conditions, colonies remain demographically secure (<1% extinction risk), but growing pressures, including avian flu and disturbance could quickly reverse this pattern. Genetic analyses revealed moderate diversity and only weak population structuring, indicating substantial dispersal among colonies. Integrating these insights, we recommend site-specific actions coupled with the protection of flyway corridors that sustain connectivity. Our integrative framework demonstrates how long-term data and modern Bayesian tools can inform targeted conservation strategies for an emblematic species.

Keywords: *integrated population model, connectivity, demographic drivers, genetic diversity, conservation planning, waterbird*s

This research was funded by WWF Greece scholarship program

Herpetology in new and ancient cities

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Urbanization and invasive species profoundly impact biodiversity, especially thermally-sensitive animals such as amphibians and reptiles. Urbanization radically transforms landscapes from predominantly natural elements to artificial human-made ones. This transformation often results in increased pollution, habitat fragmentation, and the "urban heat island effect" which poses significant challenges to ectothermic reptiles and amphibians. Research in our lab explores how herptile populations respond to urbanization in both modern and ancient cities. In this talk I will present molecular, physiological, morphological, and behavioral data on multiple species of lizards that have evolved in ancient cities for millennia (reptile species from Greece and Sicily), and what happens when they are suddenly introduced to novel urban environments for just a few decades (introduced Italian wall lizards in the USA). By examining and comparing herptile ecology and evolution in ancient and modern urban environments, we can better understand the long-term effects of human development on reptiles and amphibians and try to better co-exist with them into the future.

Feeding ecology of urban populations of the Balkan water frog (*Pelophylax kurtmuelleri*)

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The Balkan frog (*Pelophylax kurtmuelleri*) is the most widespread frog species in Greece, also present in urban streams. However, these streams are known for their high degree of degradation. Thus, the effect of the urban environment on the biology of the species, which has been little studied, is of great interest. To this end, populations from four streams of Athens, Greece, (Chalandriou, Pikrodafni, Podonifti and Kifissos River), were studied. A total of 59 individuals were captured, their stomach contents were collected either through the flushing method or dissection and prey items were identified at the Order level. Age, snout-vent length, mouth width and body weight were also recorded for each individual. The results were compared with those from natural populations of the species and other species of the genus from literature. The environment was found to have a significant effect on the species' dietary preferences, but this differed between the four populations, probably due to the different degree of degradation of each stream. In addition, factors such as age and diversity of the prey variablity that constitutes each ecosystem are likely to have influenced the results. Further research in age-homogeneous populations, considering seasonality and availability of resources in each study area may yield more concrete evidence on the effect of the urban environment on the species.

Keywords: *Amphibia, Athens, feeding habits, invertebrate diversity, natural populations, urban streams*

Carabid beetle diversity in olive orchards in relation to the management and the agroecological zone

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Olive trees are the most widespread tree cultivation in Greece. The microclimate and the landscape have an overall effect in the functioning of the olive agroecosystem. Besides, factors related to olive orchard management, are considered to be crucial for the diversity of indicator organisms, such as coleoptera. Carabidae are one of the best bioindicators for ecosystems, as they are sensitive to anthropogenic interventions, the use of chemical insecticides, and the heavy metal accumulation in agroecosystems can negatively affect them. In the present study we investigated the carabidae fauna of olive orchards, in Crete. We survey monthly from October 2021 to October 2022, using pitfall traps, in 18 olive orchards under different management (organic, conventional, abandoned) and across two agroecological zones, i.e., hilly and plain. In each orchard, ten traps per ha were placed, containing propylene glycol. 14 different genera were found and 12 species identified. *Carabus banoni* and *Tapinopterus creticus* were the species with the highest abundance. Orchards in the plain zone presented higher captures than the hilly ones, while higher captures found in the organic orchards. The differences in richness between agroecological zones are probably related to food sources and humidity. Strong differences in species composition were not found among olive orchards. This is a first attempt to understand the impact of human (agricultural) activities and agroecological zones on carabidae beetles in the Mediterranean region. We highlight the importance of organic olive orchards for increasing carabidae diversity. Further research is required to evaluate the impact of agriculture on carabidae.

Keywords: *diversity, agroecosystems, carabidae, bioindicators, human impact.*

Acknowledgments: The study took place under the framework of the project LIFE IGIC–Improvement of green infrastructure in agroecosystems: Reconnecting natural areas by countering habitat fragmentation - LIFE16 NAT/GR/000575, that is co-funded by the LIFE financial instrument of the European community and the Green Fund and the CLIMED-FRUIT - Adaptation to climate change and mitigation for perennial crops in Mediterranean Area. Funding from Horizon Europe Framework Programme (HORIZON).

Phylogeographical patterns of the Greek snake skink: preliminary results from DNA and niche modelling analyses

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Phylogeography is an interdisciplinary scientific field that combines biogeography and phylogenetics to investigate the evolutionary processes that shape the geographical distribution and genetic structure of species and their lineages. In this study, we investigate the phylogeography of *Ophiomorus punctatissimus* (Bibron & Bory de Saint-Vincent, 1833). This species is the only remaining representative of its genus in the European geographical region and the very old isolation of its ancestor in the Peloponnese makes it a living fossil and one of the oldest extant verterbrates in Greece. The wide and old diversification of its clades within the Peloponnese makes it an ideal candidate for a phylogeographic study. We collected samples from across the region, with particular focus on areas where clade diversification appears prominent and where previous sampling showed gaps. We analysed a mitochondrial marker to uncover cryptic clades within the species, infer their geographic distribution and investigate their phylogenetic relationships using Maximum Likelihood and Bayesian Inference methods. In addition, we construct maps that help visualise the suitable habitat and ecological niche of the species, both in present and in past and future conditions, using ecological models built with the species georeferenced presence data and bioclimatic variables. Based on the results of the phylogenetic analyses, combined with the ecological niche modelling, we propose a phylogeographic scenario for the diversification of *Ophiomorus* in the Peloponnese and highlight the role of paleogeography, paleoclimate, and regional geomorphology.

Keywords: *mitochondrial phylogeny, Ophiomorus punctatissimus, palaeogeography, Peloponnese, reptiles, species-distribution modelling*

The Red List of Endangered Arachnida (Araneae, Opiliones) in Greece: what have we learnt?

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In the framework of a national effort to assess the conservation status of the fauna and flora of Greece under the standards and guidance of IUCN, about 7000 animal species from many Orders were assessed. In this presentation we critically address the assessments made for 202 species of spiders and 50 species of harvestmen. Prior to this recent effort, very few species of the Greek arachnofauna were included in the global Red catalogue of IUCN. Of the assessed species, about 50% of spiders and 28% of harvestmen fall into one of the three main threat categories based mostly on Criterion B and D. The lack of information for Greek arachnofauna is clearly underlined by the assessment of an extremely high number of species as Data Deficient. The analysis of the documented threats reveals that wildfires, climate change-induced droughts, and touristic development and recreational activities are the principal factors affecting the viability of the assessed species. All these are mostly related to habitat quality degradation and are therefore an indirect way to assume their effect on the species themselves, while direct evidence of population declines or decrease of area of occurrence does not exist for any of the assessed species. This analysis highlights the lack of a concrete, organized plan for the assessment of the threats and the conservation regime of arachnids and denotes the knowledge gaps that we should address in the future to find proper ways to promote their conservation perspectives.

Keywords: endangered, spiders, harvestmen, Greece, threats, conservation

Urban Wildlife: Biodiversity of the Thessaloniki Cityscape

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Urban environments are typically not extensively studied and perceived as hostile to biodiversity. However, cities can support a surprising range of species, including some rarely associated with densely populated areas. This study reports on the faunal diversity of the city of Thessaloniki, Northern Greece – a major metropolitan center – using survey data collected over a two-year period across urban parks, streams and associated riparian/flood zones, the seafront, abandoned buildings and inactive military zones. Several field surveys were held and, through the use of citizen science platforms, we photographed, recorded, and identified species of four taxonomic groups: amphibians, reptiles, birds, and mammals. In total, we recorded 150 species in microhabitats that, despite being artificial or in close proximity to human activity and disturbance, closely resemble their natural ecosystems. Our findings contribute to the growing knowledge on urban biodiversity and highlight the need for further research into the factors that attract species to cities, their ecological adaptations and threats. It also stresses the importance of identifying and managing urban habitats, which is essential for the effective conservation of urban fauna.

Keywords: biodiversity, urban landscape, citizen science, Greece, Balkan peninsula

Seals & Meals: Decoding Mediterranean monk seal diet in the Ionian Sea

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Molecular dietary analysis of faeces offers key advantages, among them its non-invasive nature in particular. This is beneficial for endangered marine species such as the Mediterranean monk seal *(Monachus monachus).* Utilizing molecular techniques allow prey identification beyond the limitations of direct faecal analysis and can identify highly digested remains as DNA can be recovered even in total absence of hard parts. The dietary composition of *Monachus monachus* has serious implications for the species´ interaction with fisheries. Studies have shown that many of the identified preyed species are of commercial importance, demonstrating a probable overlap and competition between monk seals and fishing activities. Our goal is to track the species main prey items and, thus, identify critical conflicts with human activity essential as a basis for an effective conservation strategy. Here, we present preliminary results from the Ionian Sea, Greece, where no previous records on the species' diet exist. 30 samples of faeces were collected from caves used by monk seals during 2019-2024 in the central and south Ionian Sea. The samples were subsequently used for DNA extraction and metabarcoding analysis. Two sets of primers (16S_Chordata, 16S_Ceph) were used for prey identification, revealing target species of *Monachus monachus*. The results demonstrate the monk seal's preference for certain species while indicating a potential shift in diet composition between the Ionian and Aegean Sea sub-populations. These preliminary results support the need for conservation strategies to take into account local habitat characteristics as also prey availability and, possibly, individual preferences of seals towards specific prey.

Keywords: *environmental DNA, Metabarcoding Monachus monachus, trophic ecology, conservation, feces*

Pollution written in blood: Amphibian micronuclei as early warnings from Serbia's ecosystems

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Many amphibian populations are declining in number throughout the world. One of the factors that impacts the decline is pollution by pesticides and heavy metals. Due to permeable skin, amphibians are very sensitive to environmental pollution. The micronuclei test is a useful tool for the short-term evaluation of environmental pollution. In amphibians, this technique has been extensively used and is based on erythrocytes, which in these organisms are nucleated. With the aim to prove that the pollution is affecting anuran amphibians, we collected 37 adult anurans from different parts of Serbia for the micronucleus presence. For this purpose, we took blood samples from each animal's facial (maxillary) vein (for anurans) and subcaudal vein (for newts and salamanders) and prepared five smears for each animal. Each smear was Giemsa-stained. We screened the smears under a conventional microscope with a 1000x magnification. One thousand red blood cells (RBC) in the monolayer portion of the smear were examined. We determined and recorded the number of micronucleated RBCs as the ratio of micronuclei per 1,000 RBCs. The results have shown that in every sample there were present micronucleated RBCs. Although environmental pollution may interfere with amphibian growth and development, the induction of genetic damage after chronic exposure to low doses of chemicals is perhaps the most important biological effect.

Keywords: *amphibians, environmental pollution, micronucleus*

Focus on the herpetology of unexplored small Greek islands

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The Greek islands are home to a rich herpetological fauna consisting of about seventy species, including several endemic ones. Of the approximately 6,000 Greek islands, only 259 are known to harbor herpetofauna. As one might imagine, the least explored islands are the uninhabited ones, although sometimes relatively large, but by far the most unexplored are the small ones, such as islets and rocks. The latter are mostly difficult to reach and, often, almost inaccessible. Visiting them therefore requires a considerable commitment in terms of time, researchers involved but, most importantly, a considerable economic effort. Thanks to the PIM Initiative, a non-governmental organization, three expeditions to small Greek islands have been carried out since 2023 with the aim of improving naturalistic knowledge for conservation purposes, benefitting from local and international Mediterranean experts. To date, 8 islands and islets in the Ionian area, 23 in the Saronic Gulf and 10 in the area surrounding Milos have been visited. For 26 islands, new unpublished data were obtained. For 6 the number of species was increased, while for 5 the presence of already known species was confirmed. In contrast, four islands among those visited during the three expeditions were not shown to harbor any herpetofauna species.

Keywords*: herpetology, small island inventories, Greece.*

Biodiversity Assessment of Alpine Lake Ecosystems in the Pindus Mountains

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Alpine ecosystems represent some of the most vulnerable and underexplored habitats in Greece, functioning as ecological “islands” with high conservation value. This study aims to provide the first comprehensive, multitaxon biodiversity assessment of six alpine lakes in the Northern Pindus mountains (Grammos, Smolikas, Tymfi, Lakmos, Vasilitsa, Tymfristos), which serve as reference points for surveying a variety of surrounding habitats. Fieldwork will be conducted in spring and early summer 2025 and will span 36 days across all sites. A stratified methodology will be employed to record all major vertebrate and invertebrate taxa. Amphibians and reptiles will be surveyed through transects and time-constrained searches; birds will be documented using line transects and point counts. Large mammals will be monitored through indirect indicators (e.g., scat, hairs, tracks), trap cameras, while small mammals will be sampled using Sherman trap. For terrestrial invertebrates, pitfall traps and opportunistic observations will be used, while aquatic macro- and microinvertebrates will be sampled from both lake perimeter and the water column. Environmental DNA (eDNA) metabarcoding via NGS Illumina sequencing will complement morphological taxonomy to provide a fuller picture of aquatic invertebrate and other animal diversity. This integrated approach is expected to yield updated species occurrence data, reveal new records or range shifts, and identify conservation threats in these sensitive ecosystems. The data generated will form the basis for a long-term biodiversity monitoring framework for Greece’s alpine lakes.

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The Gyaros island MPA status, evidence from fisheries scientific surveys

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Gyaros island (Aegean Sea) is a recently (2019) established MPA in the eastern Mediterranean Sea. From June 2018 to date, a series of 30 fishing excursions with a total of >110 experimental fishing sets were realized around Gyaros island, inside the MPA. Comparison with similar data in adjacent areas outside the MPA allowed for assessing the effectiveness of the MPA. Based solely on the experimental fishing trials, the MPA seems to be functioning, since both species diversity and various population metrics were higher within the protected area. Significant political pressure by fisher organizations led to opening the MPA in June 2022, for 3 months, without any fishing permit restriction, leading to a significant deterioration of the MPA status. After the protection status was reinstated (September 2022) the MPA recovered rapidly, reaching its peak status by next year (2023). However, during the most recent period (2024-) abundance and biodiversity exhibit some decline, suggesting that the benefits gained in the course of the past years may not yet be secured. Based on questionnaire surveys conducted, a substantial part of the local fishing community is embracing MPAs. However, we have also seen that the self-interests of a fishers' minority, when coupled with non-science-based erroneous policy decisions can lead to overfishing and deterioration of MPA status. To ensure the effective conservation of the area's biodiversity it is imperative to establish a long-term and strict legal protective status for the MPA, implement an integrated management plan, and continue unimpededly the monitoring, control and surveillance actions.

Keywords: Gyaros, MPA, Mediterranean, conservation, fisheries, stakeholders

Taxonomic and functional diversity of spiders across an anthropogenic mediterranean landscape on Euboea Island, Greece

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Despite various studies on the spider fauna of Greece, research has largely concentrated on specific, predominantly protected areas, leaving much of the country underrepresented and existing data scattered. The aim of this study was to assess the taxonomic and functional diversity of spider communities on Euboea Island, Greece, a previously understudied region of Greece. The study area was a typical anthropogenic mediterranean landscape characterized by cultivated fields, olive groves and an urban area. Sampling was conducted monthly for a full year (November 2023–October 2024) in different sites belonging in one of the three habitats. A total of 305 spider individuals were collected classified into 67 species, and 71 genera —18 of which were not identified to species level —belonging to 27 families. Diversity metrics revealed notable variation among habitats, with cultivated fields exhibiting the highest alpha diversity and evenness. Beta diversity indicated distinct community composition, while gamma diversity reflected substantial regional richness. Functional diversity analysis showed a broader range of ecological roles in both cultivated fields and olive groves, suggesting greater structural and trophic complexity compared to the urban area. In addition to these ecological patterns, the study recorded a significant number of new taxa for the island, including 51 species, 37 genera and 7 families. These results underscore the role of habitat heterogeneity in maintaining both taxonomic and functional spider diversity in Mediterranean ecosystems.

Keywords: heterogeneity, ecological structure, spider communities, diversity indices, new records

An updated mitogenomic phylogeny of Colubrid snakes

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The reconstruction of the Tree of Life, i.e mapping the evolutionary relationships of all living organisms into a common phylogeny, is an ambitious project, with research efforts mainly focused on generating and utilising molecular and particularly genetic data. Traditionally, most phylogenetic studies have been based on the analysis of mitochondrial markers. However, the development of Next Generation Sequencing (NGS) methods and the use of bioinformatic tools are proven particularly useful in this process. For example, we can generate a large amount of information by using the whole mitochondrial genome as a marker, and resolve evolutionary relationships by including multiple mitochondrial genes under different evolutionary rates and models. In this study, we employed the complete mitogenome of snakes belonging to the Colubridae family to investigate their evolution. We generated datasets from sequences available in existing databases and also compiled new, unpublished ones to represent the colubrid species and genera of the Greek herpetofauna. We performed phylogenetic analyses, aiming to reconstruct phylogenetic trees, and to provide an estimation of divergence times and mitochondrial-gene substitution rates. Our work fills significant gaps in the existing complete mitogenomes of snakes and draws conclusions about the evolutionary rates of each molecular marker. Most importantly, it updates the phylogeny of this group of organisms, assesses the validity of the current taxonomy and refines our knowledge about the time of differentiation of the focal group.

Keywords: *Colubridae; complete mitochondrial genome; evolutionary history; Greek reptiles; phylogenetic relationships*

How behaviour and problem-solving ability influences individual life-history trajectories in a changing world

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Understanding how populations respond to rapid and consistent environmental stress is one major theme in current biological research. For populations to adapt to fast changing conditions, individuals first need to adjust their behaviour. Indeed, the first line of response towards environmental change is often individuals changing their behaviours, for example their exploration, foraging and reproductive decisions, which in turn might influence population and species development. Therefore, a crucial first step towards understand how adaptation to changes is focusing at the among-individual level. Here, we take a first step towards that direction by studying if and how innovation ability measured in a safe environment, and behaviour measured in standardised tests, influence the full spectrum of life-history traits in wild house mice (*Mus musculus domesticus*) in a seminatural context. Importantly, by varying an important predictor of the environment, food quality, we were also able to understand if the traits are correlated in an environment-specific manner. We found several patterns, for example that animals fed high-quality food were more likely to solve problems after a few trials than animals fed lower-quality food, despite that both solved at similar rates at the start of the experiment. Overall, the consequences of problem-solving and personality were tied to food quality and were linked to life-history traits in a complex manner. Since house mice are ecological opportunists often facing rapidly-changing environments and are a representative of many small mammals at the core of terrestrial food-webs, our results can be used to draw inferences about how the resource environment mediates the causes and consequences of several correlations among traits, such as reproductive behaviour with personality, in short-lived generalist species under environmental variation.

Capture history modulates behavioral state transitions in a wild rodent model: decoding experience-dependent behavioral flexibility using continuous-time transitions

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Rodents exhibit context-dependent behavioral responses to acute stressors, offering critical insight into their coping mechanisms and behavioral flexibility. In this study, we examined how capture history influences behavioral state transitions in a wild rodent model following exposure to a standardized handling procedure. Following brief handling, 40 individuals (20 first captures and 20 recaptures) were released into a wooden enclosure, and their behavior was continuously recorded for five minutes from the moment of release. Behavioral states were systematically annotated into discrete classes to construct an ethogram and characterize activity patterns post-release. We applied a continuous-time Markov multi-state model to estimate transition intensities (Q-matrix), state-switching probabilities, and hazard ratios evaluating the effect of capture experience. First-captured individuals displayed behavioral inhibition, characterized by prolonged immobility and minimal transitions between states, consistent with an acute stress response. In contrast, recaptured individuals exhibited increased behavioral complexity, with higher transition rates and a broader repertoire, suggestive of habituation or reduced stress sensitivity. The Q-matrix revealed substantially greater transition intensities in recaptures, particularly among exploratory and locomotor behaviors. Hazard ratio estimates further confirmed that prior handling significantly increased the likelihood of transitioning out of passive states and into active behaviors. These findings highlight the role of experience in modulating stress-induced behavior and demonstrate the value of continuous-time Markov models in capturing the temporal structure of behavioral plasticity in small mammals.

Keywords: Acute stress response, multi-state Markov model, transition intensity matrix, behavioral sequence analysis

Predation monitoring of *Caretta caretta* hatchlings by *Ocypode cursor* and *Rattus* spp. at Sekania Beach, Zakynthos (Ionian Sea, Greece)

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Predation is a significant threat to *Caretta caretta* (loggerhead sea turtle) hatchlings, especially in critical nesting areas like Sekania Beach, located within the core of the National Marine Park of Zakynthos, Greece. This study utilized a network of nine cameras, along with an extensive protocol, to monitor predator activity during the summer of 2023. The video footage, analyzed over a 48-day period (July 17–31, August 1–24, and September 12–20), recorded behaviors of two primary predators: the tufted ghost crab (*Ocypode cursor*) and rats (*Rattus* spp.). Through video footage analysis, rats were recorded multiple times scavenging and predating on hatchlings, while crabs were observed carrying dead hatchlings on a few occasions. It was unclear whether these incidents involved predation or scavenging. Descriptive statistical methods were employed to analyze predator activity across the observation period. The camera-based approach proved invaluable for documenting nocturnal predator behavior and identifying peak activity periods, with August being the busiest month for crabs. In contrast, September proved to be a period of minimal predator activity, with significantly fewer sightings of rats and crabs. Although this study focused on ground-based predators, other species such as the yellow-legged seagull (*Larus michahellis*), a known predator in the area, may interact with terrestrial predators in complex ways that influence overall hatchling mortality. These findings emphasize the importance of continued monitoring and support the use of camera traps for gaining insight into predator dynamics at *C. caretta* nesting sites, ultimately aiding in effective conservation planning.

Keywords: Sea turtles, Predators, Marine Protected Area, Ghost crab, Rat, Camera monitoring

Can leaf litter-dwelling arthropods help us understand Balkan biogeography?

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The microhabitat known as leaf litter is the above-ground portion of the forest that comprises decaying leaves and wood and is essential for nutrient cycling in forest ecosystems. Leaf-litter arthropods tend to exhibit adaptations such as loss of vision or flight linked to limited dispersal abilities, and thus, exceptionally high degrees of endemism. Coupled with their staggeringly high biodiversity, leaf litter microhabitats have been described as "terrestrial coral reefs". However, unlike actual coral reefs, a general understanding of the ecology and evolution of leaf litter arthropod communities is lacking due to their cryptic nature, especially in the understudied Balkan and Eastern Mediterranean regions. Here, we propose that ecologically dominant leaf litter-inhabiting arthropod groups such as pselaphine beetles and endogean weevils represent ideal model organisms for elucidating the biogeography of the Balkans, as their speciation patterns likely mirror geological events that shaped the region, as well as changes in forest cover and climate. Indeed, our ongoing phylogenetic and taxonomic study demonstrates that Greece's mountains display exceptionally high rates of microendemism in leaf litter and endogean arthropods, and these insects can be used for the study of key factors that shaped the zoogeography of the broader region. The possible utility of leaf litter and endogean arthropods in conservation is also discussed.

Keywords: *leaf litter, endogean, Pselaphinae, Ubychia, Curculionidae.*

A call for help: Comparing alarm call vocalizations of Northern lapwing in Italy

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Birds breeding in agricultural landscapes usually build very accessible nests on the ground, and thus, are exposed to a wide diversity of egg predators. To reduce the risk of predation, parents display a range of anti-predatory behaviours, such as breeding next to each other in colony, mobbing enemies or producing alarm calls. But predatory guilds search for prey differently: while birds predate during the day, and rely on sight, mammals forage more at night and find nests opportunistically. Thus, discriminating predators and reacting accordingly is essential. For colonial species, transmitting this information to conspecifics through specific calls may help to better react and deter potential predators. The Northern lapwing (*Vanellus vanellus)* is a colonial breeder, that nests in open fields and grasslands across the Palearctic, including Mediterranean regions. Labeled as Near Threatened by the International Union for Conservation of Nature (IUCN), population trends show a clear decline in recent years. This species is notably conspicuous and vocal during antagonistic interactions. The main scope of this study was to examine if Northern Lapwing produces different vocalizations when exposed to different guilds of nest predators. For this, a series of experiments was performed in Emilia-Romagna (Italy). Breeding individuals of 8 nests were exposed to predator dummies of four guilds: a European Hedgehog (*Erinaceus europaeus*) as mammalian predator, a Marsh Harrier (*Circus aeruginosus*) as avian predator, a Grass Snake (*Natrix Helvetica*) as reptilian predator, and a Rock Pigeon (*Columba livia*) as harmless control. After creating a catalogue of vocalizations for each nest and predator type dummy, an analysis of variance (ANOVA) was carried on, in order to observe differences of vocalizations in the presence of each predator. To our knowledge, this may be one of the first study to examine predator-specific signature in alarm calls in a shorebird.

Keywords: *Bioacoustics, Nest predation, Alarm calls, Predator recognition*

Effects of tail autotomy on adult male activity patterns and time budgets of a Mediterranean lizard

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Tail autotomy is a common anti-predator strategy among lizards, conferring greater chances of survival during an attack. Nonetheless, it carries significant costs, ranging from impaired locomotor abilities to reduced reproductive success. Here, we investigated how tail loss affects the activity patterns and behavioural time budgets of adult male Aegean wall lizards (*Podarcis erhardii*), and whether female presence modulates these effects. We hypothesised that autotomised males would reduce their overall activity and modify their behavioural time allocation in order to meet the energetic demands of tail regeneration and limit their exposure to predators. We expected the presence of females to at least partially mitigate autotomy induced changes. Behavioural trials were conducted in a semi-natural outdoor arena. We used linear models and compositional data analyses to assess the effects of tail condition and female presence on total activity and relative time allocated to four main behaviours (basking, resting, moving and feeding), while controlling for body size. As predicted, autotomised males were significantly less active than intact ones, but tail condition did not significantly alter their time budgeting. Surprisingly however, male lizards were overall less active in the presence of females, but spent relatively more time moving, a pattern hinting at a possible effort to avoid encounters. Our results showcase the significant impact of caudal autotomy on male lizard activity, suggesting that tailless lizards likely need to conserve energy for tail regeneration and/or adjust their anti-predator behaviour to compensate for a compromised ability to escape.

Keywords: behaviour, *Podarcis erhardii*, lacertids, anti-predator

Behavioral adaptations in small islands, treasures of diversity

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In the Mediterranean there are countless islands, islets and rocks, many of which host different plant and animal species. As for non-flying vertebrates, geckos and lizards are the only ones able to live on islets and rocks, adapting to extreme conditions. These small vertebrates, thanks to their adaptability, show the most varied survival strategies. Here, as an example, we report two behavioral strategies adopted by *Euleptes europaea*, a small gecko endemic to the central-western Mediterranean, characterized by nocturnal activity both on bare rocks and under thick "cushions" of vegetation at the base of the rocks. What behavioral changes have been adopted by this gecko to coexist with rats and, what else has changed? The disturbance exerted by rats seems to be limited to their movement rather than predation, inducing geckos to reduce their activity on bare rocks. A greater proportion of medium-sized individuals has also been observed, thus showing a change in the population structure of this gecko. What strategy was adopted to escape predation by *Tapinoma erraticum*, a particularly aggressive ant? Most of the geckos made escape jumps up to 3 meters from the rock face, a behavior that is not known on any other island at this extent.

Keywords*: ants, geckos, insular biota, interactions, Mediterranean, perturbation*

Chestnut (*Castanea sativa*) Forests and their contribution in Woodpecker Conservation in Greece

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Woodpecker abundance has a profound impact on forest life, as approximately 25% of all forest duelling species depend on tree cavities that they create. Despite their ecological importance, research on woodpeckers in Greece remains limited. Similarly, chestnut forests (*Castanea sativa* Mill.) are vital components of Mediterranean-type ecosystems, recognized by the Natura 2000 network, that designated chestnut-dominated woodlands and old chestnut plantations (habitat type 9260: *Castanea sativa* woods) as important areas for biodiversity conservation. This study explores the significance of chestnut forests for the conservation of woodpeckers, influencing their diversity and abundance. The research was conducted on the eastern slopes of Mount Paiko in Kilkis, northern Greece. Surveys were undertook during woodpecker breeding season across 21 sites within chestnut forests and 5 sites in adjacent oak forests, following random point count sampling with fixed time period. In chestnut forets, circular plots of 20m radius centered on the same points were surveyed for forest structure elements (living trees diameter at breast height (DBH), standing dead trees DBH, stump measurements, laying dead wood, decomposition stage). In total, 7 species of woodpeckers were observed at 20 of the surveyed locations within chestnut stands, most abundant being the Middle-spotted and the Green woodpecker. In oak forests more abundant were the Lesser spotted and the Syrian woodpecker. Structural diversity emerged as a key factor supporting species richness. Maintaining mixed agroforestry systems, such as open-canopy chestnut orchards with mature trees and deadwood, is essential for sustaining woodpecker populations in these unique habitats.

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Keywords: *woodpeckers, chestnut forests, agroforestry, forest structure*

Here to stay? Alien ants of Cyprus

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The ever-increasing transportation of people and goods has unequivocally led to the introduction and further spread of species outside their native range. Around the world, more than 500 species of ants have become alien bypassing phytosanitary inspections and border controls, with more than half of species establishing viable populations in their invaded range. The island of Cyprus lies in the heart of the Eastern Mediterranean Sea bordered by Africa and Asia, and has been a stepping stone for the movement of humans and goods for millennia. As such, a number of alien species have been deliberately or unintentionally introduced by humans, including up-to-date a total of 18 alien species of ants. Most of them have been probably introduced to the island through the horticultural pathway, hitching a ride in potted plants as contaminants of nursery material. Although their impacts are largely unknown, some species such as the little fire ant *Wasmannia auropunctata* pose serious threats to native biodiversity, human and animal health, as well as socioeconomic parameters. As research on the alien ants of Cyprus is currently ongoing, the biodiversity, taxonomy, distribution, introduction pathways, invasion history and impacts of taxa is presented. Furthermore, notes on management actions and policy needs to strengthen biosecurity protocols are discussed to mitigate further introductions, as well as the spread and impacts of injurious species.

Keywords: biological invasions, Formicidae, invasive alien species, IAS policy, *Wasmannia auropunctata*

Ant biodiversity, ecology and biogeography of Astypalaia island (SE Aegean)

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Also known as the "butterfly of the Aegean", the island of Astypalaia is one of the most isolated, forming a transitional zone between the Cyclades and the Dodecanese island groups. In terms of administrative division, Astypalaia is positioned within the Dodecanese islands. Nevertheless, its biogeographical position has been the subject of debate, while the geological history of the area and patterns of island isolation are uncertain. Up-to-date, merely 11 species of ants have been collected from the small islets of Agia Kyriaki, Kounoupoi, and Ofidoussa surrounding Astypalaia, while no records of species are known for the main island. We visited the island of Astypalaia for ten days (14th – 24th April) during 2024. Upon material collecting, we provide a first checklist of the island's ant biodiversity, reporting on a total of 30 species and morphospecies, including five alien species. Investigations on faunal dissimilarities between the eastern and western parts of the island indicated no partitioning. Unweighted pair group method with arithmetic mean (UPGMA) clustering analyses at the archipelago and island-level showed a greater affinity of Astypalaia's myrmecofauna with that of other Cycladic islands, supporting some previous investigations regarding other taxa. Nevertheless, our species inventories regarding ants in the Aegean archipelago are far from complete, necessitating further research on the biodiversity and biogeography of ants at the island level.

Keywords: Formicidae, island biogeography, species inventories, taxonomy

This research was funded by the Hellenic Zoological Society under the "Margarita Metallinou scholarship program".

Ants of the Akrotiri Peninsula (Cyprus)

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The Akrotiri peninsula is located at the southernmost point of the island of Cyprus and is considered a biodiversity hotspot for migrating birds. It includes the largest complex of wetlands and designated RAMSAR sites of the island. In the framework of Darwin Plus project DPLUS200 we surveyed the ant biodiversity of Akrotiri through hand collecting, beating sheet and pitfall trapping. Results of this study include the collection and identification of more than 6,000 specimens belonging to a total of 52 taxa, including twelve endemic and eight non-native species, collectively amounting to 59% of the 88 species of ants currently known from the island. Amongst these, four taxa are recorded for the first time from the island of Cyprus. Our findings show that despite its small size (123 km^2), Akrotiri is an important hotspot for ants on the island, hosting a large number of both "rare" and endemic taxa. Nevertheless, the collection of nine non-native species is concerning given the conservation status of the region. Further research on the biodiversity, ecology and distribution of the region's ants is necessary, especially regarding important invasive non-native species i.e. *Wasmannia auropunctata* and its potential impacts, as well as endemic species with limited distribution and narrow ecological requirements i.e. *Oxyopomyrmex pygmalioni* and *Temnothorax akrotiriensis*.

Keywords: biodiversity, biological invasions, Formicidae, UK overseas territories, taxonomy

Preliminary mitochondrial phylogeny of *Platyceps najadum* reveals deep and shallow evolutionary relationships

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Platyceps najadum, also known as *Dahl's whip snake*, is a non-venomous species of snake in the family Colubridae. The species has a wide geographical range, extending from the Balkan Peninsula across the Aegean, Cyprus, Anatolia, and as far as the Caucasus region and Turkmenistan. The phylogeography of the species has not been thoroughly researched so far, especially in the Balkan region. The aim of the present study is to explore the phylogeographic patterns of *P. najadum*, with a special focus on Greece. The complete cytochrome b gene was used to infer the phylogenetic relationships among Greek populations and representative populations from the Balkans and Anatolia. Genetic divergence was estimated as p-distance values and phylogenetic trees were constructed with the Neighbour Joining and Maximum Likelihood methodologies. The results of the phylogenetic analyses support the presence of three distinct clades. The first clade to split groups the Armenian samples, the second one corresponds to the isolated population of Turkmenistan and the third clade hosts populations from the Balkans and western Turkey. Phylogenetic relationships and low genetic divergence values indicate that *P. najadum* has recently colonized the Balkan Peninsula. The defined geographic distribution and topology of the maternal phylogeny likely coincide with significant paleogeographic and paleoclimatic changes throughout the geological history of the Aegean Sea, Anatolia, and the Caucasus region.

Keywords: *Aegean Sea, Anatolia, Colubridae, Dahl's whip snake, palaeogeography, phylogeography*

Monitoring of the Lesser Kestrel (*Falco naumanni*) in Lechaina and the surrounding area (NW Peloponnese)

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Since 2015, we have systematically monitored the Lesser Kestrel population in Lechaina, Ilia, through field observation and the ringing of pulli. In response to the ongoing reduction of natural nesting sites in the region, we installed 69 artificial nest boxes in Lechaina and 23 in surrounding villages. This initiative has significantly improved the species' reproductive success over time, with new breeding pairs also established in Myrsini and Andravida. The first individuals typically arrive in the area by late February, with the majority settling by mid-March. By late July, the breeding season concludes, and the birds depart the region. Breeding population estimates have shown a steady increase: approximately 30–43 breeding pairs were recorded in 2021, over 50 in 2022, and at least 55 in 2023. Since 2021, a total of 320 pulli have been ringed using both metal and color rings—50 from 12 nests in 2021, 124 from 33 nests in 2022, and 146 from 33 nests in 2023. Re-sightings indicate that juveniles typically return to their natal area in their second year. Reproductive data reveal that 59% of pairs laid five eggs, 27% laid four, 8% laid three, and 6% laid six. No clutches contained fewer than three eggs. Among nests where ringing occurred, fledging success was highest in nests with five chicks (46%), followed by four chicks (31%), three chicks (17%), two chicks (5%), and six chicks (1%). These findings highlight the value of long-term monitoring and nest box provision in supporting Lesser Kestrel populations in agricultural landscapes under pressure.

Keywords: *Falco naumanni, artificial nest boxes, ringing, reproductive success*

The osteological collection of the National Museum of Natural History Goulandris, Greece

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Systematic collections are invaluable resources for the scientific community, as they support research in fields such as genetics, molecular biology, evolutionary biology, environmental toxicology, public health ecology, biogeography, systematics, and taxonomy. The osteological collection of the National Museum of Natural History Goulandris' is an important scientific asset, featuring specimens not only from Greece but also from various other countries. The systematic osteological collection began in the early 1990s. To date, 269 specimens have been catalogued, including 127 skulls, 78 skeletal parts, 29 full or partial skeletons, and 52 carapaces. These specimens represent five vertebrate classes: Mammalia, Reptilia, Aves, Fish (Class Chondrichthyes and Superclass Osteichthyes) and Amphibia. The majority of the specimens are mammals (45.72%), followed by reptiles (28.62%) and birds (22.30%). Geographically, the collection includes specimens from across Greece, with most originating from Central Greece (21.51%) and the Peloponnese (14.72%). Additionally, a notable portion (8.30%) consists of specimens from Africa. Each specimen is accompanied by a determination label. Furthermore, all specimens have been digitized and photographed using a Nikon D7500 camera with an AF-S DX Micro NIKKOR 40mm f/2.8G lens. Digitization enhances the accessibility and impact of museum collections and aligns with global trends toward sustainable development.

Keywords*: osteological collection, Goulandris Museum, Greece*

The role of urbanization and behavior in the global spread of the Common Myna

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Invasive species pose a major threat to global biodiversity, yet the mechanisms underlying their success remain poorly understood. The common myna (*Acridotheres tristis*), one of the world's most successful avian invaders, offers a valuable model for studying biological invasions. While inflicting damage upon biodiversity worldwide, the common myna also serves as a model for investigating the drivers behind biological invasions. Our research examines native and invasive populations of the common myna to track distribution shifts and identify drivers of invasion success. Species distribution modelling reveals that range expansion is strongly associated with proximity to urban areas, highlighting the dual role of humans in transporting the species to new sites, and urban environments that offer conducive conditions for its proliferation. The model also identifies areas at risk of future invasions, including the Mediterranean region. Behavioral experiments reveal enhanced cognitive traits in invasive populations, including reduced neophobia and increased motor innovation, facilitating exploitation of novel resources in human-altered environments. Additionally, invasive mynas exhibit reduced predator-avoidance responses compared to a local species, particularly in areas of high human density. This diminished fear response enables them to maintain foraging activity in high human presence.
Our findings emphasize the common myna's remarkable behavioral flexibility and its ability to thrive in human-modified environments. Understanding these traits is crucial for developing effective conservation strategies to mitigate the impacts of invasive species and prevent further biodiversity loss.

Keywords: *Invasive species, Behavioral flexibility, urbanization, innovation, Common Myna*

Insights on the current White Stork (*Ciconia ciconia*) breeding population in Greece

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The White Stork (*Ciconia ciconia*) is an emblematic bird species throughout its range, making a remarkable increase over the last decades following a population decrease and local extinctions in its breeding range. In 2024, we conducted a nation-wide breeding census of the species on the grounds of the 8th International White Stork Census, in order to assess the Greek breeding population's trend, status, range and productivity. The census methods undertaken included checking human settlements and other localities where the species has been historically nesting, as well as extensive surveys in regions where the species is known to expand. Data were collected by personnel of the Hellenic Ornithological Society (HOS) and Natural Environment and Climate Change Agency (NECCA) Management Bodies, as well as volunteers of the HOS in order to entirely cover mainland and insular Greece. Our findings demonstrate an increase in the White Stork breeding population, now amounting to 2800 pairs and corresponding to a 13% increase within the last decade. Most nests were located on electricity poles, be it artificial (65%) or natural platforms (26%), with fewer nests on other human structures, whereas more than 7800 chicks were counted. The breeding census illustrates that the species is making a comeback in southern parts of Greece like the Peloponnese, as well as readily colonizing insular Greece with a handful of nests in Evvoia, Crete and Lesvos. Further research will provide critical insights into the species' expansion dynamics and its underlying causes, thereby informing targeted and effective conservation strategies.

Keywords: census, artificial nests, range expansion, recolonization

The European Badger (*Meles meles*) in Agricultural Landscapes: Seasonal Dynamics, Farmers' Perceptions, and Public Health Implications

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The aim of the present study was to investigate the ecological role, behavior, and potential public health impact of the European badger (*Meles meles*) in an intensive agricultural area in Galatas, Western Greece. Camera traps were deployed to monitor badger's activity patterns across seasons while fecal samples were collected to assess parasitic infections through microscopic and molecular methods. Farmer's perception regarding badger presence, crop damage and species knowledge were also evaluated via questionnaires. This study was conducted in 0.3 km^2, maize-cultivated areas supporting a local badger population of 8-9 individuals, monitored for 4514 hours. Badgers' activity was lowest during winter and maximum during spring, with a subsequent decline from summer to autumn. Farmer responses aligned with field observations (~70% agreement), with 57% reporting crop damage between 0–20%, 34% between 20–40%, and 9% between 40–60%. Regarding diet, 79.8% of respondents considered the badger herbivorous, while 19% recognized its omnivorous behavior. Forty-five fecal samples were analyzed with four different parasites being identified, including first European and Greek reports of *Strongyloides procyonis* and *Ancylostoma caninum* and the first Greek report for *Perostrongylus falciformis*. *Cryptosporidiidae* members were identified only at genus level. The findings demonstrate the remarkable adaptability of *M. meles* to human-modified environments, showcasing its behavioral flexibility and seasonal reproductive strategies. However, this close association with agricultural areas may increase opportunities for parasite transmission. Consequently, wildlife monitoring is crucial for potential zoonotic threats detection, safeguard livestock, and protect public health, especially in intensively farmed rural landscapes where human-livestock-wildlife interactions are frequent.

Keywords: *wildlife monitoring; zoonotic risk; camera traps; Greece*

Investigating the impact of epigenetic variation on evolution in wild *Cyanistes caeruleus* pedigrees

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Epigenetic mechanisms influence phenotypic plasticity and adaptation. If epigenetic states are heritable and shape offspring phenotypes—similar to epialleles in plants—they could be subject to natural selection, warranting their inclusion in evolutionary theory. The last major update to evolutionary theory occurred nearly a century ago, and Crick's Central Dogma, which dictates a unidirectional flow of genetic information from DNA to protein, is outdated. To bridge this gap, an extended evolutionary synthesis incorporating all forms of inheritance is needed. This PhD project addresses this need by investigating intergenerational epigenetic variation in a large, wild *Cyanistes caeruleus* pedigree. The study quantifies inheritance patterns of 5mC methylation independent of genetic variation and parental effects, leveraging families with extra-pair offspring. Using EM-seq, RRBS, and Pool-seq data from hundreds of individuals—alongside technical replicates—the project will establish a robust analytical pipeline to address the sources and inheritance of 5mC methylation in natural populations. The key aims are: (1) evaluating the role of technical replicates and their relevance in similar studies, (2) identifying genomic regions most suitable for epigenomic analysis, and (3) quantifying heritable 5mC variation using linear mixed models. These findings will enhance epigenomic analysis pipelines, improve statistical robustness in heritability estimates, and provide insights into the relevance of epigenetic variation to evolution.

Keywords: *epigenetic inheritance, 5mC methylation, blue tit, quantitative genetics, evolution, pedigrees*

Wild Boars on Corfu Island… it's complicated
On the situation with Wild Boars *Sus scrofa* on the Greek island of Corfu

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The Wild Boar *Sus scrofa*, is a crucial part of the food chain, a desired game species, but also a menace to some farmers. During Holocene prehistory, but also in recent times the Wild Boar has been periodically part of the faunal elements of some Greek islands. The current situation with its reappearance on Corfu Island raised questions to the locals about how this happened. Data about the species were collected in the field and through interviews with the personnel of the Forest Department, members of the Hunting Clubs, social media material etc., while during 2020/21 a targeted mammal survey took place on the island. The Wild Boar presence during the Pleistocene but also during the Holocene, when Corfu got separated as an island, indicates that the species can be considered native. Additionally, to that, since the mid-1980s, there is a flow of animals swimming from the opposite mainland, naturally recolonizing Corfu. Its first extinction date remains unclear. Its recent local status is affected by the fact that some individuals originate from natural recolonization, while some others from deliberate reintroduction efforts in the 1990s and others possibly by escaping captivity. As it has no natural predators, hunting could continue as a measure of population management, at levels that the species will not be in risk of re-extinction. Also, due to the relative isolation, the island could serve as a backup population, in case of mainland collapse, due to the African Swine Fever.

Keywords: *Wild Boar, Corfu, Recolonization, Native*

Tame, but otherwise the same - little evidence for consistent changes in behavioural traits of island lizards

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Island habitats often differ markedly from those on the mainland in a suite of biotic and abiotic factors. They typically harbour less predators, competitors, and prey species and resources tend to be scarcer or more variable. In response to these conditions, many island dwelling species evolved a series of morphological, physiological, and life-history adaptations, collectively referred to as the 'island syndrome'. While morphological and life-history island-induced trait shifts are well documented, the effects of insularity on behaviour remain largely unexplored. In this study, we examined the effects of insularity on two often interrelated behavioural domains: cognition and personality. We compared a suite of cognitive and personality traits of Aegean wall lizards (*Podarcis erhardii*) from several mainland, island, and small islet populations. We anticipated that the ecological peculiarities of insular environments would induce convergent changes in the behaviour of island lizards. However, contrary to expectations, we found no clear or consistent shifts in cognitive or personality traits linked to insularity. Although both mainland and insular lizards exhibited variation in their behavioural profiles, differences were most pronounced at the population level, potentially obscuring broader patterns associated with island living. One notable exception was a discernible decrease in aggression among insular lizards compared to their mainland counterparts, suggesting that high population densities on islands alter the economics of territorial defense. Our findings highlight the complexity of behavioural evolution in insular systems and suggest that, unlike morphological and life-history traits, behavioural responses to insularity may be more variable and nuanced than previously assumed.

Keywords: cognition, personality, aggression

Restoring Ecological Connectivity in Fragmented Streams: A Case Study on Low-Gradient Larinier Fish Passages in a Turkish Tributary

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The construction of all types of hydraulic barrier on rivers has various ecological impacts, including habitat fragmentation, changes in water quality and a decline in the biodiversity of aquatic communities. Fishes migrating to reproduce are among the most affected by these barriers and different fish passage models have been developed to mitigate this ecological problem. Designed to support the migration of strong swimmers such as salmon and trout, Larinier fish passage (LFP) is typically applied to hydraulic barriers with high vertical drops and base slopes of more than 12%. This study marks the first time that the LFP has been used in a culvert structure with a low base height (approximately 90 cm) and a 4% slope. This innovative approach was developed under natural conditions on the Kurtköy Stream, which flows into Sapanca Lake. Fish migration activity was monitored monthly over two periods: February–December 2023 (without fish passage) and January–December 2024 (with fish passage). During the first period (2023), only *Squalius pursakensis* and *Phoxinus strandjae* were found upstream of the culvert, whereas ten different fish species were recorded downstream. In the second period, individuals of seven different species (*Alburnus istanbulensis, Gambusia holbrooki, Petroleuciscus borysthenicus, P. strandjae, Rhodeus amarus, S. pursakensis* and *Vimba vimba*) were observed above the LFP. Considering that many species of varying sizes used this fish pass this study proposes the LFP—operated under natural conditions at a low slope using an innovative approach—as a fast and practical solution for maintaining ecological continuity in culvert structures with low gradients.

Keywords: *Fish migration, hydraulic barrier, ecological connectivity, small-bodied fish, Sapanca Lake, Kurtköy Stream*.

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Hydraulic Barriers Limit Upstream Fish Diversity: Evidence from Four Tributaries of Lake Sapanca, Türkiye

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To evaluate the impacts of hydraulic barriers on fish assemblage patterns in the İstanbul, Mahmudiye, Yanık, and Balıkhane Streams which discharge into Lake Sapanca, monthly electrofishing surveys were conducted between February 2023 and March 2025 using a SAMUS-725G electroshock device. Sampling was systematically carried out both upstream and downstream of the first hydraulic barrier in each stream. Throughout the study period, 12 fish species were recorded downstream of the barriers in the both İstanbul and Yanık streams, 9 species in the Mahmudiye Stream, and 17 species in the Balıkhane Stream. In contrast, upstream sections contained only 3 species in the İstanbul Stream, 2 in the Mahmudiye Stream, 1 in the Yanık Stream, and 17 in the Balıkhane Stream. Notably, the culvert structure (Barrier 1) in the Balıkhane Stream did not seem to hinder fish movement or alter distribution patterns. Conversely, the first hydraulic barriers in the İstanbul, Mahmudiye, and Yanık Streams were found to significantly restrict upstream fish passage and contribute to habitat fragmentation. These findings underscore the necessity of either removing such barriers or implementing effective fish passage solutions to mitigate their ecological impacts.

Keywords: *Anthropogenic effects, Barrier removal, Downstream, Fish migration, Fish passage, Longitudional connectivity,*

This work was supported by the TÜBİTAK-1001 (Project Number 122Y318).

Contribution to the Arthropoda of the Ionian islets

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The Ionian Islands, also known as the "Eptanisa" (i.e., Seven Islands), are located off the western coast of Greece in the Ionian Sea. There are the seven main islands (although Kythira is geographically separate from the main cluster, situated off the southern coast of the Peloponnese and administratively part of the Attica region), which generally experience a Mediterranean climate with mild, wet winters and warm, sunny summers. The islands are known for their lush green landscapes, in contrast to the more arid Cyclades. Amongst them are a plethora of smaller, rocky islets, predominately between Lefkada, Kefalonia and the coastline of Western Greece. Fourteen of those islets were visited for biodiversity censusing during May 2023. Arthropoda were collected by hand or aspirator, sweep-netting and soil sieving. The collected specimens were appropriately curated, identified, deposited and digitized during the DiSSCo Project at the Zoology Museum of the University of Athens (ZMUA). The main taxa recorded were Coleoptera, Isopoda, Hymenoptera (mainly Formicidae), Hemiptera, Dictyoptera, and Myriapoda found in almost all locations. Biogeographic analyses (UPGMA clustering, similarity indexes) show certain similarities between islets while the small island effect's stochastic factors and chance events are evident for some taxa. Further analyses of the patterns for beta and gamma diversity will aid our understanding of the biodiversity drivers for those islets and how these may be affected by climate change and other human impacts.

Keywords*: arthropoda, islets, Ionian, biogeography, small island effect*

The echolocation and social calls of Cypriot pipistrelle bats: evidence for phylogenetic divergence

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Bioacoustic studies can contribute towards unveiling hidden animal diversity, as demonstrated by small pipistrelle bats (Mammalia: Chiroptera) in Europe. The description of two phonic types, 45kHz and 55kHz in *Pipistrellus pipistrellus sensu lato* led to genetic studies that confirmed the hypothesis for two full species, *P. pipistrellus sensu stricto* and *P. pygmaeus* respectively. However, looking for phylogenetic information in bat echolocation calls may be misleading, since they are more linked to the species habitat and behavior than to genetic history. For example, *P. hanaki* belongs to the *P. pygmaeus* clade but has echolocation calls that are most similar to *P. pipistrellus s. str.* Social calls instead, are likely to be more closely associated with phylogeny, at least in European species. The phylogeny of Cypriot pipistrelles is not yet resolved, since only a handful of specimens have been examined morphologically and genetically so far. Based on these findings, it has been proposed that Cyprus is occupied by *P. pipistrellus s. str.* and the endemic subspecies *P. pygmaeus cyprius,* together with the well differentiated *P. kuhlii.* During the past decades, extensive acoustic material has been collected across Cyprus. Spectral and temporal analyses put in question the existence of *P. pipistrellus s. str.* on Cyprus, since no typical echolocation and social calls of this species have been recorded. These results, in combination with the description of *P. pygmaeus cyprius* which has unique social calls support the hypothesis of a rather distinct lineage and highlight the need for an extensive genetic study.

Keywords: Bioacoustics, cryptic diversity, chiroptera

An updated list of the cave biotopes and other bat roosts in Greece with proposed protection zones

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Caves in Greece (Habitat type 8310: Caves not open to the public) serve as refugia for the majority of bat species listed in Annex II of the Habitats Directive (92/43/EU) as well as provide habitat for several endemic cavernicolous invertebrates. Mitigating pressures (e.g. pollution, vandalisms, nuisance and blockage of entrances) to these fragile biotopes is essential for the long-term survival of the species and constitutes a legal obligation of the state. Moreover, effective management of the broader areas surrounding caves and other bat roosts is equally important, as they provide food to foraging bats and determine the amount and quality of organic matter and water entering the underground habitat as well as its microclimate. During 2019, in the context of LIFE GRECABAT (LIFE17 NAT/GR/000522 «Greek Caves and Bats: Management Actions and Change of Attitude», Actions A3 and C3), we identified the most significant bat roosts in Greece (caves, mines, buildings etc.) as well as cave habitats of important invertebrate species, to be proposed as protection sites in the context of the ongoing Special Environmental Studies and Management Plans. The main selection criteria included the number of bat species and sizes of colonies in each roost, as well as the number of typical species and narrow endemic invertebrate species for Habitat type 8310. Furthermore, we suggested establishing protective zones surrounding each site. In this presentation, we provide an updated approach to the protection of caves and other bat roost in Greece, comprising newly discovered colonies and the modelling of foraging habitats for the bat species.

Keywords: Chiroptera, troglofauna, conservation

Hidden biodiversity in Cretan aquatic habitats: A survey of freshwater molluscs

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Freshwater molluscs play a vital role in aquatic ecosystems and can serve as effective bioindicators of water quality. However, the diversity and habitat preferences of freshwater molluscs on the island of Crete remain poorly documented. We investigated the molluscan fauna of wetlands protected under national law (PD, GG AAP 229/19.06.2012), as well as other aquatic habitats across the island. When possible, we measured physicochemical water parameters to assess the environmental tolerances of the observed species. Field surveys revealed at least 14 freshwater mollusc species, including one bivalve. No molluscs were detected at 16 of the 34 sampling stations. *Galba truncatula* (Müller, 1774) and *Theodoxus fluviatilis* (Linnaeus, 1758) were the most frequently encountered species, while *T. fluviatilis* and *Melanopsis buccinoidea* (Olivier, 1801) were the most abundant, with local densities reaching up to 200–300 individuals/m². Preliminary results suggest that *G. truncatula* and *T. fluviatilis* exhibit a relatively high tolerance to varying environmental conditions, although further research is needed to confirm this finding. The surveyed aquatic habitats act as refugia for at least half of the freshwater mollusc species currently known from Crete. To ensure their effective conservation, we recommend maintaining the existing protection regime and implementing long-term monitoring of both species' presence and environmental conditions in light of ongoing environmental change.

Keywords: *gastropods, bivalves, environmental tolerance, protected wetlands, monitoring scheme*

Freshwater gastropods at risk: new insights on two rare species from northern Greece

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Greece is recognized as a biodiversity hotspot for freshwater gastropods. However, the freshwater gastropod fauna of the Greek mainland remains largely underexplored. *Theodoxus transversalis* (Pfeiffer, 1828), a species with scattered populations across the Danube River basin, is known in Greece from a single site along Axios river. *Holandriana holandrii* (Pfeiffer, 1828), which occurs south of the Alps, has only been recorded in Greece from the Tempi Valley along the banks of Pineios river. *T. transversalis* and *H. holandrii* were recently assessed for the Greek Red List as Critically Endangered and Near Threatened, respectively. We conducted targeted field surveys at 26 sites across Axios and Pineios river basins during spring–summer 2024 and spring 2025 to map the distribution of these species and assess their population status in Greece. *T. transversalis* was not detected at any of the surveyed sites, and its presence in Greece could not be confirmed. *H. holandrii* was found alive at one site along the banks of Axios river, a location where it had not previously been recorded. Our findings highlight the urgent need for expanded field surveys to locate additional populations of both species and to establish a long-term monitoring program for the sites where they are currently found. Future research should focus on identifying specific threats to these species and understanding their responses to environmental change.

Keywords: *river basins, aquatic molluscs, field surveys, Theodoxus transversalis, Holandriana holandrii*

This research was funded by WWF Greece scholarship program

Home range and fly routes estimation of Bonelli's Eagle (*Aquila fasciata*) assist in conservation efforts for the species in Greece

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Identification of movement routes and key areas used by birds is essential for the development of effective management strategies and conservation planning. We implemented an extensive GPS telemetry program to investigate the home range and movement patterns of the Bonelli's Eagle (*Aquila fasciata*) in Greece. Our aim was to identify the species' hotspot areas during the post-fledging dispersal period. We applied dynamic Brownian Bridge Movement Models to estimate the home range (HR: 95%, 75%) and core areas (CAs: 50%) for 54 Bonelli's Eagles that were radio-tagged between 2019–2024. Juvenile eagles were radio-tagged at the nest before fledging across Attica, Evvoia, Peloponnese, Cyclades, Dodecanese, and Crete. Each individual was followed on average for 454 ± 331 days (range: 5–1426 days), contributing to a cumulative monitoring period of over 24,000 bird-days. The 75% and 95% HRs across all individuals was calculated at 6,572 km² and 44,294 km², respectively, while the 50% CA covered 774 km² within Greece. Eagles originating from Crete remained on the island, occasionally visiting nearby islets, whereas individuals from the mainland and other islands also dispersed beyond national borders. CAs were primarily located in Crete, southeastern Peloponnese, and central Greece (both eastern and western regions). The juvenile eagles used concrete aerial pathways within the mainland and between Aegean islands and settled temporarily in certain areas (e.g. small islets, wetlands). Our findings highlight a network of critical areas interconnected by consistent flight corridors, which should be considered when planning infrastructure developments such as wind farms and power lines.

Keywords: satellite telemetry, juvenile dispersal, birds of prey, dBBMM, flying corridors, movement patterns

The genus *Poiretia* (Gastropoda: Spriraxidae); Taxonomy and biogeography of the species present in Greece

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Spiraxidae are distributed mainly in Central America and the Caribbean, while in southwestern Palearctic is represented by two genera, *Poiretia* and *Sardopoiretia*, both are carnivorous land gastropods. The latter is endemic of Sardinia while *Poiretia* is distributed in western Balkans, Italy, Algeria, Libya (Cyrenaica) and NE Turkey. According to previous studies there are seven species within *Poiretia*, three of them, *P. delesserti, P. compressa* and *P. dilatata* with two subspecies (*P. d. peloponnesica*, *P. d. marginata*) are present in Greece, west of Pindos Mts.: Ionian islands, western mainland, Peloponnisos and western Crete. Based on the rich material held in the Natural History Museum of Crete we studied all the Greek taxa. Our study was based not only on shell characters but also on anatomical data for all taxa present in Greece. We have to mention that anatomical data for both subspecies of *P. dilatata* were studied for the first time. Based on the shell and significant anatomical differences we raise the two subspecies at species level. As a result, in Greece we have 4 species, two of them being endemic of Peloponnisos (*P. peloponnesica*) and of Crete (*P. marginata*). The two endemic species reflect the isolation of Peloponnisos and Crete from the Greek mainland during the Pliocene. On the contrary, *P. delesserti* and *P. compressa* present a continuous distribution in the western Balkans and Greek mainland is their southernmost presence.

Keywords: *Mollusca, Zoogeography, Endemism, Euglandininae, Mediterranean*

Preliminary study of the myrmecofauna of Dodecanese islands, Greece

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Greece is a biodiversity hotspot distinguished by its high habitat heterogeneity, hosting a large number of endemic and rare ant species. Despite the abundance of studies on the myrmecofauna of the Dodecanese islands, some islands have not been previously censused necessitating further studies, since collection effort was restricted to larger islands, lacking detailed studies on the ant diversity of smaller islands from the archipelago. This study aims to supplement our knowledge of the ant fauna of the Southeastern Aegean Archipelago (Dodecanese islands), presenting novel data for both major and minor islands (e.g. Nisyros, Kos, Agathonisi, Tilos, Pserimos, Arkioi). We used morphology-based taxonomy, cataloguing the ant fauna of the Dodecanese islands, denoting endemic and alien ant species. New records of both native and non-native species are presented for selected islands, the Dodecanese archipelago as well as Greece as a whole. Although species-level identification and biogeographical analysis are ongoing, the results will contribute significantly to ecological assessments and conservation strategies in the region.

***Keywords**:* checklists, Formicidae, Southeastern Aegean, taxonomy

Seeking for hidden invaders: Investigating ants in plant nurseries of Attica region

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Invasive alien species (IAS) are a major driver of global biodiversity loss while also causing major economic problems. More than 520 ant species have been transported outside their native range with some causing serious socioeconomic and environmental problems. Despite the evident lack of information, most ants seem to reach Europe as contaminants in nursery material and plants. As such, it is important to monitor their presence and spread, especially that of species included in the Regulation of IAS of EU concern i.e. *Wasmannia auropunctata* and *Solenopsis* spp. In Greece, a total of 16 alien ant species have been recorded with data on their impacts being minimal. The aim of this ongoing study is to survey the ant biodiversity of plant nurseries in Attica focusing on: (1) detecting the possible presence of EU concern ant species; (2) evaluating the significance of the horticultural pathway in the introduction and spread of novel or existing alien ant species; and (3) assessing potential suitable microhabitats to native and/or endemic ant species. Ants will be collected from 20 plant nurseries in Attica, located at various sites around Athens. This study is expected to provide novel taxonomic and distributional data on both possibly new and existing alien species introduced and subsequently spread in Attica through plant trade.

Keywords: alien species, biological invasions, Formicidae, introduction pathways, plant trade

New phylogeographic insights into *Elaphe quatuorlineata* (Lacépède, 1789) and the discovery of the Antimilos lineage

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The four-lined snake, *Elaphe quatuorlineata*, is a non-venomous colubrid snake widely distributed across the Balkan and Italian Peninsulas. Within its range, including both mainland and insular Greece, four morphological subspecies have been described, namely "*skyrensis*" from the island of Skyros, "*parensis*" from Paros, "*muenteri*" from some of the Cyclades islands, and "*quatuorlineata*" from the mainland and a few islands. Our study investigated the species' phylogeographic structure and the taxonomic validity of its subspecies using molecular markers. Samples represented the entire geographic distribution, including several islands which had not been previously genetically studied, such as the small Aegean islet of Antimilos. The analysed DNA markers were the mitochondrial cytochrome b gene (*cytb*) and, for the first time for this species, a nuclear single-copy marker derived from the neurotrophin-3 (*NT3*) gene. While the nuclear marker turned out to be remarkably conserved, the mitochondrial marker was suitable for reconstructing robust phylogenies through Neighbor-Joining and Maximum Likelihood analyses that produced trees of similar topology. Notably, our results revealed a distinct and well-differentiated clade corresponding to the "*muenteri*" population of Antimilos whose presence had often been called into question. This lineage forms a monophyletic clade with the "*quatuorlineata*" mainland clade suggesting an ancient geographical isolation from the continental populations. Regarding the described subspecies, the majority were found to be paraphyletic or inconsistently supported, indicating that the current taxonomy does not accurately reflect the subspecific phylogenetic structure and underlines the importance of a future taxonomic reevaluation.

Keywords: Aegean Sea, Four-lined snake, mitochondrial markers, molecular phylogeny, phylogeography,, subspecies

Roe Deer Density Estimation in Three National Parks of North Macedonia: A Baseline for Predator-Prey Management

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Estimating ungulate population densities is inherently challenging and resource-intensive, yet such data are essential for effective wildlife management, particularly where predator-prey dynamics are critical to conservation outcomes. In North Macedonia, native wild ungulate populations remain under significant hunting pressure and may exist at suboptimal densities relative to the carrying capacity. The roe deer (*Capreolus capreolus*) plays a pivotal role in this system, serving as the primary prey of the critically endangered Balkan lynx (*Lynx lynx balcanicus*), whose persistence and recovery depend on adequate prey availability. To inform conservation strategies, we conducted systematic camera trapping across three national parks: Mavrovo, Galičica, and Pelister. Individual male roe deer were identified based on unique antler characteristics, and data was analysed using spatially explicit capture-recapture (SCR) models to infer population density. Both likelihood-based and Bayesian frameworks were used to assess model robustness and uncertainty. Preliminary results reveal spatial variation in density estimates: Mavrovo National Park exhibited the highest density at 1.17 individuals/km² (SE = 0.43), followed by Pelister at 1.07/km² (SE = 0.78), and Galičica at 0.71/km² (SE = 0.91). These baseline estimates represent a crucial step toward understanding the current status of prey availability for the Balkan lynx and provide a foundation for future management and conservation planning aimed at sustaining predator-prey balance in the region.

Keywords: *Capreolus capreolus*, camera trapping, predator-prey dynamics, conservation biology, SCR

Urban Oases: Lizards Exhibit Increased Body Size and Water Loss in Urban Environments

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Rapid urbanization from expanding human development has radically altered the structure, ecology, and microclimate of landscapes worldwide. These dramatic environmental alterations subject ectotherms to novel ecological situations and may select for distinct ecomorphological and ecophysiological traits. Consequently, populations inhabiting urban environments often display unique morphological and physiological traits impacting vital biological functions, such as water balance. Here, we investigate the effects of urban development on morphology and cutaneous evaporative water loss (CEWL) in the Aegean wall lizard (*Podarcis erhardii*) on the island of Naxos, Greece. We found that lizard population density and habitat type strongly influenced snout-vent length (SVL), with more dense populations and larger lizards found in urban areas. This increase in SVL, in turn, seems to drive corresponding increases in key head and limb morphological measures, resulting in an overall larger body size in urban lizards. Higher CEWL rates in urban lizards had a negative relationship with environmental vapor pressure deficit (VPD). Our findings highlight the impacts of urbanization on lizard ecophysiology and ecomorphology and advance our understanding of how urbanization shapes organismal adaptation, offering insights into evolution and persistence in human-modified landscapes.

Keywords: *Podarcis, Naxos, Climate, Morphology, Physiology, Evolution*

Gut Microbiome Diversity in Greek Vipers: A Comparative Perspective

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The gut microbiome, defined as the community of microorganisms residing in the gastrointestinal tract, plays a crucial role in host digestion, immunity, and metabolism. It can also be used to address fundamental questions in evolutionary biology, including coevolution and adaptation to host–parasite interactions. Although extensively studied in certain mammalian taxa, gut microbial communities in other vertebrate groups, particularly reptiles, remain poorly understood. Recent evidence in snakes has revealed ecological and physiological associations with microbial community structure, as well as links to venom composition. Greece is home to five species from the Viperidae family, which offer a new system for investigating gut microbial diversity. This study presents the first comparative analysis of intestinal bacterial communities across *Vipera ammodytes*, *Montivipera xanthina*, *Macrovipera schweizeri*, *Vipera berus bosniensis*, and *Vipera graeca*. Using Oxford Nanopore Technology and full-length 16S rRNA sequencing, we identified 142 bacterial taxa spanning 31 phyla, 16 of which were shared among all species. Alpha diversity indices indicated similar microbial richness and evenness across species, while beta diversity analysis revealed significant differences: *V. ammodytes*, *M. schweizeri*, and *M. xanthina* clustered together, distinct from *V. berus* and *V. graeca*. Clustering patterns appeared to reflect both phylogenetic relationships and ecological factors. These findings fill a key knowledge gap and offer a foundation for future research exploring associations between gut microbiota, venom composition, and snake physiology.

The research project was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) and NECCA under the “2nd Call for Actions to protect, conserve and promote biodiversity. Field studies of endemic, endangered and nationally important species of Greece» (Project Number: 12786).

Parasite Island: Drivers of Ectoparasite Levels in Insular Lizard Populations

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Parasites are key drivers of ecological and evolutionary processes, yet the factors shaping ectoparasite levels in insular populations remain poorly understood. We studied ectoparasite (mite and tick) loads in three lizard species — *Mediodactylus kotschyi*, *Hemidactylus turcicus*, and *Podarcis erhardii* — across 83 island populations in the Aegean Sea, Greece. We captured animals in the field, measured their morphology and physiological condition, as well as quantified their ectoparasites. We tested hypotheses relating parasite burdens to environmental variables (grazing intensity, resource availability, marine subsidies), host traits (sex, size, pregnancy, tail condition), and physiological responses (body condition, body temperature). Our results show that parasite loads vary substantially between species: *M. kotschyi* carried the highest mite loads, *P. erhardii* the highest tick loads, while *H. turcicus* had the lowest levels overall. Larger individuals tended to host more mites, though tick loads were size-dependent only in *M. kotschyi*. Surprisingly, parasite loads showed few consistent links to sex or pregnancy. Grazing intensity was associated with increased tick loads in *M. kotschyi*, but marine subsidies and arthropod biomass had limited effects. Individual-level analyses revealed that mite load correlated with body condition and tail loss in *M. kotschyi*, but parasite loads did not consistently reduce body condition across species. Our findings suggest that host-parasite interactions on islands are shaped by a complex interplay of species-specific traits, individual health, and environmental context, emphasizing the need to integrate ecological, physiological, and biogeographical perspectives in island parasitology.

Keywords: body condition, geckos, lacertids, mites, ticks, island biology

Calypso Bird Observatory – The Coming of Age of the Southmost Bird Ringing Station of Europe

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Gavdos, believed to be Odyssey's mythical Ogygia, is a small, habitat-diverse island at the southmost boundary of Europe, and the entry point for the northward bound migrants crossing the open sea from Africa in spring. Its strategic location makes it an exceptional site for studying open-sea bird migration along the Aegean flyway, a route that remains understudied despite its significance for conserving millions of migratory birds breeding across Europe including Russia and parts of Asia. This presentation highlights the evolution of the University of Crete's research station on Gavdos since its inception in 2002, its challenges, achievements and future prospects, demonstrating its importance within the national as well as international research networks. We provide an overview of annual ringing statistics of some 20.360 birds of 95 species ringed in 8 years (spring 2002-2004 and spring and autumn passage 2021-2024), phenology and parasite loads, along with the human potential and currently running research programs. The locations of the 15 long-distance recoveries are scrutinized with the known population-specific flyways given in the Euring Bird Migration Atlas. Plans are presented for supporting collaborative research networks and multidisciplinary programs in the frame of One Health initiatives for the study and potential establishment of an early warning system regarding emerging zoonotic diseases. The Calypso Bird Observatory plays an important role in advancing ornithological research in Greece, emphasizing its contribution to conservation of migratory bird species and protected areas. Funded by NECCA.

Keywords: *Gavdos, bird migration, zoonoses, One Health, Natura 2000*

The importance of connectivity of wet meadows in supporting the Macedonian crested newt

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Wet meadows in the Prespa basin cover a small area and are often interspaced within and around reed belts. Despite their small area, these habitats support high biodiversity, and are noted to play an important role as breeding and dispersal habitats for amphibians. In this regard, we aim to assess the connectivity of the wet meadows in the transboundary Prespa Basin to evaluate their role in sustaining viable populations of the Macedonian crested newt (*Triturus macedonicus*). Connectivity analyses were conducted in Graphab 2.8, using a 5x5m rasterised wetland habitat map as a baseline, and a 1000m threshold for species movement through unsuitable habitats. The delta Probability of Connectivity metric quantified the importance of habitat patches and corridors in facilitating the dispersal of the Macedonian crested newt. The highest connectivity was observed between patches located between Greater Prespa Lake and Lesser Prespa Lake. Corridor analyses revealed a maximum path distance of approximately 800 meters between patches, with true path lengths rounding to 3 kilometers, including within-patch paths. Higher corridor permeability was associated with better habitat functionality and increased species movement. Twenty-six interconnected meta-patches were identified, highlighting critical areas for maintaining viable crested newt populations. The study underlines the importance of wet meadows in the Prespa Basin for supporting genetic exchange and sustaining viable *Triturus macedonicus* populations. The findings provide targeted recommendations to enhance habitat connectivity, ensuring the species' persistence in this dynamic landscape.

Keywords: *conservation, landscape management, PrespaNet, restoration, Triturus macedonicus*

First record of *Rhinopoma microphyllum* Brünnich, 1782 (Chiroptera: Rhinopomatidae) in Europe

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The greater mouse-tailed bat (*Rhinopoma microphyllum*), a species of the monotypic family Rhinopomatidae, inhabits arid and semi-arid regions and its range extends from northwest African countries through Sahel, Egypt and western Arabia to NW India. During the survey of a coastal bat cave in Arkadia prefecture, Greece, on August 2024, a live male individual of the species was found roosting close to the entrance. On-site identification was based on morphological characteristics and measurements (forearm and tail lengths). Further on, echolocation calls were recorded, tissue samples were collected for genetic analysis, and fresh faecal pellets were gathered for further examination. To the best of our knowledge, this is the first record of the family Rhinopomatidae in Europe, raising questions about the individuals' origin. Although the species does not maintain a permanent population in Greece, it is not known wheather regular seasonal movements take place or novel ecological pressures prompt the species' northward dispersal. This observation highlightings the need for further research on the overseas movement behaviour of bats in the Mediterranean.

Keywords: Greater mouse-tailed bat; off-shore movements; Greece

Nationwide tracing of two top freshwater fish invaders using eDNA sampling

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Environmental DNA (eDNA) has emerged as a powerful tool for biomonitoring freshwater fish, including the detection of invasive species. This study utilises MCMC Bayesian and occupancy modelling to evaluate the efficacy of eDNA methods compared to conventional electrofishing for monitoring two invasive fish species, *Gambusia holbrooki* and *Pseudorasbora parva*, across multiple river basins in Greece. The eDNA approach demonstrated slightly higher sensitivity for detecting *G. holbrooki* (56% detection rate) compared to electrofishing (50%), notably at sites with historical presence, but negative electrofishing results. Conversely, eDNA was less sensitive for *P. parva* (38% vs. 44% for electrofishing), with the false negatives potentially linked to methodological errors, hydrological factors, or inhibition by co-extracted compounds. Environmental variables, such as wetted width, substrate coarseness, water turbidity, and flow velocity, significantly influenced eDNA detectability, with broader waterways enhancing detection and coarser substrates or higher turbidity reducing it. The survey confirmed the widespread distribution of both invasive species, while also revealing new records of *P. parva* in the Peloponnese, highlighting the need for rigorous monitoring to detect and control further spread. These findings underscore eDNA as a less resource-intensive and potentially more sensitive biomonitoring tool, if methodological limiting factors are addressed to optimize its application in national-scale fish surveys.

Keywords: *eDNA, biomonitoring, invasive, occupancy, modelling*

Ecological Corridors towards Species Population Viability: Science, Policy, and Practice

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Ecological corridors are areas that connect isolated patches of natural habitats, enabling wildlife to move through fragmented landscapes. Acknowledging the need of a national strategy for strengthening ecological connectivity in Greece, we paved the way for a) an identification analysis of potential corridors between the Natura 2000 continental areas, b) a pilot ecological corridor mapping of each of three flagship large mammal species (brown bear, red deer, chamois) at a regional scale, and c) a thorough review of ecological corridor related policies at international, EU and national level, proposing improvements to the relevant Greek legal framework. Based on the evidence acquired, we proceed from modelling to pilot application of measures aimed at improving the red deer population viability in Attica-Boeotia. Through a holistic approach, we aim to understand and reduce obstacles that deer encounter in their natural dispersal - through ecological corridors - towards the mountain ranges west of Mt. Parnitha. Moreover, we try to reduce the exposure of dispersing deer to threats, by attracting them away from high-risk areas, while concurrently raising awareness and capacity of local stakeholders to mitigate conflict - real or perceived - with deer. By improving our ecological knowledge for an iconic species, we aspire that our work will also serve as a pivotal case study to highlight the importance of developing a national plan for ecological corridors designation and management.

Keywords: *connectivity, mapping, advocacy, biodiversity, modelling, mammals*

The entomological value of Mt. Triklario/ Sfika: Orthoptera and Lepidoptera

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Mt. Triklario/Sfika in northwestern Greece (GR1340010) lies south of Prespa National Park (GR1340001) and hosts a diverse yet understudied entomofauna. Field surveys were conducted in 2024 to document, enrich, and verify the list of known species of butterflies (Lepidoptera) and grasshoppers (Orthoptera), and to evaluate the ecological importance of the region, focusing on sites under pressure from a planned wind power station project. Sampling was carried out using time-constrained visits and random observations from early June to August (12 sampling days). Across 46 sampling points, 75 butterfly species (including one species complex) and 28 Orthoptera species were identified. Notably, 5 butterfly species were recorded for the first time in the area. Among butterflies, 7 species are Near Threatened or Vulnerable in Europe, 2 species are protected under the Habitats Directive (92/43/EEC) (*Euphydryas aurinia* & *Parnassius mnemosyne*), and 5 are endemic to Europe. Regarding Orthoptera, 3 species are of conservation interest, including *Paracaloptenus caloptenoides*, a species protected under the Habitats Directive (Annex II, 92/43/EEC), recorded inside the polygon of the planned wind power station. Our results highlight the ecological value of the mountain, which faces threats such as land artificialization, habitat loss and degradation, and grazing abandonment or intensification. The study underlines the need for continued monitoring of the area and supports the region's importance for biodiversity conservation. This work was undertaken as part of the project "Biodiversity Conservation in Transboundary Prespa", coordinated by the NGO network PrespaNet.

Keywords: *Lepidoptera, Orthoptera, Biodiversity conservation, Ecological importance, PrespaNet*

Does Habitat Quality Shape Animals Cognition and Behavior? Evidence from Two Populations of a Single Species

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Rapid environmental change requires animals to adjust their behavior to novel conditions. These behavioral adjustments often rely on cognitive processes, such as acquiring, retaining, and using environmental information. While cognition plays a critical role in behavioral flexibility, we still lack a clear understanding of how cognitive traits vary across different populations within a species. In other words, whether such differences reflect plastic responses to local environments or indicate potential for local adaptation and evolutionary change. To address this, we studied multiple mainland populations of the Aegean Wall Lizard (*Podarcis erhardii*) that differ in habitat conditions, including predation pressure, structural complexity, and refuge availability. We tested four behavioral and three cognition traits. Here we present our findings from two populations, Litochoro and Chalkidiki, based on three behavioral assays: one assessing problem-solving ability (Escape box task) and two evaluating personality traits: neophobia and anti-predator behavior. Our initial results revealed differences between the two populations, suggesting that natural variation in habitat quality may act as a selective pressure shaping cognitive traits.

Keywords: *Cognition*, *Neophobia*, *Anti-predator behaviour*, *Problem solving*, Lacertidae, *Podarcis*

The research project was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the Call "Basic Research Financing (Horizontal support for all Sciences), National Recovery and Resilience Plan (Greece 2.0)" (Project Number: 16081).

Recording and analysis of predation incidents of loggerhead sea turtle (*Caretta caretta*) hatchlings by their main predator, the yellow-legged gull (*Larus michahellis*), at Sekania, a Strictly Protection Zone of the NMPZ

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The research was conducted at the National Marine Park of Zakynthos (NMPZ), specifically at Sekania beach, a Strictly Protected Area. Data collection was achieved through an advanced monitoring system, which contributed to the acquisition of scientific information for management purposes. Since 2022, cameras have been installed along the Sekania nesting coastline by WWF Greece in cooperation with the Management Agency, through which data is collected. It should be noted that human presence disrupts the natural flow of ecosystem processes and acts as a deterrent not only for predators but also for the presence of the protected species itself, the loggerhead sea turtle *Caretta caretta*. Therefore, innovative technological methods are used to conduct field research. The study that aimed at recording and analyzing predation incidents involving hatchlings and understanding predator ecology, was carried out during the summer of 2023. In this research, 55.460 video recordings were analyzed using a documentation protocol consisting of 23 columns related to the predation process and predator behavior. Subsequently, a descriptive statistical analysis of the data was conducted based on spatial, temporal, and monthly factors, as well as the moon phase. Additionally, failed nesting attempts of the loggerhead sea turtle (*Caretta caretta*) were recorded and analyzed. The areas with intense predation and the hours during which the predators active were identified. The study of the main predator species targeting hatchlings and eggs aims, among other objectives, to develop strategic management measures for the conservation of sea turtles both within the NMPZ and at an international level.

Keywords: *Protected Areas, Sekania, Caretta caretta predation, Larus michachellis ecology*

Impact of the environment on cognitive behaviour in two populations of the Aegean wall lizard (*Podarcis erhardii*)

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Cognitive processes enable animals to perceive, respond to, and adapt to environmental challenges. Lizards, as top consumers in many islet ecosystems, offer valuable models for investigating how ecological pressures shape the evolution of cognitive traits. This study examined neophobia, exploratory behaviour, and problem-solving ability in two populations of *Podarcis erhardii* subjected to contrasting levels of predation and isolation. Twenty-one individuals were collected from Mount Parnitha (mainland, high predation) and 24 from Anafi Island (low predation). Behavioural assays included novel objects to assess neophobia, a lid-removal and escape box tasks to evaluate problem-solving ability, and movement tracking in a novel environment to onvestigate exploratory behaviour. Results showed that island lizards exhibited significantly lower neophobia and greater exploratory tendencies compared to their mainland counterparts, suggesting that reduced predation pressure promotes bolder and more exploratory phenotypes. Neophobic responses were found to be flexible and context-dependent, reflecting adaptive behavioral plasticity rather than fixed personality traits. Both populations demonstrated problem-solving capabilities though individual learning performance varied. Additionally, morphological variables such as snout–vent length (SVL), sex, and tail condition were found to influence behavioural outcomes. These findings underscore the importance of ecological context in shaping cognitive flexibility and behaviour in reptiles, contributing to a broader understanding of animal cognition and informing conservation strategies, particularly in the face of habitat change, biodiversity loss, and increasing anthropogenic pressures.

Keywords: *cognition, learning, behavioral ecology, Podarcis, Lacertidae*

The research project was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the Call "Basic Research Financing (Horizontal support for all Sciences), National Recovery and Resilience Plan (Greece 2.0)" (Project Number: 16081).

Bird ringing in the Nestos-Vistonis National Park

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Bird ringing is a useful tool for bird migration and biodiversity monitoring of an area. In the years 2022-2023, nine ringing expeditions with a total of 55 field days, took place in the Nestos-Vistonis National Park, during the NECCA project "Monitoring project of migration and other biological parameters of avifauna". More specifically, ringing took place in Porto Lagos, Almyra Velonis, Lafri and Nestos Delta. Mist nets where used and also birds were ringed in nestboxes in Rhodopi Prefecture. There were six ringing expeditions for passerines and waders (spring, autumn, winter of 2022 and 2023), each lasting about a week. There were also three expeditions for ringing chicks of Kestrels (*Falco tinnunculus*) and Lesser Kestrels (*Falco naumanni*) in nestboxes installed by the NECCA. In total, there were ringed 974 birds of 70 species. Some species were ringed for the first time in the project area, e.g. Great Spotted Woodpecker (*Dendrocopos major*), Barred Warbler (*Curruca nisoria*) and Masked Shrike (*Lanius nubicus*). There was an international retrap of a Wood Sandpiper (*Tringa glareola*) from Sweden. Many bats were also caught, including a new species for Greece. Therefore, the study area is considered to be important for avian migration and nesting, and continued monitoring is recommended.

Keywords: *migration, nesting, mistnets, nestboxes, waders, passerines*

Hybridization of the Epirus water frog, *Pelophylax epeiroticus* (Amphibia, Anura), in Greece

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The Epirus water frog, *Pelophylax epeiroticus*, has been recently assessed for The IUCN Red List of Threatened Species (2023) as Near Threatened. In this study we investigated the extent of hybridization between *P. epeiroticus* with other *Pelophylax* species in Greece, using molecular markers. Total genomic DNA was extracted from 363 individuals, covering the entire known distribution of *P. epeiroticus*, as well as adjacent regions, and the serum albumin intron-1 (SAI-1) gene segment was amplified. SAI-1 analysis identified four hybridization areas. 216 individuals from these areas were further genotyped in 12 microsatellite loci. Hybrid detection using SAI-1 revealed 44 hybrids (18 *P. epeiroticus x P. kurtmuelleri*, 20 *P. kurtmuelleri x P. shqipericus*, and 6 *P. shqipericus x P. epeiroticus)*. Microsatellite analysis uncovered two distinct gene pools within these hybridization areas and revealed 14 additional individuals showing mixed ancestry. The combined use of molecular markers suggested that 39.6% of the 363 individuals represented *P. epeiroticus*, 44.3% *P. kurtmuelleri*, and 15.9% hybrids. The discovery of genetic elements linked to *P. epeiroticus* and *P. shqipericus* outside their natural ranges, as well as the identification of their hybrids through SAI-1, is of exceptional importance. The population status of Epirus water frog, combined with the potential genetic erosion through hybridization with other *Pelophylax* species, raises concerns about its current conservation status and emphasizes the need for targeted conservation efforts and deeper investigation into the pressures threatening this species.

Keywords: Hybrid detection, SAI-1, microsatellites, *Pelophylax shqipericus*, *Pelophylax kurtmuelleri*

The biodiversity of the Almyropotamos Wetland

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The Almyropotamos Wetland is a small but an important wetland with unique habitat characteristics, which until today remains unknown to the general public but also to the scientific community. It is located in the prefecture of Fthiotida, about half a kilometer from Achladi village. It is a coastal permanently flooded wetland with brackish water with characteristic halophytic and semi-halophytic vegetation (tamarisks, reeds, etc.). The aim of this work was to investigate and record for the first time the animal biodiversity of the Almyropotamos wetland. Samplings and field observations were conducted from 2023-2025 with frequent site visits at all seasons. Four gastropod taxa we recorded; *Tritia neritea, T. corniculum, Steromphala adansonii* and one species from family Muricidae. Three crustacean species were documented; *Gammarus aequicauda, Idotea balthica* και *Lekanesphaera monody,* with the former being particularly abundant. Regarding the fish fauna, 12 species have been recorded with *Mugil cephalus*, *Chelon labrosus*, *Dicentrarchus labrax*, *Sarpa salpa*, *Gobio cobitis* being common and regular visitors of the wetland. Permanent resident of the wetland is the non-indigenous *Gambusia holbrooki,* and rare-visitors with a single-recording were *Lithognathus marmyrus*, *Parablennius gattorugine*, *P. sanguinolentus, Sparus auratus* and *Atherina boyeri.* During the study, 53 bird species were recorded and all bird check lists have been added to the eBird global database. Regular visitors include *Larus michahellis*, *Buteo buteo*, *Corvus cornix, Hirundo rustica, Phylloscopus collybita, Passer hispaniolensis* and *Tringa nebularia.* Last but not least, 15 amphibians and reptiles have been documented including *Testudo marginata*, *Elaphe quatuorlineata*, *Lacerta trilineata* and *Pseudopus apodus.*

Keywords: animals, birds, conservation, diversity, estuaries, coastal

Regional variations of Bonelli's eagle (*Aquila fasciata*) reproductive phenology and breeding success rates across Greece and Cyprus

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To assess the breeding status of the *Aquila fasciata* population, we conducted a five-year survey (2019–2023) across both historical and newly identified territories of the species in Greece (i.e., the Aegean Islands, Crete, Attica, and the Peloponnese) and Cyprus, as part of a large-scale conservation project. In total, we monitored 135 territories, revealing regional variations in reproductive phenology, with the onset of egg-laying occurring earliest in Attica and latest in the Peloponnese. Reproductive success, measured as the ratio of successful to occupied territories and productivity (fledglings per occupied territory) ranged from 0.34 to 0.53 and 0.50 to 0.83, respectively, with Cyprus exhibiting the highest rates and the Aegean region the lowest. Although the number of fledglings per successful pair consistently exceeded 1.1 across all regions, the overall breeding success (fledglings per egg-laying pair) remained below 1.05 in Greece and reached 1.36 in Cyprus. Alarmingly, high juvenile mortality (≥ 58%), combined with low productivity and limited breeding success, raises serious conservation concerns about the long-term viability of the Bonelli's eagle populations in both Greece and Cyprus.

Keywords: *egg-laying*, *productivity*, *islands, LIFE Bonelli eastMed*

First breeding colony of Audouin's Gull in Petalioi island complex (S. Evoikos/Greece)

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The well-documented knowledge of breeding biology and nesting habitat use constitute information of vital importance for seabird species that we aim to conserve or plan to use as bioindicators of marine ecosystems. Here we present the first results concerning breeding behaviour and egg dimensions (length, width and weight) of Audouin's Gull (*Ichthyaetus audouinii*) on a new colony established in an uninhabited islet of Petalioi Island Group (S. Evoikos/Greece). Colony size has been determined by direct counts of occupied nests within the framework of a seabird's survey expedition during mid-May 2024. More specifically, a total number of 28 eggs and 18 chicks were found in 20 active nests. The overall clutch size (mean ± s.d.) of the colony was 2.30 ± 0.73 eggs. Length, width and weight scores of eggs were estimated at 6.29 ± 0.21 cm, 4.42 ± 0.15 cm and 61.01 ± 7.21 grams respectively. In addition, egg size was also estimated according to the volume index, $L \times W^2$ (length and width in cm) so as to make comparisons with other colonies, and was found 123.30 ± 10.43. The data presented here demonstrate the ability of this endemic species to the Mediterranean Basin, in occupying new territories scattered on islets and small rocky islands in the Aegean. Taking into consideration that Audouin's Gull is still geographically restricted and suffered by a global decrease in numbers, more attention is needed regarding the knowledge of newly established colonies.

Keywords: *marine birds, Ichthyaetus audouinii, Evoikos, Charadriiformes, avifauna*

Eurasian Spoonbill *Platalea leucorodia* (Threskiornithidae, Aves) in Greece: Breeding population, nesting and wintering grounds

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We studied the Eurasian Spoonbill *Platalea leucorodia* in Greece by recording the breeding population, the colonies and the wintering grounds. At least seven surveys of Spoonbill colonies were carried out during the period 2003-2024. In each survey the location and the number of nests of each nesting species were recorded. The wintering grounds were found from the confirmed observations of colour-ringed birds and data from the GPS-GSM transmitters that were attached to juvenile birds at the colonies of Axios Delta and Kerkini Lake. The number of nests increased during the study period from 223 (2003) to 814 (2024). Spoonbills have been recorded nesting in at least 13 colonies at seven wetlands. The number of colonies increased from four in 2003 to eight in 2024. Spoonbills were nesting in mixed colonies with egrets, herons, cormorants and Glossy Ibises exclusively within protected areas. Despite the expansion of colonies and the increasing number of nests, more than 90% of the nesting population was recorded in three wetlands (Amvrakikos Gulf, Kerkini Lake and Axios Delta). The birds nesting in Greece wintered at Greek wetlands mostly (29 birds or 74.4%). The rest (10 birds or 26.6%) wintered in Turkey (4 birds or 10.3%), Tunisia (3 birds or 7.7%), Israel (2 birds or 5.1%) and Egypt (1 bird or 2.6%). The growth in numbers of colonies and nests may be attributed to the improved wetland protection status in Greece and therefore, the absence of disturbance in nesting and wintering grounds.

Keywords: *Wetlands, bird ringing, telemetry, GPS-GSM transmitters*

The first Red List of Greek Odonata

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The Greek odonate fauna is composed of 79 native species, including 3 endemic, out of the total 143 species recorded in Europe. Despite Greece being a significant hotspot for Odonata conservation in Europe, no extinction risk assessment has been carried out until recently. In 2023, the first Greek Red List for odonates was carried out. Extinction risks assessments were based on the IUCN Red List Categories and Criteria following their most updated guidelines. Out of 79 species assessed, 17 (~22%) have been assigned in a threatened category (Critically endangered-CR, Endangered-EN, Vulnerable-VU). One species, *Pyrrhosoma elisabethae*, a Balkan endemic, was assessed as CR.. The three Greek endemics (*Boyeria cretensis, Coenagrion intermedium and Cordulegaster helladica*) have been assessed as EN, EN and VU, respectively. The main threats to Greek odonates include droughts and habitat shifting due to climate change, and human induced habitat alterations. Water abstraction, nutrients, and pesticides are also significant threats. Spatial data analysis revealed that 11 out of the 17 threatened species have less than 50% coverage within the Natura 2000 network. Conservation efforts must heavily rely on legislative measures and policy enforcement at both national and sub-national levels, together with land and water resources management. Awareness campaigns, especially for the threatened species are necessary. Population data are lacking for the majority of species, emphasizing the need for further research, particularly in light of changing climate conditions and shifts in species distribution. Conservation measures must be implemented as soon as possible for *P. elisabethae* in order to avoid its possible extinction in the near future.

Keywords: biodiversity, IUCN categories and criteria, conservation, endangered species

Distribution update and habitat assessment of the Greek endemic and endangered odonates *Coenagrion intermedium* and *Boyeria cretensis*

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The dragonfly fauna of Crete is relatively limited in diversity but includes two endemic and globally endangered species: *Coenagrion intermedium* (Lohmann, 1990) and *Boyeria cretensis* (Peters, 1991). In 2024, an extensive field survey was conducted at 98 sites across the island, covering all known published and unpublished locations of occurrence, as well as potentially suitable habitats. The aim was to update species distributions, enhance understanding of their habitat preferences, and assess prevailing threats. At each site, various ecological parameters were recorded, including stream channel characteristics, bank structure, anthropogenic modifications, and riparian zone quality. Habitat assessments were conducted using the QBR and IHF indexes. *B. cretensis* was recorded in 16 watersheds across Crete and co-occurred with *C. intermedium* in 15 of them. Absence was noted in 8 and 7 sites or subcatchments, respectively. Both species were predominantly found in shallow streams (average depth: 10–30 cm), with 46% of these habitats featuring a coarse substrate. High levels of shading (70–95%) were observed in 81% of occurrence sites, and 62% exhibited complex riparian vegetation. The presence of submerged roots within the river channel emerged as a critical microhabitat feature for larval development of both species. Severe threats for both species are riverbank modifications and the desiccation of springs or stream segments. The findings emphasize the need to maintain the structural integrity of permanent rivers and streams in Crete and highlight the synergic effect of increasing water abstraction and the ongoing climate crisis on the endemic dragonfly populations.

Keywords: *Crete, dragonfly conservation, Cretan Spectre, Cretan Bluet, endemism*

This research was funded by WWF Greece scholarship program

Species-level molecular phylogeny of the genus *Entomogonus* Solier, 1848 (Coleoptera, Tenebrionidae)

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The genus *Entomogonus* Solier, 1848 has comprised 15 described taxa most of which distributed in Anatolia. In this study, we investigate the phylogenetic relationships of specimens from Türkiye and neighbouring areas with the aims to delimit already described and potentially cryptic species of the genus and reconstruct their evolutionary history. A species-level phylogeny of the genus were inferred using mitochondrial and nuclear markers. We applied various species delimitation algorithms to define species partitions in the group. Phylogenetic analysis recovered 18 major clades that partially supports the existing morphological species boundaries. In addition to the previously described species, four new lineages with specific morphological characters and geographic distribution were obtained. Our analyses show that the divergence and diversification of the main clades dated back approximately 20-22 Ma ago correspond to the period in which Anatolia was undergoing an important differentiation process that probably isolated the ancestral populations to restricted areas or basins. This implies an important role of Anatolian habitats and ecosystems from the early Miocene to the present, in the speciation and divergence of genus *Entomogonus*.

Keywords: *Entomogonus, Tenebrionidae, species delimitation, morphology*

Curiosity filmed the cat: Use of camera traps to estimate the abundance of the Cretan wildcat

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The Cretan wildcat is the most elusive carnivore of Crete and available information for the species are extremely sparse. Its taxonomy and phylogenetic relations remain uncertain. The aim of our study was to estimate the abundance and the habitats of the Cretan wildcat by deploying camera traps (CT). Six areas were selected (two in each of the three mountain ranges of Crete), where 10 stations of CT pairs were deployed per area, and distance of about 1km between the stations. The CTs remained in each station for more than a month. Survey effort totalled 4673 active trap nights. We used two alternative lures, catnip (*Nepeta cataria*) and cat urine from domesticated cats, to attract wildcats. Species distribution modelling including ours and older documented points of the animal's presence, was used to estimate the area of occupancy and capture-recapture estimators were used for abundance. According to our species distribution models, we estimated the area of occupancy to 657 km^2. in Crete. We managed to document the presence of at least 10 individuals (2 Lefka Ori, 2 Psiloritis 6 Dikti). The only area that had multiple recaptures was Dikti (Katharo plateau) and we estimated the wildcat abundance to 0.5 – 2.5 individuals /km^2, which is comparable to other relevant studies. Assuming the estimation from Katharo applies to the total area of occupancy, the total population of the Cretan wildcat ranges between 328-1642 individuals. Documented threats for the Cretan wildcat are hybridization, poison baits and shepherd-wildcat conflicts. This project was funded by N.E.C.C.A. Greece.

Keywords: SDM, occupancy, capture-recapture

Genetic Structure and Differentiation of *Phoxinus strandjae* (Drensky, 1926) Populations in the Sapanca Basin (NW Türkiye)

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The aim of this study is to conduct a genetic analysis of the Bulgarian minnow *Phoxinus strandjae* distributed in the Sapanca Basin (NW Türkiye) and to contribute to both the biodiversity data of Türkiye and the scientific literature by submitting the obtained data in GenBank. A total of 163 specimens of *P. strandjae*, representing 11 populations, were collected using a SAMUS-725G electrofishing device from four stations situated within the lotic systems of the Sapanca Basin between September 2023 and July 2024. The dorsal fin tissues were dissected under laboratory conditions from the collected fish specimens for DNA isolation. DNA extractions from the dissected tissue samples were performed using the Qiagen DNeasy Blood & Tissue Kit following the manufacturer's protocol. The DNA barcode region (COI) and nuclear ISSR1 and ISSR3 loci were employed to assess the genetic variation among populations. Phylogenetic analyses were conducted using MEGA X, DnaSP 6 and Popgene 1.32. MEGA X was utilized to construct phylogenetic trees and calculate pairwise genetic distances. DnaSP 6 was employed to assess haplotype diversity, nucleotide diversity, and polymorphism indices, while Popgene 1.32 was used to estimate genetic differentiation parameters. The conducted genetic analyses provide a fundamental framework for understanding the population structure, genetic diversity, and evolutionary dynamics of *P. strandjae* in the Sapanca Basin. The present study effectively determined whether hydraulic barriers in the Sapanca Basin have led to genetic differentiation or caused a genetic bottleneck among the upstream and downstream populations of this species.

Keywords: *Genetic diversity, DNA barcode, ISSR, freshwater fish, population differentiation*

This study was supported by the TÜBİTAK-1001 (Project number 122Y318).

Something old, something new, something borrowed, something shrew: a geometric morphometrics approach for the study of fossil and modern *Crocidura zimmermanni* mandibles

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The Cretan shrew, *Crocidura zimmermanni* (Wettstein, 1953), is one of the few species of the Pleistocene endemic faunas from Mediterranean islands that still survives as a "living fossil". The species is currently classified as Endangered and it is only found in the mountainous areas of Crete but its past distribution, indicated by the fossil record, included many sites from lower altitudes. The present study examined complete mandibles of *C. zimmermanni* from five published fossil localities (photographed in the Department of Earth Sciences of Utrecht University) and modern specimens (kindly provided by the Natural History Museum of Crete) using geometric morphometrics, to uncover possible responses of the species to ecological pressures of the past. Shape and centroid size analyses resulted in a distinction between fossil and present-day specimens, in general agreement with metric data from previous researchers, attributing these differences to adaptations of the Cretan shrew upon the arrival of competitive shrew species in Crete or to adaptations to new habitats. Smaller- scale variations between the different fossil localities are also observed, but more geological and paleoenvironmental data are required to determine if they can be correlated with specific events. Further analyses will be conducted in comparison with *C. gueldenstaedtii* specimens and taphonomical alterations observed on the fossil *C. zimmermanni* specimens that are considered indicative of the interactions of these animals with their predators.

This research was funded by the Hellenic Zoological Society under the “Margarita Metallinou scholarship program”.

Keywords: Cretan shrew, shape, centroid size, Pleistocene, Crete

Stranding Events and Causes of Mortality of Beaked Whales (*Ziphius cavirostris*) in Greece: A Review of 30 Years of Strandings Data

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Cuvier's beaked whale (*Ziphius cavirostris*) is the most frequently stranded beaked whale species in the Mediterranean Sea, while other species, such as the *Mesoplodon* spp., are reported mainly at the Western Mediterranean area. Strandings of beaked whales have been documented along Mediterranean coastlines since 1803. Various anthropogenic factors, including military activities, seismic surveys, vessel collisions, bycatch, ingestion of plastics, pollution, as well as parasitic and infectious diseases, have been associated with these events. This study presents an overview of beaked whale strandings recorded along the Greek coastline over the last 30 years (1995-2025) and investigates potential causes of mortality. From 1995 to mid-2025, more than 172 Cuvier's beaked whales' strandings were recorded in Greece, involving both single individuals and mass strandings. In recent decades, several mass strandings have coincided with naval mid-frequency active sonar (MFAS) exercises. Necropsy findings from the majority of these events revealed consistent lesions compatible with "gas and fat embolic syndrome", suggestive of decompression-like sickness. Other pathological findings included suppurative granulomatous nephritis caused by nematode infections (*Crassicauda* spp*.)*, bronchopneumonia, and evidence of plastic ingestion. These findings underline the urgent need for the establishment of a coordinated National Stranding Response Network, the development of standardized necropsy protocols and systematic collection of biological samples. Such measures are essential to accurately assess mortality rate and causes of death, evaluate emerging threats, and implement effective conservation strategies for beaked whales in Greek Seas.

Keywords: *marine mammals, Ziphius cavirosrtis, mass stranding, anthropogenic threats, diseases, Greek Seas*

Phylogeographic patterns in the sky islands of the South Balkans: the cases of the Orthopteran genera *Parnassiana* and *Oropodisma*

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Sky islands are isolated mountains surrounded by lowlands with extremely different habitats from them. Their inhabitants are subject to complex evolutionary mechanisms, as their level of isolation shifts frequently due to the intervening lowlands acting both as barriers and corridors. *Parnassiana* and *Oropodisma* are two Orthopteran genera endemic to the mountains of the Balkans with similar distribution patterns, represented by numerous local endemic species co-occurring on the same mountains. The aim of this project is to compare the dispersal patterns and evolutionary history of the two genera using phylogeographic methods based on mitochondrial markers. Specimens were collected from 39 mountains of the South-Western Balkans and total DNA was extracted. Sequences were obtained via the Sanger method, phylogenies were reconstructed using Bayesian Inference analyses, and divergence times were estimated with BEAST. Results show that divergences among major clades in both genera predate the Pleistocene glacial cycles, and are related to processes of the Pliocene. For example, the Korinthian Gulf is a barrier isolating Peloponnese for more than 3.5 my, and the lineages inhabiting Taygetos are basal at their respective clades. For more recently diverged lineages, *Oropodisma* shows a simple pattern with nearby mountains sharing closely related lineages that split in the Middle Pleistocene, while *Parnassiana* is more complex, with species co-occuring in the same mountains and populations from distant mountains appearing close phylogenetically.

Keywords: *balkan endemics, glacial cycles, mitochondrial marker, Peloponnese, phylogeny, Pindos range*

Following footprints: recording Gliridae species in Sterea Ellada and NE Peloponnese

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Despite the increasing efforts in recent years the three more common dormouse species to record in Greece – the forest dormouse (*Dryomys nitedula*), the edible dormouse (*Glis glis*) and the hazel dormouse (*Muscardinus avellanarius*), distribution data at the southern parts of the country remain incomplete.Thus, this study presents the findings of the field survey carried out across ten Natura 2000 sites in Western Greece, Eastern Sterea Ellada and Northeastern Peloponnese. At each site, 15 track tunnels were deployed on tree branches during the summer of 2024 and collected after ca. three weeks. Additionally, trap cameras were installed at each site, in order to support the evaluation of the study method efficiency in recording dormice and to increase the possibility of recording the regionally rare *Muscardinus avellanarius*. A rather low proportion of the identified tracks belonged to the Gliridae family (28,8%), suggesting lower presence in comparison to other regions in Greece. However, the results did confirm the presence of all three species in the study area. *Glis glis* was detected in five out of ten sampling sites, indicating its wider distribution. In contrast, *Dryomys nitedula* was recorded at only one location (Mt. Panaitoliko), an unexpected observation that contradicts other findings, such as from most parts of the Peloponnese, where it is rather prevalent. On the other hand, the hazel dormouse was recorded in two sites. In conclusion, these findings enhance the current knowledge of Gliridae species and provide valuable insights for future monitoring and conservation efforts.

Keywords*: Glis glis, Dryomys nitedula, Muscardinus avellanarius, track tunnels, distribution*

Bioblitzes and the City Nature Challenge 2025: Creating a Citizen Science Movement for Biodiversity Monitoring in Greece

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Citizen Science initiatives, such as Bioblitzes, have proven effective strategies for enhancing public engagement in biodiversity monitoring while producing valuable ecological data. iSea, in the framework of the "observing NATURE" project, has organised several Citizen Science actions aiming to raise public awareness and participation in the production of primary biodiversity data, in connecting people with nature and science, but also to promote the use of citizen science data within the academic community. The City Nature Challenge (CNC) is an annual, global Bioblitz event encouraging extensive public participation in recording urban biodiversity through friendly "contests" between cities worldwide. In 2025, iSea acted as the national organiser for Greece, coordinating activities in Thessaloniki and Athens. During all Bioblitzes, participants recorded local species, making their observations through a Citizen Science tool, iNaturalist, following specific guidance to ensure data reliability. Collaboration with academic institutions, NGOS, local authorities, and initiatives was crucial in maximising outreach and scientificity. In only three events, citizens contributed 1,751 observations, documenting 811 species, with the involvement of 191 observers. The initiative aims to establish a sustainable Citizen Science nationwide initiative, involving citizens in conservation efforts. While promoting urban bioblitzes, such as CNC, can potentially set the foundations for creating urban biodiversity checklists, it can also highlight the ecological importance of green spaces in cities and guide management strategies within sustainable development. Furthermore, the development of Citizen Science actions, through the structuring of systematic data collection protocols, can increase the robustness of locally based ecological knowledge and address environmental knowledge gaps, but more importantly, improve the attitudes and understanding of the public on environmental topics.

Keywords: *citizen participation, environmental awareness, iNaturalist, conservation, biodiversity data*

Living among the relics: A multi-approach survey of mammalian diversity in archaeological sites of Greece

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Archaeological sites are expected to function as refugia for biodiversity, providing shelter and stable habitats for many species. In this study we assessed for the first time the mammalian diversity of six archaeological sites, i.e. Mystras, Akrokorinthos, Ancient Messini, Epidaurus, Ancient Olympia in the Peloponnese and Ancient Delphi in Sterea Ellada. We employed a combination of approaches, namely, direct or indirect observations (through biondicative signs), camera trapping, live trapping and owl pellet analysis, and all data was recorded on the Qfield GIS application. The analysis of Barn Owl (*Tyto alba*) pellets from Ancient Olympia and Long-eared Owl (*Asio otus*) pellets from Ancient Epidaurus revealed the presence of small mammals, such as *Dryomys nitedula*, *Crocidura gueldenstaedti*, *Microtus thomasi*, *Apodemus flavicollis/sylvaticus,* and *Mus musculus domesticus.* In addition, live trapping revealed the presence of the common taxa *Apodemus epimelas*, *Mus musculus domesticus* and *Rattus rattus*, whereas *Meles meles*, *Martes foina* and *Vulpes vulpes* were commonly recorded through faecal identification at several sites. Notably, spraints of the protected species *Lutra lutra* (otter) were found in Ancient Olympia. Camera traps in Mystras captured *Meles meles* and several individuals of *Sus scrofa*. Finally, a few bat species were documented: *Rhinolophus ferrumequinum* in Akrokorinthos and *Rh. hipposideros*, *Rh. ferrumequinum* and *Myotis nattereri* in Mystras. The protected environment of archaeological sites does seem to support a good species diversity but to fully understand their ecological importance, a more extensive and systematic study of these areas is required, as well as the implementation of this work in more archeological sites.

Keywords: owl pellet analysis, live trapping, camera trapping, species presence

Move, Adapt, or Die: The genomic diversity of *Gypaetus barbatus* and the impacts of climate change

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Estimation of the genomic diversity of natural populations, along with its spatial distribution, is essential for understanding the ecological and evolutionary processes that shape population structure and influence their resilience to environmental change. Such insights are crucial for developing effective conservation and management strategies. The bearded vulture (*Gypaetus barbatus*) has a limited population across Europe, with particularly low numbers in Greece, where it is currently found only on the island of Crete. Our aim is to investigate the biodiversity patterns of the Cretan bearded vulture population and to provide an in-depth understanding of the genomic basis of adaptation, as well as the species' responses to environmental pressures. Additionally, we will gain insights into their phylogeny, enhancing our understanding of their evolutionary relationships. To achieve these objectives, we analyzed 27 historical samples (feathers, toepads, and blood) collected from individuals in Crete over the period 1971–2023, along with an additional six samples from captive bearded vultures housed at the Owl & Birds of Prey Rescue Station in Austria, originating from wild populations in Greece and Asia. DNA extraction and library preparation were carried out using specialized protocols for historical DNA in a dedicated cleanroom of the ancient DNA lab, IMBB-FORTH, followed by high throughput whole-genome sequencing. Our results are expected to shed light to the evolutionary relationships and potential patterns of adaptation among individuals of different geographic origin, in order to inform targeted conservation actions and policy recommendations.

Keywords: *Bearded vulture, Conservation genomics, Genomic diversity, Historical DNA*

Chalcidoidea of Cyprus: Biodiversity, distribution, ecology and biological invasions

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Chalcid wasps (Hymenoptera: Chalcidoidea) are a hyper diverse group of insects with more than 27,000 described species and 50 families around the globe. Estimations of their true numbers even reach the astonishing number of half a million species. Their role is crucial in both natural and man-made habitats as they mitigate other insects' populations, and many species have been used as biocontrol agents. Nevertheless, their true biodiversity, ecological associations and evolutionary patterns remain largely understudied, especially in southeastern Europe and the Mediterranean. The island of Cyprus is located at the heart of the eastern Mediterranean, in close proximity to Asia and Africa. At the outset of this study, based on sparse literature records often focused on agricultural applications and biological control agents, merely 124 species of Chalcidoidea were known from Cyprus. Following literature investigations and two years of material surveys this number has more than doubled, with more than 250 species and morphospecies currently known from the island. Nevertheless, this is still a huge underestimate of the true chalcid species richness in Cyprus. At least 160 species and 80 genera are new for Cyprus, while some species are potentially new to science. Here, we provide an update on the overlooked biodiversity, ecology, biological invasions and biogeography of the Chalcid wasps of Cyprus.

Keywords: Hymenoptera, parasitic wasps, hidden biodiversity, systematics

Parasitic wasps (Hymenoptera: Chalcidoidea) associated with Cecidomyiidae (Diptera: Nematocera) in Greece

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The hyperdiverse superfamily Chalcidoidea includes more than 27.000 described species of parasitic wasps worldwide, although it is estimated to include around half a million species. More than 450 species of chalcid wasps have been reported from Greece, nevertheless, their biodiversity and ecology are largely understudied in contrast to those of many other European countries. Many chalcid wasp species have co-evolved and are associated with gall-producers such as gall midges of the family Cecidomyiidae. These wasps are often host-specific, although some generalist species tend to parasitize a wide range of gall midges and by extent found on numerous plant species. Up-to-date, more than 230 species of gall midges have been reported from Greece, although there has never been a structured study and catalogue of their parasitoids' biodiversity, ecology and host-specificity at the country level. Herein, we present the first review on the parasitic chalcid wasps associated with Cecidomyiidae in Greece, providing more than 80 records of chalcid wasp morpho-species, many of whom are new additions to the fauna of the country. Additionally, we report more than 45 new ecological associations between gall midges and chalcid wasps, potential new species to science, and preliminary insight on the biogeography of both gall midges and chalcid wasps across Greek administrative divisions.

Keywords: trophic networks, biodiversity, systematics, Pteromalidae, Eulophidae

Assessing freshwater gastropod diversity in peri-urban versus urban freshwater ecosystems of Attica, Greece: A Case Study of Vravrona wetland and Chalandri stream

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The Mediterranean Basin ranks as the world's second-largest biodiversity hotspot, with the Balkan Peninsula sub-region standing out as the primary hotspot for threatened freshwater gastropod diversity, both at the European level and within the Mediterranean region. This study presents a comparative analysis of freshwater gastropod assemblages in two distinct aquatic ecosystems in Attica, Greece: an urban stream in the Municipality of Chalandri and a peri-urban wetland within the Natura 2000 site GR3000004 Vravrona-Paraktia Thalassia Zoni. Field surveys, habitat mapping, and qualitative and quantitative samplings were conducted to assess species richness and abundance patterns. A total of seven gastropod taxa were recorded, including two Greek endemics: *Planorbis atticus* Bourguignat, 1852 (assessed as LC in the IUCN Red List) and *Pseudamnicola macrostoma* Küster, 1853 (recently assessed as EN in the IUCN Red List). Remarkably, *P. macrostoma* was recorded for the first time in Chalandri. The Vravrona wetland exhibited slightly higher overall gastropod frequencies, reflecting its protected status, whereas the urban Chalandri stream supported lower biodiversity, likely due to anthropogenic pressures. However, *P. macrostoma* displayed significantly higher abundance in Chalandri, potentially linked to its ecological preferences and tolerance to polluted conditions. The Sørensen similarity index revealed a high faunal similarity (83.3%) between the two sites. These findings highlight the ecological significance of urban aquatic habitats and underscore the urgent need for further research and targeted conservation strategies to protect endemic and threatened freshwater gastropod species in urban environments.

Cheek-list of alien, pest and invasive insects in Republic of North Macedonia (Lepidoptera, Blattodea, Orthoptera, Zygentoma, Thysanoptera, Coleoptera, Diptera, Hemiptera, Heteroptera and Hymenoptera)

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From the available literature and our field research, 116 species can be safely proposed for the list of alien, pest and invasive insect's species for the Republic of North Macedonia. The list includes 17 species of moths. The family Pyralidae is represented by 4 species; the families Gelehiidae, Gracillariidae by 3; Crambidae and Noctuidae by 2 species each and the families Erebidae, Teneidae and Tortricidae by 1 species each. From the order Blattodea 2 species have been recorded, 1 from the family Blattellidae and 1 from the family Blattidae. Order Orthoptera is represented by 1 species of the family Grylidae. The order Zygentoma is represented by 1 species from the family Lepismatidae. The order Coleoptera is represented by 45 species from 13 families: Ptinidae is present wqith 9 species; Chrysomelidae and Nitidulidae with 8 each; Latridiidae 7; Dermestidae 5 species; the families Anthicidae, Cerambicidae, Bostrichidae, Coccinelidae, Cryptophagidae, Hysteriidae, Mycetophagidae and Staphylinidae are represented by 1 species each. The order Diptera has 3 species present in the Republic of North Macedonia, one each from the families Agromyzidae, Drosophilidae and Culicidae. The order Thysanoptera is represented by 2 species from the family Thripidae. The order Hemiptera has 35 species established in North Macedonia; 19 belong to the family Aphididae; Coccidae and Diaspudidae are present with 3 species each; the families Pentatomyidae, Tingidae and Oxycareinidae are represented by 2 species each; the femilies Aleyrodidae, Diaspudidae, Monophlebidae and Membracidae is represented by 1 species. The order of Heteroptera is represented with 3 species from three families Lyctocoridae, Cimicidae and Nabidae. The order Hymenoptera has 7 species from three families, the family Formicidae has 3 species, Aphelinidae and Encyrtidae have 2 species each.

Key words: Cheek-list, alien, pest, invasive insects, North Macedonia

Island Freshwater Endemism Under Threat: A Preliminary Study of Two *Tinodes* (Psychomyiidae: Trichoptera) Species

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The Greek endemics *Tinodes megalopompos* and *Tinodes archilochos* (Trichoptera: Psychomyiidae) have been recorded exclusively from Naxos, Paros, and Ikaria, and have been **assessed as Endangered (EN) and Vulnerable (VU)** respectively, in the Greek Red List of Threatened Species. Despite their ecological importance to the freshwater biodiversity of the Aegean islands, their current distribution and population status remain largely unknown, with the most recent confirmed records dating back to the 1970s–1980s. As part of this study, samplings and field observations were conducted both at previous known localities and at new localities with similar habitat characteristics, aiming to document the current distribution of the species and provide a preliminary assessment of their habitat conditions. Pressures such as water over-abstraction, tourism development, and the impacts of climate change were recorded during site visits. These species depend on small spring-fed streams, a habitat type becoming increasingly rare on Aegean islands, rendering them particularly vulnerable to hydrological and climatic disturbance. The next steps include the implementation of awareness and outreach activities within local communities, aiming to support future conservation initiatives through collaboration between scientists, citizens, and local stakeholders. This research is supported by a WWF Hellas fellowship and contributes meaningfully to the long-term protection of Greece's endemic freshwater fauna, while also enriching our understanding of island-scale patterns of freshwater endemism in the eastern Mediterranean.

Keywords: biodiversity, climate change, conservation prioritization

Spatial and environmental drivers of terrestrial, semiaquatic and aquatic diversity in Aegean islands

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Island ecosystems are ideal natural laboratories for studying biodiversity patterns, as they allow us to disentangle the roles of spatial isolation and environmental heterogeneity in shaping species composition. We analyzed beta diversity across 125 islands and islets in the Aegean Archipelago, using presence–absence data from nine taxonomic groups (aquatic, semi-aquatic, and terrestrial) with varying dispersal abilities. Beta diversity was partitioned into turnover and nestedness components following Baselga's framework, and the effects of spatial (distance to mainland, inter-island distance, island area) and environmental (elevation, climate variability, geology, land use) factors were evaluated through Mantel tests and hierarchical variance partitioning. We tested the following: (H1a) aquatic organisms show higher endemic-to-total species ratios than semi-aquatic or terrestrial groups; (H1b) low-dispersal taxa exhibit higher endemism than those with moderate or high dispersal ability; (H2) beta diversity is higher in low-dispersal taxa, reflecting stronger geographic and ecological differentiation across islands; and (H3) spatial factors primarily shape aquatic communities, environmental filtering dominates in terrestrial groups, and semi-aquatic taxa respond to both drivers. Our results support these hypotheses. Species turnover was the dominant component of beta diversity, especially in low-dispersal taxa, which also showed higher endemic-to-total species ratios. Terrestrial groups were primarily influenced by environmental filtering, aquatic taxa by spatial isolation and semi-aquatic groups exhibited intermediate responses. These findings underscore the importance of considering species traits such as dispersal ability in understanding community assembly. Also, highlight the value of integrating multiple taxonomic groups and ecological drivers in island biogeography studies, with direct implications for biodiversity conservation.

Keywords: island biogeography, nestedness, species turnover, dispersal limitation

Morphometric discrimination of closely related *Glyptapanteles* species (Insecta: Hymenoptera: Braconidae: Microgastrinae)

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Glyptapanteles is a cosmopolitan genus comprising approximately 300 species of endophagous parasitic wasps, primarily associated with exposed macrolepidopteran hosts. It has been recorded from host species belonging to over 25 families of Lepidoptera. Most *Glyptapanteles* species exhibit a gregarious parasitising strategy, although solitary species exist. Given the large number of morphologically similar species within the genus, this study investigates the potential for species identification based on fore wing shape and size using landmark-based geometric morphometrics. Specimens of four species (*G. compressiventris, G. fraternus, G. liparidis, and G. porthetriae*) were collected in Serbia. The hosts for *G. compressiventris* and *G. porthetriae* were two erebids, *Arctia villica* and *Lymantria dispar*, respectively, whereas the host species are unknown for the remaining two species. Twenty-one landmarks were placed at vein intersections and vein projections along the wing margin, taking advantage of the well-developed venation. The results show clear separation among species in the PC1 × PC2 morphospace, with *G. fraternus* being the most distinct, characterised by narrower wings, an elongated distal part, a short and narrow first discoidal cell, and a rounded first submarginal cell. *Glyptapanteles liparidis* was also well separated based on a narrower first submarginal cell, a shorter second discal cell, and a longer marginal cell. The current analysis indicates that forewing morphology provides reliable characters for distinguishing all four *Glyptapanteles* species without overlap. This suggests that as additional species are included, clear separations are likely to emerge, potentially supporting or challenging identifications based on existing keys and revealing possible errors in synonymy.

Keywords: *Glyptapanteles, Serbia, fore wings, geometric morphometrics, Braconidae, systematics*

Against the current: Linking laboratory-measured swimming performance to riverine flow preferences in a threatened Greek freshwater fish

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Swimming performance is a key physiological trait of freshwater fish, directly influencing foraging, predator avoidance, migration, and habitat selection. The Evrotas chub, *Squalius keadicus*, is an endemic cyprinid, inhabiting the Evrotas River basin, in the Peloponnese, Greece. The species is considered endangered according to the latest evaluation of IUCN (2024), primarily threatened by hydrological perturbation and intermittency of its riverine habitats. Thus, our objective was to investigate the species' locomotive capacity under varying flow conditions to better understand its physiological limits. We quantified the swimming performance of *S. keadicus* under controlled laboratory conditions, by measuring the critical swimming velocity (U_{crit}) of individuals collected from the wild and currently maintained at HCMR aquarium facilities. We conducted swimming performance trials in a specialized experimental apparatus (5-l swimming tunnel) following well-established methodology. The experimental protocol involved placing each subject in the swimming tunnel at a water speed of 1 TL s^{-1} for 10 min to habituate, and then increasing the water speed at a rate of 1 TL s^{-1} every 5 min, until the fish was unable to hold its position against the current. Preliminary analysis revealed critical velocities ranging from 42.8 to 78.25 cm s^{-1}. We then compared these laboratory-measured velocities to previously reported microhabitat use data curves, indicating optimum flow velocities for chubs of approximately 50 cm s^{-1}. The implications of our findings are discussed in the context of evaluating the species' resilience to flood/drought conditions and other hydrological challenges, for the design of appropriate future conservation measures.

Keywords: *swimming capacity, U_{crit}, endangered species, Squalius keadicus, microhabitat use, biodiversity conservation*

Exceptional Ethanol Tolerance in the Oriental Hornet (*Vespa orientalis*): Insights into Metabolic Adaptation and Symbiotic Ecology

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Ethanol, a naturally occurring by-product of sugar fermentation in fruits and nectar, is routinely consumed by many animals in trace amounts. Despite its ubiquity, ethanol is a cytotoxic compound, and even ethanol-adapted species are generally impaired by concentrations exceeding 4%. In this study, we examined ethanol metabolism and its physiological and behavioral consequences in the Oriental hornet (*Vespa orientalis*), a common social wasp in the Eastern Mediterranean region known to forage on fermenting substrates. Remarkably, *V. orientalis* tolerated chronic ingestion of ethanol solutions up to 80% without measurable impacts on survival, nest construction, or intraspecific aggression. Using $^{13}C_1$-labeled ethanol, we demonstrate that hornets rapidly metabolize ethanol at rates far exceeding those documented in honeybees (*Apis mellifera*). Genomic analysis further reveals multiple paralogues of the $NADP^+$-dependent alcohol dehydrogenase gene within the genus *Vespa*, suggesting a possible genetic basis for this enhanced detoxification capacity. Our findings propose a functional link between ethanol tolerance and the evolutionary ecology of mutualisms between vespids and fermenting yeasts, offering a new perspective on the metabolic resilience of insect species adapted to ethanol-rich environments and the role of insects as vector for yeast and their ecological and agricultural importance.

Keywords: *Vespa, Yeast, Ethanol, Metabolism, Stable Isotopes.*

Free-ranging Cats in China: Ecological effect, Fundamental Biology, and Management Solutions

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With the rapid urbanization in China, the number of free-ranging cats has increased dramatically, posing a serious threat to biodiversity. Our recent research shows that free-ranging cats in China kill billions of wild animals every year, and their population growth is significantly affected by human factors such as feeding and abandonment. Meanwhile, socioeconomic factors such as education level, and religious belief influence people's attitudes towards free-ranging cats and their views on management strategies. Analyses of cat-related content on social media reveal that cat videos can evoke strong emotional resonance, and content creators have a great impact on public perception. In addition, the home range and activity patterns of free-ranging cats are affected by their breeding status and sex, and there is a close interaction between them and humans. To effectively manage the population of free-ranging cats, it is necessary to comprehensively consider ecological, social, behavioral, and other factors, leverage social media and influencers to promote responsible pet ownership, and raise people's awareness of ecological protection, so as to meet people's emotional needs for cats while reducing the negative impacts of free-ranging cats on the ecological environment.

Keywords: *Free-ranging Cat; Invasive Biology; China; Wildlife Conservation*

Combined effects of glyphosate and ambient temperature on the energy management of a wall lizard: First evidence from a controlled exposure study

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Pesticides and climate change are significant drivers of biodiversity loss, with their synergistic interaction resulting in exponentially detrimental consequences. Pesticides primarily disrupt important functions of pest organisms. Nevertheless, studies highlight their adverse effects on non-target organisms, including reptiles. Lacertid lizards are particularly relevant, given their occurence in agricultural habitats where exposure to pesticides inevitably happens through their diet, hydration, and direct contact with contaminated soil. Moreover, the reduced complexity of agro-environments compromises optimal thermoregulatory opportunities. Glyphosate the most widely used herbicide worldwide, has been demonstrated to cause toxic effects on reptiles' fitness (on gut microbiome, reproductive and endocrine system, shifted thermoregulation). Nonetheless, EFSA's most recent report excludes reptiles from glyphosate risk assessments due to absence of adverse and biologically relevant endpoints. We conducted a biologically relevant ecotoxicological experiment to assess the combined effects of glyphosate and temperature on the level of expression of standard metabolic rates (SMR) of male *Podarcis bocagei*. Individuals were divided into two groups, with equal representation of body weight. Exposure to glyphosate occurred every second day, for 21 days, through contaminated *Tenebrio molitor* larvae previously injected with 5 µl of glyphosate sub-lethal dosage (0.5 mg/ kg bw). Post-exposure, SMRs were measured through open-flow respirometry at three different temperatures relevant for the species (18, 25, 29 °C). Glyphosate-exposed animals displayed uniformly elevated SMRs across all tested temperatures, indicating that glyphosate increases baseline energy expenditure. Our study may contribute to future risk assessment and conservation prioritization of lizard species potentially sensitive to glyphosate-induced alterations on their bioenergetics.

Keywords: *ecotoxicology, SMR, synergistic effects, pesticides, climate change, Lacertidae*

The Conservation Value of an Environmental and Cultural Icon, the Cretan Agrimi

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The agrimi (*Capra aegagrus cretica*) is a subspecies of the wild goat (*Capra aegagrus*), endemic to Crete. It is an important element of the natural and cultural landscape of Crete, currently threatened by illegal hunting, habitat loss, and disease; therefore classified as an endangered Greek mammal. Wildlife conservation cannot be successful without incorporating human dimensions in management plans. We used a contingent valuation method to estimate the annual willingness to pay (WTP) of 301 Cretans for implementing a 5-year conservation plan for the agrimi. The mean annual WTP was EUR 72.5, totalling EUR 18.5 million annually when projected to the number of households in Crete. People with moralistic attitudes stated a higher, and people with dominionistic attitudes stated a lower, WTP. Younger people, females, people with higher education, and those with higher income pledged a higher WTP than older people, males, and those with lower education and lower income. Findings could be used to inform policies and collect funds necessary for the conservation of the iconic agrimi of Crete.

Keywords: *environmental economics, questionnaire survey, public perceptions, Caprinae, Greece*

Assessment of an insular population of the priority species *Testudo hermanni*: Preliminary findings from Agios Achilleios island, Lesser Prespa Lake

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The Hermann's tortoise (*Testudo hermanni*) was recently classified as Vulnerable (VU) globally by the IUCN due to population declines, while in Greece it is currently considered Near Threatened (NT). It is protected under the EU Habitats Directive (92/43/EEC, Annexes II and IV) and listed in Appendix II of CITES. The species is threatened by habitat loss, illegal collection for the pet trade, road mortality, and wildfires. This Capture-Mark-Recapture (CMR) study was carried out as part of a volunteer programme of the transboundary NGO network "PrespaNet" on Agios Achilleios island (in Lesser Prespa Lake, northwestern Greece). Here, we present preliminary findings on population size and body condition, based on data collected from 2022 to 2024. Capture probabilities were modelled using E-SURGE to estimate total (T) and sex specific population sizes for 2023 (T ≈ 437, CI: 289-687) and 2024 (T ≈ 329, CI: 160-690), which showed a possible decrease in female abundance. Body Condition Indices (BCI) were first calculated and then investigated using generalized linear mixed-effects models (GLMM), revealing significant variation between sexes, with males exhibiting lower BCI than females. Variability in field effort and timing between sessions influenced our findings, emphasizing the need for standardized sampling effort, particularly in peak activity periods, to improve data consistency. Such isolated island populations are good candidates for long-term population monitoring, ecological education, and citizen science initiatives.

Keywords: *Capture-Mark-Recapture, citizen science, PrespaNet, tortoise monitoring*

Exploring the micromammal fauna of a karstic plateau on Mt. Triklario, northwestern Greece

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Mount Triklario/Sfika (1749 m asl) lies adjacent to Lesser (Mikri) Prespa Lake, at the southern edge of the transboundary Prespa basin. This limestone mountain is characterized by mixed deciduous, oak and beech woodland up to ca 1500 m asl and a karstic plateau made up of a network of sinkholes (dolines) and rocky outcrops interspersed with dry grasslands. Addressing a lack of related studies in the area, we conducted live-trapping surveys targeting small mammals during the summers of 2010 and 2024. Baited live traps were set across the area and checked daily. The total sampling effort amounted to 513 trap-nights in 2010 and 490 trap-nights in 2024. In total, six species were recorded: one vole (*Chionomys nivalis*), three field mice (*Apodemus sylvaticus*, *A. flavicollis*, and *A. epimelas*), one shrew (*Crocidura gueldenstaedtii*), and one mustelid (*Mustela nivalis*). *A. sylvaticus* was the most widely distributed species across the plateau and was most frequently encountered at mid-elevations, as was *A. flavicollis*. *A. epimelas* was the most abundant species, appearing to favour the higher elevation, where *C. nivalis* also appeared to be restricted. The remaining two species were only recorded in low numbers in the higher parts of the plateau. *Dinaromys bogdanovi*, a target species of the survey was not located. Related studies have been implemented in other areas of the transboundary Prespa basin (Mt. Pelister and Mt. Galičica), but the micromammal fauna of alpine and pseudo-alpine habitats in the region remains insufficiently documented and merits further research.

Keywords: *live trapping, PrespaNet, pseudo-alpine plateau, rodents, small mammals*

Ant (Formicidae) diversity of olive orchard agroecosystems in relation to the management and the effect of agroecological zone

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Ants are among the most abundant insects in ecosystems and agroecosystems. In this study, the ant fauna of six paired conventional and organic olive orchards, located in two agroecological zones (hilly and plain), were surveyed in Crete (Greece), using pitfall traps. Specimens were collected from May 2023 till May 2024, and identified to genus and where possible, in species level, using taxonomic keys. In each orchard 10 traps per ha were placed, containing propylene glycol. 17 different genera were found, and 33 species identified with the most common *Pheidole pallidula*, followed by *Aphaenogaster simonellii* and *Monomorium creticum*. The presence of *Strumigenys membranifera* was identified for the first time in Crete. The organic olive orchards have a higher ant abundance and diversity compared to conventional ones, and hilly supported higher populations than the plain ones. Ants in olive orchards are important for pest regulation, soil fertility and nutrient recycling. Findings highlight the potential of ant communities to be used as as bioindicators in olive orchards. Further analysis of the species found and of the effect of different farming practices on the ant diversity is required, to determine the most appropriate practices for maintaining olive orchard's ant functional diversity and ecosystem services.

***Keywords*:** Ant diversity, Olive orchards, Green infrastructure, Agroecology Bioindicators, Strumigenys

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Freshwater gastropods of the Louros River and Lake Ziros, Western Greece

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The freshwater ecosystems of Greece host exceptionally high gastropod diversity, with a notable degree of endemism. However, the freshwater gastropod fauna of many Greek rivers and lakes remains poorly explored. Such is the case for the Louros River and Lake Ziros in western Greece, where gastropod diversity has not yet been systematically documented. This study investigates the species richness and distribution of freshwater gastropods in these two systems. Species identification was based on morphological and anatomical characteristics, while phylogenetic relationships were assessed using mitochondrial COI (mtCOI) gene sequences. A total of nine gastropod taxa were recorded, including three endemics: *Bithynia graeca* Westerlund, 1879, classified as Endangered (EN) on the IUCN Red List; *Radomaniola haesitans* Westerlund, 1881; and *Planorbis atticus* Bourguignat, 1852, both classified as Least Concern (LC). Additionally, the invasive New Zealand mud snail, *Potamopyrgus antipodarum* J. E. Gray, 1843—listed among the 100 worst invasive alien species in Europe—was found in the Louros River. New distributional data were documented for both *R. haesitans* and *B. graeca*. Notably, this study reports for the first time the remarkable variation in shell morphology of *R. haesitans* and describes the detailed anatomy of male specimens of *B. graeca*.

Keywords: *Species richness, Truncatelloidea, Greece, Morphology, COI*

Non-invasive quantification of handling-induced stress in Passeriformes via infrared thermography of the ocular region: a standardized experimental approach

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The quantification of acute stress responses in wild avifauna remains a methodological challenge in conservation physiology, where the minimization of observer-induced disturbance is paramount. Infrared thermography offers a non-invasive technique capable of detecting rapid shifts in peripheral surface temperature mediated by sympathetic nervous system activation, thereby serving as a valid surrogate for acute stress assessment. In this study, we developed and implemented a standardized experimental protocol to assess acute handling-induced stress responses of multiple Passeriformes species to handling. Individuals were captured during spring migration using mist nets and subjected to a fixed morphometric protocol. To mitigate immediate post-capture stress effects, each bird was placed in a darkened wooden containment chamber for a five-minute period to facilitate physiological stabilization. Infrared thermal images of the ocular region—a vascularized, uninsulated thermal window—were obtained at three critical timepoints: (1) immediately post-capture within the net, (2) during biometric processing while manually restrained, and (3) after a controlled five-minute recovery period in a dark wooden containment chamber. The maximum eye surface temperature (Tmax) was extracted from each thermogram, and thermal response trajectories were evaluated across successive handling stages. Statistical analyses, including ANOVA, and multiple regression incorporating biometric covariates, revealed consistent evidence of stress-induced hyperthermia, with significant elevations in Tmax during handling. Individual-level heterogeneity in thermal response magnitude was substantial, suggesting differential autonomic reactivity potentially linked to intrinsic traits or life-history states. The integration of this approach into field-based ornithological protocols provides new opportunities for mechanistic understanding of vertebrate stress physiology.

Keywords: Stress-induced hyperthermia; thermal imaging; sympathetic nervous system; conservation physiology

Review of the Orthoptera biodiversity of Zakynthos Island, Greece

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Zakynthos is an area very poorly researched regarding it's orthoptera and it's invertebrate biodiversity in general. Kühnelt and his colleagues were one of the first teams to research the island's invertebrate fauna, recording eight orthoptera species. Later in 1939, Ramme published a new tettigoniid species from Zakynthos (*Eupholidoptera megastyla*), while more recently, T.Stalling published the first record of *Myrmecophilus ochraceus* from the island. These, along with the records of F.Willemse published in Fauna Graeciae and L.Willemse and his colleagues published in the book The Grasshoppers of Greece, compromise the only published Orthoptera records from the island, adding up to only 17 species. This research aims to shed light on the orthoptera biodiversity of one of the least zoologically researched islands of Greece. The collection localities were selected based on different habitats known from the island, in order to record as many species as possible. The specimens were collected on the field both during daylight and in some localities at night, using a simple net. They were later preserved and identified using standard methods and taxonomic keys. In order to better understand the species' distribution across the island, the available records from the platform iNaturalist were also used. In total, 48 species were recorded from Zakynthos and it's neighboring islets, of which 16 are new for Zakynthos or the Ionian islands and 15 had not been recorded bibliographically on the island before. The large number of newly recorded species highlights the importance of zoological research in such insufficiently researched areas.

Keywords: New records, Ionian islands, species distribution, cryptic species

Three decades of sea turtle rehabilitation in Greece (1995-2024) indicate a high anthropogenic impact

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Wildlife hospitals contribute in rehabilitating injured, weak and sick animals (thereafter "injured") while fulfilling a social need for their welfare and raising awareness about anthropogenic threats that impact wildlife. The establishment of ARCHELON's Sea Turtle Rescue Centre (STRC) in 1994 in Glyfada, Greece, and its continuing operation since then, provides the opportunity to assess threats that sea turtles encounter in their habitats. Injured sea turtles are located and transported to the STRC through the nationwide Sea Turtle Rescue Network initiated by ARCHELON in 1992, which continues to operate with the involvement of the authorities and concerned citizens. In the 30-year period (1995-2024) of its operation, 1539 sea turtles (*Caretta caretta* and *Chelonia mydas*) were rescued and admitted for rehabilitation. From 1339 cases of known admission cause, 87.3% admissions were attributed to fisheries interaction, with 51% of them bearing deliberately inflicted traumas, 7.5% from boat strikes and plastic ingestion, and 5.2% from natural causes (sickness, hypothermia, predation). In total, the anthropogenic impact accounts for almost 95% of all cases of known admission cause, a finding that is consistent with the results of other studies in the Mediterranean. Nevertheless, the percentage of deliberately inflicted injuries, presumably after capture in fishing gears, is the highest in the Mediterranean. These results, providing valuable information for the threats that sea turtles face in the Greek seas, are being used in the context of a LIFE NATURE project (LIFE Marenatura), in order to assist in the planning of appropriate conservation strategies.

Keywords: *threats, conservation strategy, Caretta caretta*, *Chelonia mydas, conservation planning*

Seroprevalence and Geographical distribution of Selected Infectious and Parasitic Diseases in Wild Carnivores in Greece: A Retrospective Study (2020-2025)

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The increasing presence of wild carnivores in urban and peri-urban environments presents new challenges for public and veterinary health, particularly in relation to the transmission of infectious and parasitic diseases among wildlife, domestic animals, and humans. In this study the seroprevalence and geographical distribution of selected zoonotic and veterinary-relevant pathogens in wild carnivores across Greece are presented. A total of 71 wild carnivores—including red foxes (*Vulpes vulpes*), golden jackals (*Canis aureus*), European badgers (*Meles meles*), and martens (*Martes foina*)—were examined. These animals were admitted to "ANIMA" Wildlife Rehabilitation Centre (Athens) between 2020 and 2025 and originated from eight distinct geographic regions of Greece. Blood serum samples were analysed at the veterinary diagnostic laboratory "VET IN PROGRESS PLUS" (Athens) using indirect immunofluorescence assays (IFA, IgG and IgM) for the detection of antibodies against *Leishmania infantum*, *Toxoplasma gondii*, *Neospora caninum*, *Babesia canis*, *Ehrlichia canis*, *Leptospira canicola*, *Leptospira icterohaemorrhagiae*, *Anaplasma phagocytophilum*, and Canine Distemper Virus (CDV). The presence of *Dirofilaria immitis* antigen was assessed using ELISA. Seroprevalence rates varied among pathogens: 10% for *L. infantum*, 73.2% for *T. gondii*, 0% for *N. caninum*, 17.6% for *B. canis*, 23.9% for *E. canis*, 36.1% for *Leptospira* spp., 35.3% for *A. phagocytophilum*, 57.7% for CDV, and 4.5% for *D. immitis*. Notably, the study documents the first confirmed cases of *D. immitis* infection in *Meles meles* in Greece, as well as a novel case of Babesiosis in *Canis aureus*. These findings highlight the need for integrated One Health approaches in wildlife management and disease control.

Keywords: wild carnivores, diseases, prevalence, distribution, Greece

Advancing the understanding of watershed–lake interactions: The case of Prespa Lakes

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Understanding the interactions between transboundary watersheds and lake ecosystems is fundamental for effective environmental management and conservation, particularly in regions such as the Greek part of the Prespa Lakes watershed. Monthly field measurements of physicochemical, hydrological, biological (seasonal sampling; benthic macroinvertebrates and diatoms), and chemical parameters were conducted during 2022–2023 at multiple sites across key tributaries discharging into the Lesser and Great Prespa Lakes. Further analysis incorporated the estimation of selected components of the water balance of both Prespa lakes and the investigation of tributary contributions to the water quality of Lesser Prespa lake via pollutant load analysis. The ecological status of stream sites ranged from High to Moderate, the most impaired ecological status detected at downstream sites, where agricultural drains and livestock units are detected. Benthic macroinvertebrate fauna diversity at these sites was degraded and dominated by pollution tolerant taxa, which was also true for diatom assemblages, despite their high species richness. Concerning the qualitative and quantitative interactions between streams and the Lesser Prespa Lake, no strong correlation was ascertained between streams' pollutant loads and the lake's own loads. This insight was also supported by a moderate relationship between the lake's volume changes and watershed water inflows, while both findings highlighted the need for further understanding of the internal hydrodynamic processes and the physicochemical conditions of Prespa Lakes. By incorporating climate change impacts, our results contributed to the development of targeted protection and management strategies aimed at optimal and sustainable use of the regional water supplies.

Keywords: *ecological status, water quality monitoring, hydrological processes*

Behavioral studies of individuals of the rock shrimp *Palaemon elegans* under the presence of the parasite *Bopyrus squillarum*

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The rockshrimp *Palaemon elegans* is one of the crustacean species that has been studied for certain behavioral traits, consistency over time and possible presence of behavioral syndrome. Having previously investigated (unpublished data) certain behaviors of adult rockshrimps, in the present study we focused on individuals infected by the isopod ectoparasite *Bopyrus squillarum* often seen attached on the branchial chamber of crustaceans. Four individual behavioral traits investigated, with certain experimental tanks and recording with a digital video camera, were activity/A, shoaling/S, exploration/E, and boldnesss/B. Four trials were repeated (week 1 and 2) for the determination of consistency over time using Spearman correlations tests which were also used for possible behavioral syndrome. The behavioral trials were performed at two different temperatures: one group of 20 infected shrimps was collected (Saronic Gulf, N 37^o 47' 18,7" E23^o 53' 0,2") in September 2024 and the other 20 infected shrimps in October 2024; the sea water temperature of 26^{o}C (high) and 20^{o}C (low), respectively maintained also in the experimental tanks. Activity was higher in the high temperature group compared to the low temperature one. Only one marginal consistency over time ($P=0.05$, $\rho=0.43$) was detected in exploration in the high temperature group. Two significant relationships ($P<0,05$, $\rho<0.04$) were observed between activity-shoaling (negative) and shoaling-boldness (positive) only in week 2 of the high temperature group. One marginally positive relationship ($P\sim0.05$, $\rho=0.43$) was apparent between activity-exploration in week 2 of low temperature group. These results do not indicate a behavioural syndrome as in other studies with uninfected rockshrimps.

Keywords: *activity, shoaling, exploration, boldnesss*

Uncovering Hidden Diversity: A Field-Based Investigation of the Endemic Land Snail Genus *Tsoukatosia* in Greece

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Despite its relatively small size, Greece hosts one of the richest terrestrial snail faunas in Europe, with 695 recorded species—59% of which are endemic. Among these, the genus *Tsoukatosia* stands out as the only endemic genus of land snails in Greece that has never been observed alive. Currently comprising 10 species, all endemic to mainland Greece, *Tsoukatosia* is primarily distributed in the Peloponnese, with isolated species in Central Greece and on Mount Athos. According to the IUCN Red List, one species is Critically Endangered (*T. evauemgei*), three are Vulnerable, and three are Near Threatened. This project seeks to locate and study living individuals of this elusive genus for the first time, using targeted field surveys. By improving understanding of the biology, ecology, and systematics of *Tsoukatosia*, the study aims to help address a major knowledge gap and contribute to future evidence-based conservation efforts. The scientific novelty of this work lies in addressing not merely a gap, but a complete absence of biological knowledge about a distinct evolutionary lineage. Documenting the current distribution, status and threats to *Tsoukatosia* represents an important step toward conserving one of Europe's most poorly known gastropod groups.

Keywords: biodiversity, gastropods, IUCN, mollusca

Lights out: Impacts of artificial light at night on benthic communities in a Greek coastal lagoon

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Artificial light at night (ALAN) is considered one of the most serious anthropogenic stressors to aquatic ecosystems in recent decades. Marine organisms have adapted to natural light rhythms, but artificial light sources interfere with this natural behavior and can lead to changes in community composition and ecosystem functioning. Very few studies have been conducted so far on the effects of ALAN on coastal benthic invertebrate communities. This study was conducted in 2024 in Klisova lagoon on November 1st, 2024, located within the Messolonghi-Aitoliko complex in Western Greece. The site was selected due to its rural setting with limited sky glow, only minimally affected by nearby fisheries and streetlights. A total of fifteen light traps, including three control traps devoid of any light source, were deployed for three hours. The light treatments consisted of glow sticks with four distinct colors - white, red, blue, and green - each one reiterated thrice. Preliminary results indicated that traps with light attracted significantly more organisms than control traps. Green and white attracted the highest numbers, while blue and red were less attractive. The number of taxa was similar in green, blue, and white, lower in red and controls. Organisms were drawn to different colors, likely due to their vision and color perception. These results show that benthic invertebrate communities are sensitive to ALAN, with currently unknown consequences for ecosystem functioning. With increasing coastal illumination, these effects will intensify, and more research is urgently required to create guidelines and regulations pertaining to light emissions.

Keywords: *Light pollution, ALAN, Light attraction, Benthic invertebrates*

Water-Usage Behaviour of Eleonora's Falcon (*Falco eleonorae*): Effects of Morph, Temperature, Humidity and Presence of Conspecifics at its Breeding Ground

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Eleonora's falcon (*Falco eleonorae*) is a long-distance migratory and polymorphic falcon that breeds during the hottest months of the year—summer—in the Mediterranean, primarily in the Aegean region. The species occurs in two colour morphs—light and dark—and is known to systematically visit freshwater ponds at its breeding grounds. However, the influence of environmental (temperature, humidity) and biotic (morph, presence of conspecifics) factors on this behaviour remains poorly understood. In this study, we investigated how morph, temperature, humidity, and the presence of conspecifics influence water-usage behaviour during the pre-breeding (May) and breeding (September) periods on the small Greek island of Antikythera. Using action cameras and BORIS software for ethogram-based analysis, we recorded and coded water usage behaviour at insular ponds. During the pre-breeding season, both morphs tended to reduce the duration of wetting behaviour in the presence of other falcons. However, during the breeding period, light morphs tended to bathe for longer when conspecifics were present at the same pond. Temperature significantly affected the percentage of time spent using water relative to the total time individuals were observed at the pond for both morphs during the pre-breeding period, while humidity influenced this ratio only in light morphs during breeding. As climate change increases the frequency of drought conditions and reduces freshwater availability, further investigation into the species' communal behaviour and reliance on water sources is critical to understanding their adaptability in a rapidly changing environment.

Keywords: *Eleonora's falcon, bathing, temperature, water ponds*

Investigating the presence of the Critically Endangered Roach's mouse-tailed dormouse (*Myomimus roachi*, Gliridae) in Greece

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The Roach's mouse-tailed dormouse is the rarest of the five Gliridae species occurring in Europe. It has a highly restricted distribution, limited to scattered locations in European Turkey, Asia Minor, Bulgaria, and Greece. This study focused on the Evros prefecture in NE Greece, near the Greek-Bulgarian border - the only region in the country where *M. roachi* had previously been indirectly recorded based on barn owl pellet analysis in 2016. The study area consisted primarily of agricultural land, interspersed with sparse and fragmented patches of oak forest of varying age and extent. During summer 2024, systematic surveys were conducted at 26 sites, employing 75 track tunnels, 25 camera traps, and 4 nest boxes, predominantly placed on oak trees (88%) and left in place for three weeks. Additionally, barn and little owl pellets were collected from three sites along the Greek-Bulgarian border and examined for cranial remains. The appearance of both an adult and a juvenile *M. roachi*, captured in video evidence from two forest fragments, strongly suggests the presence of a breeding population in Greece, with further support potentially forthcoming from ongoing pellet analysis. The edible dormouse was the most frequently recorded species, followed by the forest dormouse, highlighting the intense interspecific competition *Myomimus* faces for feeding and nesting resources. This represents the first successful field survey to directly confirm the presence of *M. roachi* in Greece and constitutes a critical step toward the official designation of the area as a protected zone at both national and international levels.

Keywords: *arboreal mammal, track tunnels, camera-trapping, endemic fauna*

From Policy to Practice: Implementing Long-Term Conservation Strategies for Loggerhead Turtles at Sekania Beach, Greece

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Sekania beach, located in Laganas Bay, Zakynthos, Greece has been designated as an "Absolutely Protected Area" within the National Marine Park of Zakynthos (NMPZ) since 1999. This designation, which permits only scientific research, safeguards one of the world's most critical nesting sites for the loggerhead sea turtle (*Caretta caretta*). In response to increasing tourism pressures, WWF Greece acquired 32.7 hectares of land behind the beach in 1994 through a pan-European campaign, aiming to preserve the habitat's ecological integritySince then, the conservation efforts of WWF Greece aim to ensure the stability of environmental parameters and maintain the area suitable for nesting. Sekania is an intricate case study due to its integration of marine, coastal, and terrestrial areas, all significant for the successful nesting of *Caretta caretta*. A Management Plan, together with a steady and intensive presence in the area, turn the challenge of protection to a reality. The protection and conservation of this *Caretta caretta* nursery, necessitate the monitoring of ecological and morphological parameters as well as predation to hatchlings. The conservation strategy includes a variety of activities including small-scale anti-erosion works, measures to prevent wildfires, the wardening of the area as well as management and volunteering activities. The adoption of novel technologies to improve monitoring precision and management efficiency is also key. Robust synergies with the NMPZ, the relevant authorities, academic institutions, and other NGOs strengthens conservation outcomes and ensures the long-term preservation of Sekania as a critical *Caretta caretta* nursery and a model for integrated habitat protection.

Keywords: *Sekania, Caretta caretta, ecosystem services, Protected Areas*

Otters in a box: implementing conservation measures for a semi -aquatic mammal in wetlands of the Peloponnese

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The Eurasian otter (*Lutra lutra*) is a semi-aquatic carnivore of high conservation interest. As part of two conservation projects in protected areas of the Peloponnese under the 'Management Unit of Strofylia Wetlands National Park and Protected Areas of Western Peloponnese' and the 'Management Unit of Chelmos–Vouraikos National Park and Protected Areas of the Northern Peloponnese' the installation of otter holts was implemented in 2023, for the first time in Greece. Twelve holts were locally constructed from wood-based materials, following international guidelines. Sites were surveyed for suitable microhabitats; holts were partially disassembled to fill the floors with appropriate soil material, reassembled and camouflaged to blend with riparian vegetation, while keeping both entrances accessible. Two holts were installed at each of five sites (three in Chelmos-Vouraikos and two Strofylia-Kotychi), while two additional sites hosted one holt each. Holt placement was coupled with camera traps operated to assess holt use until early summer 2024. Although clear otter occupancy was not yet confirmed, otters were recorded at three sites in the Strofylia-Kotychi wetland system (including a pair near a holt) and at one holt in Planitero (Chelmos). Stone Martens and Eurasian Badgers showed the most interaction with the holts, whereas Golden Jackals, Red Foxes and Wild Boars, though frequently recorded, showed little interest. These preliminary results underscore the importance of long-term monitoring, as holt colonization may take several months, but also demonstrate high tolerance of holt presence by wildlife. Continued surveillance will support evaluation and potential replication across other riverine sites in Greece.

Keywords: *Lutra lutra*, otter holt, camera trapping, habitat enhancement, wildlife monitoring

Small island effects and population divergence in the Skyros Wall Lizard (*Podarcis gaigeae*)

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One of the major challenges facing conservation managers and policymakers is the lack of knowledge regarding the ecology and biology of many species and populations, which often results in inaccurate assessments within the Red List of Threatened Species. One such case is the narrow endemic lizard *Podarcis gaigeae*, commonly known as the Skyros wall lizard, listed as Vulnerable in the IUCN, and in particular the narrow endemic population inhabiting Piperi island (*P. g. weigandii*) northeast of Alonissos. Its high isolation, small population size and environmental pressures, such as intensive grazing and invasive species, raises concern regarding its current endangered status. However, and as of now, this population remains entirely unexplored. Anticipating that the geographical isolation from Skyros Archipelagos where *P. g. gaigeae* is present and the particular conditions prevailing on Piperi islet may have prompted genetic and phenotypic divergence, in this study we examined various morphological, physiological, genetic and ecological traits and compared the results with our previous findings for 10 islet and Skyros populations of *P. g. gaigeae*. Ecological and physiological findings align with our hypothesis, revealing significant differences between *P. g. weigandii* on Piperi Island and *P. g. gaigeae* Skyros lizards, while ddRAD data are currently being analysed. These results hold significant implications for effective conservation strategies aimed at safeguarding this narrow endemic population.

Keywords: Aegean, digestion, ddRAD, insularity, lacertid, thermal biology

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Investigating the current taxonomy of Blue Throated Keeled Lizard (Algyroides nigropunctatus) using integrative genomics and behavioral approaches

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Prezygotic isolation mechanisms are often considered the most critical barriers to gene flow, maintaining reproductive boundaries between populations or incipient species. These barriers frequently arise as by-products of divergent natural or sexual selection, or from their interaction. Colonization of novel environments, particularly islands, can further accelerate divergence in mate preferences, thereby promoting sexual isolation. Here, we focus on two geographically and phenotypically distinct subspecies of the Blue-throated Keeled Lizard (*Algyroides nigropunctatus*): *A. n. nigropunctatus* and *A. n. kephallithacius*. The *kephallithacius* morphotype, is restricted to the Ionian islands (Lefkada, Kefalonia, Ithaca), and parts of western Aetoloakarnania, while the *nigropunctatus* occupies the remainder of the species' range. Although both subspecies meet in the Agrinio valley, recent phylogenetic analyses revealed they form distinct, monophyletic lineages with no evidence of introgression, despite geographic proximity, suggesting potential species-level divergence. To evaluate the presence and strength of reproductive isolation between these lineages, we propose an integrative approach that combines genomic data (ddRADseq), controlled mate choice experiments, and analysis of mating-related chemical cues (pheromones). We will test 24 individuals of each morphotype from the contact zone, along with 24 individuals from pure populations for behavioral responses to opposite-sex conspecifics. We will estimate genetic distances, detect potential hybrids, and characterize pheromone composition. Through this multifaceted framework, we aim to shed light on the processes underlying early-stage speciation and to assess the roles of sexual and ecological selection in maintaining lineage separation. Ultimately, our results will contribute to resolving the taxonomic status of *A. nigropunctatus* and inform conservation strategies.

Keywords: *prezygotic isolation, species delimitation, taxonomical investigation, phylogeny*
This research was funded by the Hellenic Zoological Society under the "Margarita Metallinou scholarship program"

Alburnus volviticus, an endemic fish species in peril due to river fragmentation and hydrological fluctuations

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The potamodromous fish species *Alburnus volviticus* is endemic to Lake Volvi and classified as endangered according to IUCN. The species has been the subject of sporadic research, and thus there is very limited knowledge regarding its biology and ecology, and there is currently no management plan in place. The study area of the present research was the Melissourgos Stream, which is the main breeding area of the targeted species. The presence and distribution of fishes was examined through electrofishing surveys. The existing transverse barriers in the bed of the Melissourgos Stream were also mapped, and their effect on the movement of the targeted species and on the water quality was assessed. *Alburnus volviticus* was found in very small numbers and only in one sampling station, downstream of a transverse barrier, which seems to prevent its further upstream migration. The limited number of fish could be attributed to the interrupted water flow at a location close to the river mouth during the spawning migration period. None of the barriers appears to affect water quality. The results of the study provide information on the distribution of the targeted species at the Melissourgos Stream, and the anthropogenic pressures that threaten it; information that is necessary for designing an effective management plan that will ensure its sustainability.

Keywords: *Alburnus, distribution, hydrology, Lake Volvi, river barriers*

This research was funded by WWF Greece scholarship program

First record of the masked bee species *Hylaeus orientalicus* in Europe

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Bees (Apoidea: Anthophila) are the most important pollinators in the Mediterranean region, a global biodiversity hotspot and a center of bee speciation. Europe currently hosts 2,138 bee species, with Greece exhibiting the highest species richness among European countries, totaling 1,187 recorded species. *Hylaeus* is a globally distributed genus within the family Colletidae, commonly referred to as "yellow-faced" or "masked bees" due to their characteristic pale markings on the head and thorax. *Hylaeus orientalicus* (Warncke, 1981) was previously known from Israel to Turkey. This study reports the first record of the species in Greece and Europe based on a long-term sampling effort on Chios Island. Eleven specimens (2 females, and 9 males) were collected from four localities in both burnt and unburnt areas. The species was recorded on different plant species but at one site it showed a strong association with the plant species *Euphorbia acanthothamnos*. Its presence across eastern, western, central, and southern parts of Chios suggests an established population, likely originating from the nearby Turkish coast. Further research is needed to clarify its distribution, host plant relationships, and habitat preferences within the island and maybe other parts of Greece.

Keywords: *Bees, Hylaeus, First record, Colletidae, Mediterranean, Pollination*

Basic life-history and conservation of the Rock Partridge (*Alectoris graeca*) in National Park Galichica

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The Rock Partridge (*Alectoris graeca*) is an ecologically significant species contributing to seeds dispersal and maintains predator-prey dynamics. The species is endemic to Europe, with its core distribution in the Balkans. This study aimed to enhance the knowledge of its population, habitat preferences, and movement patterns through GPS telemetry, distance sampling, and field observations in Galichica National Park, a mountainous region in North Macedonia . Two individuals were fitted with GPS transmitters, providing insights into their seasonal variations in home range, which expanded from 0.29 km² during the breeding season (March – August) to 0.7 km² in the non-breeding season (September – February). The differences between home ranges sizes in the different periods is dependent on food availability and weather conditions. Distance sampling estimated a population of 170 - 300 breeding pairs within suitable habitats, with densities ranging from 1.35 to 2.05 pairs/km². The observed population density of *Alectoris graeca* in Galichica National Park aligns with the average across its distribution range - Italy (0.55 – 3.48 pairs/km²) and France (0.4 – 2.1 pairs/km²), confirming the park as a suitable habitat for the species to thrive. Habitat analyses revealed a strong preference for open rocky environments with short vegetation in the breeding season (March – August), while winter movements indicated adaptation to lower altitudes near forest edges. Due to their reliance on open rocky habitats, now threatened by undergrazing in Galichica, conservation efforts focus on habitat restoration, protection, and habitat management to prevent overgrowth and support *Alectoris graeca* and other species.

***Keywords*:** *Alectoris graeca, conservation, distance sampling, habitat preference, PrespaNet, telemetry*

Bird community structure in Thessaloniki, Greece

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Birds have proven to be valuable ecological indicators across various ecosystems. Their study in the ever-expanding urban environment is essential for understanding and enhancing the capacity of cities to host wildlife. Thessaloniki in northern Greece has one of the lowest ratios of green space per inhabitant in Europe; nevertheless, birds play a crucial role in its ecological structure. The structure of Thessaloniki's bird community was examined through point counts in 75 green spaces during the breeding season of 2022. Metrics of bird species richness, evenness, diversity, and abundance were calculated, and the effects of 20 environmental and disturbance variables were assessed. Urban green spaces hosted 45 species, with the House Sparrow (*Passer domesticus*), Feral pigeon (*Columba livia*), Common Swift (*Apus apus*), Common Starling (*Sturnus vulgaris*), and Collared Dove (*Streptopelia decaocto*) being the most abundant urban dwellers, readily exploiting urban environments. The Great Tit (*Parus major*), European Greenfinch (*Chloris chloris*), Common Chaffinch (*Fringilla coelebs*), European Goldfinch (*Carduelis carduelis*), and Eurasian Blackcap (*Sylvia atricapilla*) were the most abundant urban adapters/avoiders, preferring natural habitats and mostly found in larger green spaces. All structure metrics, except abundance, were most affected and positively influenced by green space size. The number of pedestrians was the most important factor, positively influencing abundance but negatively affecting the other metrics. Results highlighted the importance of expansive green spaces for fostering rich and diverse bird communities.

Keywords: *urban ecology, green spaces, species diversity*

Bird diversity and composition in a semi-natural, lowland woodland: annual and seasonal changes

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Bird communities reflect the total biodiversity of a habitat. In this study we evaluated passerine bird species diversity within a lowland, semi-natural woodland over an 18-year period (2007-2024), examining seasonal and annual changes. Using bird catching (for ringing) at the woodland of the backyard of the Forest Research Institute (ELGO - DIMITRA) at Vassilika Thessaloniki, we estimated Species Richness, Species Evenness, Shannon-Wiener index and Simpson index values annually, along with monthly and yearly capture numbers. Overall, 6563 birds of 60 species were captured and ringed. These included resident species (present all year round), migrating (present in migrating periods only), breeding migrants (migrating species nesting in the area), wintering and occasionally or accidentally present. Seasonal variation in both, captured bird numbers and species composition was observed, with peaks during autumn migration, while there were no significant interannual changes. Although the Simpson and Shannon-Wiener indices showed relatively high diversity (0.88 and 2.66, respectively) and the mean Species Richness was high (31.7), there was an uneven distribution of species (Species Evenness 0.22). The values of the indices remained stable over the years, although changes in community composition were observed, as the European Goldfinch *Carduelis carduelis* was not recorded in the last 10 years, while the Eurasian Jay *Garrulus glandarius* was recorded only in recent years. At the same time, there was a significant decrease in the numbers of the Olivaceous Warbler *Iduna pallida*, accompanied by an increase in the numbers of the Common Redstart *Phoenicurus phoenicurus* and the Common Firecrest *Regulus ignicapilla*.

Keywords: Woodland, biodiversity, bird diversity, passerines

Comparing arthropod community composition between urban and natural areas of the peri-urban forest of Agia Paraskevi in Attica

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Biotic and abiotic factors are significantly altered by the extensive human presence and activity in natural ecosystems, affecting their biodiversity. Different levels of anthropogenic influence have varying rates of impact on ecosystems, thereby shaping their species composition and distribution. Natural habitats are known to be more resilient to biological invasions, while also better sustaining endemic taxa in contrast to anthropogenic habitats. The aim of this study is to compare the arthropod fauna in peri-urban and forested areas of Agia Paraskevi, based on the anthropogenic pressure they receive. The existence of seasonal variation in arthropod diversity on these sites will also be examined. Data was collected from June 2022 to May 2023 using pitfall traps. Selected taxa (families Formicidae, Tenebrionidae, Carabidae, Isopoda, and other ground-dwelling arthropods) were chosen to be identified to the lowest possible level. Seasonal variation in arthopod composition and phenology is analyzed, highlighting the importance of systematic research while taking into account the sites' diverse variables. In addition, alien species are identified, indicating the position of anthropogenic habitats as niches of biological invasions. Such studies can further advance our understanding of the impact of urbanization on arthropod community composition, thus, managing biological invasions of alien arthropods and their integration into natural habitats, as well as, increasing the availability of suitable microhabitats for rare and endemic taxa in habitats experiencing varying degrees of anthropogenic interference.

Keywords: soil diversity, pitfall traps, urban biodiversity

Birds Arriving Depleted or Fuelled to Gavdos Island in Spring: The Perils and Advantages of Migratory Flights Over the Libyan Sea

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Long-distance flights over freezing altitudes, deserts, and open seas—supported by innate compasses, learned navigation skills, and favourable weather—offer migratory species significant fitness advantages. However, these journeys carry substantial risks along difficult stretches like the Libyan Sea, where survival depends on critical staging sites. Trapping surveys reveal emaciated birds and high mortality due to irreversible metabolic collapse caused by fuel reserve depletion. Identifying and protecting such stopover sites is vital for conservation. Targeted measures, such as habitat enhancement can provide life-saving food, water, and shelter. Despite their importance, the role of Greece's ~6,000 islands and islets remain largely understudied, even under the Natura 2000 network. To address this, we investigated Gavdos—the southernmost point of Europe, located 260 km north of Libya—as a stopover site for spring migratory birds. Using fuel load data from 17,512 birds ringed over seven years, we replicated the analyses of a recent study on energy-depleted migrants on Gavdos and two other southern Greek islands. We observed significantly higher percentages of birds with depleted fuel reserves, with average fat and muscle scores of 1.87 and 1.83, respectively, among newly ringed birds. Importantly, we correlated daily energy status with the wind direction, underscoring the critical role of tailwinds in preserving the metabolic integrity required for open-sea crossings. Our findings highlight the importance of long-term monitoring and comprehensive datasets for effective conservation strategies. Gavdos' function as a critical stopover site reinforces the need for continued research and targeted action to protect these sites. Funded by NECCA.

Keywords: *Aegean, stop-over sites, obligatory refuelling, migration mortality, Natura 2000*

Conservation challenges for the charismatic freshwater lamprey *Caspiomyzon graecus*

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The Critically Endangered and rare endemic Epirus brook lamprey (*Caspiomyzon graecus*, Renaud & Economidis, 2010) is one of the most important yet understudied and relatively unknown freshwater fish species in Greece. As a living fossil, it represents a unique case of evolutionary significance, belonging to the lampreys—among the most ancient lineages of freshwater fish on Earth. The only known location of the species is the stream fed by the Kambi springs (Louros River system- Epirus region). This study is part of the conservation initiative for emblematic species of Greek fauna, coordinated by WWF Greece and funded by the Greek Wildlife Alliance initiative. Its primary objective is to evaluate the current condition of the species' habitat and identify anthropogenic pressures threatening its survival. A combination of traditional and advanced methods were employed, including the assessment of physicochemical and hydromorphological parameters, electrofishing—this non-lethal method allows for the safe collection of individuals- and the application of the innovative environmental DNA (eDNA) technique in water samples. The presence of the Epirus brook lamprey was not confirmed by either electrofishing or eDNA analysis. However, the eDNA method demonstrated its effectiveness by detecting four other fish species, thereby strengthening the overall reliability of the study. It is important to highlight that the sampling campaigns documented significant hydromorphological modifications in the Kambi stream, including deforestation and removal of riparian vegetation, channel modification, sediment extraction, river embankments, and the closure of Kambi's sluice gate, impacting the habitat suitability for *C. graecus*.

Keywords: *Anthropogenic pressures, Endangered species, Environmental DNA (eDNA), Epirus brook lamprey, Hydromorphological modifications*

This research was funded by WWF Greece scholarship program

Unveiling Hidden Gene Flow: Hybridization in Endemic Peloponnesian Lizards

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Hybridization between closely related species represents a significant process in evolutionary biology, often with profound implications for species boundaries and diversification. In the Peloponnese Peninsula, the cryptic endemic lizards *Podarcis peloponnesiacus* and *Podarcis thais* exhibit largely parapatric distributions, with limited zones of sympatry previously reported at Lake Doxa and Lake Stymfalia, but without prior evidence of hybridization. Here, we investigate (a) the geographic extent of the contact zone between these species and (b) the occurrence of hybridization. We collected genetic material from 240 individuals across 42 sampling sites. Field identification, based on morphological traits, was followed by genetic analysis of the mitochondrial ND4 gene and 11 microsatellite loci. A contact zone was identified, extending from the northeastern to the southeastern Peloponnese, along the Evrotas Valley (Laconia Prefecture). Approximately 10% of the individuals examined were identified as putative hybrids, predominantly found at sites where the distributions of the two species converge. At these sites, the frequency of hybrids was notably elevated, reaching up to 100% in some cases. Furthermore, strict sympatry between the two species was observed only at two locations at Mount Mainalon and Mount Parnon. The detection of hybridization unveils a previously unrecognized aspect of the evolutionary history of these two species and highlights the contact zone as a key system for investigating the mechanisms driving species interactions and gene flow.

Keywords: *Podarcis peloponnesiacus, Podarcis thais, molecular markers, species boundaries, contact zone, sympatry*

The diet of the Bonelli's Eagle (*Aquila fasciata*) in Greece and Cyprus

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KEYWORDS: Diet diversity; Eastern Meditteranean; pellets; prey remains; foraging flexibility

In this study, we investigated the diet of the Bonelli's Eagle (*Aquila fasciata*) in Greece and Cyprus by examining pellets and prey remains collected between 2019 and 2023. As a top predator in coastal and insular ecosystems, this species plays a key ecological role, yet it is experiencing population declines due to human-related mortality and prey scarcity. Our objective was to provide baseline data on feeding specialization, dietary niche breadth, and spatial overlap across regions. In mainland Greece, avian prey occurred most frequently in the diet, with the Hooded Crow (*Corvus cornix*) being the commonest species (15%). However, mammals contributed more to biomass, with the domestic goat (*Capra hircus*) accounting for 23% and the European hare (*Lepus europaeus*) for 18.4%. In the Aegean, the diet was characterized by a high frequency of Black Rats (*Rattus rattus*, 22%) and a unique reliance on the Yellow-legged Gull (*Larus michahellis*), which accounted for 17.9% of total biomass. Reptiles were also more prominent in this region, comprising 12.1% of prey frequency and 7.9% of biomass. On Crete, the Wild Rabbit (*Oryctolagus cuniculus*) was the primary prey species, with the highest frequency (22.8%) and biomass contribution (38.1%). In Cyprus, the Black Rat was the most frequently prey species consumed (39%) despite its low energetic value, though key biomass contributors included the European hare (*Lepus europaeus,* 23.6%), the Chukar Partridge (*Alectoris chukar*, 14.9%), the Feral pigeon (*Columba livia*, 12.2%), and the Hooded Crow (8.7%). Overall, the Bonelli's Eagle exhibits considerable foraging flexibility in eastern Mediterranean; adapting its diet to local prey availability with birds dominating in frequency, and mammals providing the bulk of its energetic intake.

Keywords: Diet diversity; Eastern Meditteranean; pellets; prey remains; foraging flexibility

Exploring the hidden freshwater macroinvertebrate biodiversity of Greece's "dragon lakes" through eDNA: a first national application in alpine ecosystems

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The loss of biodiversity is a major global concern, particularly in sensitive and understudied ecosystems such as alpine freshwater lakes. In Greece, these high-altitude lakes—locally known as "dragon lakes"—are isolated, ecologically valuable habitats that remain poorly documented in terms of freshwater biodiversity. This study presents a first national application of environmental DNA (eDNA) metabarcoding for the assessment of freshwater macroinvertebrate diversity in four alpine lakes: Gistova (2,350 m), Smolikas (2,150 m), Verliga (2,050 m), and Mikri Arena (2,050 m). Sampling was conducted in May and June 2024, with an additional pilot winter sampling in January 2024 at Mikri Arena. eDNA was collected using Sterivex™ filters in the field and extracted with a modified DNeasy Blood & Tissue Kit protocol. The mitochondrial COI region was targeted with universal primers, and sequencing was performed on a high-throughput platform. Taxonomic assignments are currently being processed, primarily at the family level, with several detections reaching species-level resolution. This work lays the foundation for implementing eDNA-based biomonitoring in alpine freshwater systems in Greece and highlights the method's value in accessing difficult-to-monitor environments, enhancing biodiversity surveillance efforts, and informing conservation strategies.

Keywords: metabarcoding, high-throughput sequencing, COI gene, field sampling, biodiversity assessment, non-invasive monitoring

Behavioral studies of oviparous individuals of the rock shrimp *Palaemon elegans*

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The rock shrimp *Palaemon elegans* is a decapod crustacean species previously investigated for certain individual behavioral traits as well as their consistency over time and the potential presence of behavioral syndromes. Building upon earlier findings on adult males and non-oviparous females (unpublished data), the present study focuses on oviparous female individuals to examine the expression and correlation of four behavioral traits under different thermal conditions. A total of 40 oviparous individuals were tested in two seasonal groups (n = 20 each), collected from the Saronic Gulf (37°47'18.7"N 23°53'02.3"E) in August 2024 and March 2025. The water temperature was maintained at 25–26°C for the summer group (high temperature) and 19–20°C for the spring group (low temperature). The traits evaluated were activity, boldness, exploration, and shoaling. Behavioral assays involved digital video recordings and standardized tank experiments. Due to pre-spawning molts and egg release—particularly in the high-temperature group—repeated trials (a second week) could not be conducted, preventing assessment of behavioral consistency over time. The rockshrimps in both groups responded reliably to all individual behavior tests, showing the relevant characteristic. Activity levels were higher at the high temperature. A single significant correlation was observed between shoaling and exploration ($P = 0.002$, $\rho = +0.64$) only in the high-temperature group. Thus, possible presence of a behavioral syndrome cannot be supported for the oviparous roskshrimps compared with adult female non bearing eggs (unpublished data). These findings emphasize the role of reproductive status and environmental temperature in shaping behavioral expression.

Keywords: activity, *boldness*, *exploration, shoaling*

New Research Avenues on Animal Societies in Greece and Adjacent Regions

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Group-living has evolved in various animal species. As animals move and interact with others, they generate an ever-changing social web, where each individual both experiences a unique social environment and contributes to that of others. The characteristics of these social environments, e.g., the complex spatio-temporal variability of group formations, can have profound implications for individual reproduction and survival. Scaling out, social interactions can influence key ecological and evolutionary processes, such as seasonal collective migrations. However, identifying complex interactions in nature is challenging as it requires following most individuals in a population over extended periods of time. Thanks to a combination of recent technological advances and traditional observation techniques, a rich toolkit to monitor individual behaviour and track the movement of entire groups is available. Several social organisms, such as fish forming schools, rodents living in hierarchical societies, wolfs forming packs, and even colonial breeding birds, are already being studied in Greece and adjacent regions. This roundtable aims to form a network of support and collaboration among early-career and senior researchers, fostering studies on group-living and collective behaviour. The session will include talks on current socio-ecological questions and available methodologies, followed by a roundtable discussion and brainstorming on future prospects.

Morphological characteristics and variability of the Cyclades blunt nosed viper, *Macrovipera schweizeri*, throughout its distribution range

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Blunt-nosed vipers are a group of viperine snakes of the genus *Macrovipera*, distributed across the Near and Middle East, North Africa and reach four islands in the Aegean archipelagos. The Cyclades blunt-nosed viper, commonly known as the Milos viper (*Macrovipera schweizeri*), is endemic to the western Cyclades islands of Milos, Kimolos, Sifnos and Polyaigos. The species is currently listed as "Endangered" by IUCN. Despite its conservation status, few studies have been conducted on *M. schweizeri*, and its taxonomic position remains uncertain. Previous studies have suggested that the Sifnos population may represent a distinct subspecies or even species. To further explore this possibility, we measured a set of morphological traits in individuals from all four islands. These traits are the following : head length (HL), head width (HW), total length (ToL), snout-to-vent length (SVL), tail length (TaL), and body mass (weight). Furthermore, we calculated morphological ratios: TaL/ToL, TaL/SVL, HL/SVL, and HL/HW, and assessed the body condition index (BCI) of each individual using Fulton's index (K). Here we present the first findings.
The research project was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) and NECCA under the "2nd Call for Actions to protect, conserve and promote biodiversity. Field studies of endemic, endangered and nationally important species of Greece» (Project Number: 12786).

Delimitation of exclusion zones for wind farm development along pelican flight corridors in northern Greece

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Dalmatian pelicans *Pelecanus crispus* are colonial waterbirds which often nest in one wetland but commute to others to feed during the breeding season. These wetlands may lie up to ca 200 kms away from their nesting site. To minimize flight energy costs during these foraging trips, pelicans follow aerial "corridors" along which they are apt to use local conditions, such as thermals and updrafts to soar and glide between destinations. Between June 2012 and April 2025, we fitted GPS/GSM transmitters on 70 Dalmatian pelicans captured at Prespa and Kerkini lakes, in order to study their movements and time budgets. One of the main goals was to locate, delineate and map as accurately as possible all aerial zones ("corridors") of frequent usage by flying pelicans, aiming at delimitating wind farm exclusion zones, to reduce negative impacts of wind turbine development, i.e., mortality, displacement and flight disruptions. We used 5.088 GPS fixes, taken at 0-350 m above ground, within the national borders, and in a polygon delimited by Lakes Prespa in the W to Lake Vistonis in the E and the Polyfytou dam lake in the S. We conducted a Hotspot Analysis (Getis & Ord 1992) in Arc GIS Pro ®. Most exclusion zones lied between lakes Prespa, Kastoria, Doirani and Kerkini, forming an almost continuous narrow corridor. Other scattered exclusion areas in a parallel line to the south, delimit very high usage locations where building wind parks can prove detrimental for pelicans.

Keywords: *pelicans, wind farm exclusion zones, northern Greece.*

Responses of ground and darkling beetle assemblages to tillage and intercropping methods in a dryland multi-treatment carob cultivation

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Studies on edaphic arthropod responses to agricultural intensification and management have been increasing, as the need for transition from conventional to sustainable management has become more crucial under climate change, although studies focusing on carob (*Ceratonia siliqua* L.) cultivations are very limited. This study is the first to compare edaphic beetle assemblages (Carabidae and Tenebrionidae) based on a series of agricultural management methods in Cyprus, including conservation tillage, mulching, and intercropping (thyme, Cyprus' vetch and clover). Our initial hypothesis was that tilled plots would be indicative of low arthropod diversity, promote trophic group homogeneity and dominance of generalist and adaptable taxa, with reduced presence of ground beetles. Our results showed lower diversity caused by tillage under the harshest conditions of summer, contrary to the hay mulching treatment that was characterised by the highest carabid diversity. Partially confirming our initial hypothesis, tilled plots were also dominated by detritivore presence (%), while predatory beetles were the least represented in the plots (spring, autumn, and summer periods). We have also identified a significantly negative effect of tillage active status on the presence of phytosaprophage beetles, contrary to predatory carabids that were positively affected by the presence of thyme and lack of intervention in plots. This study highlights the negative effects of even reduced (conservation) tillage in reducing edaphic beetle diversity during the warmest period of the year but also driving artificial selection pressures for adaptable detritivore taxa, contrary to thyme intercropping and unmanaged plots that may benefit pest control and bioindicator taxa.

Keywords: *Carabidae, Diversity,Sustainable management, Tenebrionidae, Tillage, Trophic composition*

Genetic and morphological diversity of the Macedonian crested newt, *Triturus macedonicus*: taxonomic and conservation implications

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The Macedonian crested newt, *Triturus macedonicus*, is an endemic urodele of the Balkan Peninsula and a priority species (ANNEX II, 92/43/EEC). Phylogenetically, it comprises three geographically distinct mitochondrial clades: Clade 1 ("Northern"), Clade 2 ("Zagori"), and Clade 3 ("Olympus"). This study investigates whether mtDNA sub-structuring in *T. macedonicus* is reflected in the nuclear genome and external morphology, to assess subspecies delineation potential. We analyzed 278 mtDNA sequences, multilocus genotypes from 509 individuals, and morphometric data from 210 individuals, across 96 breeding sites, focusing on Greece, where all three mitochondrial clades are present. The results confirm three well-supported divergent mitochondrial clades, though nuclear markers (microsatellites) and external morphology exhibit limited congruence. Nuclear markers reveal two main, well-differentiated gene pools: one including populations from mtClades 1 and 3, covering most of the species' distribution, and a second, restricted to southern Albania and Epirus, including populations of mt Clade 2. The latter gene pool shows further sub-structuring into two distinct population groups: one from the Zagori region and another from Lake Pamvotis' basin. Morphological variation in body size and shape is primarily attributed to sexual dimorphism rather than differences among mitochondrial clades. The observed mito-nuclear discordance, along with the mismatch between genetic and morphological patterns, undermines recognition of mitochondrial clades as separate subspecies. However, two geographically and genetically distinct population groups meet the criteria for designation as separate Evolutionarily Significant Units (ESUs). Within each ESU, genetic diversity patterns support the recognition of distinct Management Units (MUs), potentially requiring targeted conservation strategies.

Keywords: *amphibians; mitochondrial DNA; nuclear DNA; mitonuclear discordance; cryptic diversity; conservation units*

Contribution to the ant fauna of the United Arab Emirates

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The United Arab Emirates (UAE) are situated in the south-eastern part of the Arabian Peninsula, sharing borders with Oman, Saudi Arabia and Yemen. The country has a hot desert climate and biogeographically stands at the borderline between the Palaearctic and Afrotropical biogeographic realms. Currently, 127 species and subspecies of ants have been identified from the UAE, including four endemic and 14 non-native species according to AntWiki. In the framework of the BSc Thesis of the first author, ants from the UAE were collected by the last author, as well as various students from the UAEU, and deposited at the Zoology Museum of the University of Athens. Specimens were then curated and identified to the species level. Specimens belong to 85 morphospecies, including 55 endemic and 17 non-native species. New distributional data are presented, with 17 native and six non-native species being reported for the first time for the UAE. The genus *Lasius* is reported for the first time from the Arabian Peninsula, with specimens belonging to the *Lasius turcicus* complex potentially being non-native to the country. Three distinct morphospecies of *Iridomyrmex* are detected, elevating the number of known introduced taxa from the genus to four. Three specimens, identified as *Cataglyphis* cf. *flavobrunnea*, probably belong to a new undescribed species, necessitating further material collection for examination. Future studies could aim towards creating new and updating existing identification keys, monitoring the introduction and spread of non-native species, as well as deciphering the status of morphospecies of uncertain taxonomic positioning through the use of molecular tools.

Keywords: Arabian Peninsula, biological invasions, Formicidae, taxonomy, UAE

Prolonged Spring Stopovers of European Bee-eaters (*Merops apiaster*) on Gavdos Island Give a False Impression of a Large Migratory Influx: It's Only a Few Flocks, Not Thousands of Birds

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The spring passage of European Bee-eaters over the small island of Gavdos, the southmost point of Europe, is a conspicuous event, as loud flocks numbering 30-50 birds congregate around cultivations, beehives and fresh-water resources. Birds consistently arrive from south and depart toward Crete, 38 km to the north, suggesting brief stopovers. Based on visual observations and bird behaviour only, and over six years (2002-2004, 2022-2024), we estimated that 900-1500 birds, split into 30 flocks, use Gavdos as a stopover site during spring. However, intense ringing-recapture efforts in 2024 revealed the actual number of staging birds is up to three times lower than estimated from visual observations, and likely doesn't exceed 500 individuals, repeatedly observed over successive days and weeks. Recaptures were frequent throughout spring, with prolonged stopovers most notable for birds arriving in late April. Of 373 ringed individuals (April 19-May 12), 145 were recaptured 373 times, averaging 2.6 recaptures per bird. The average time between ringing and final recapture was 4.9 days, with a maximum of 20 days recorded three times for birds ringed on April 22. Notably, 40.7% (59) of these individuals were last recaptured at ≥5 days, and 14.5% (21) at ≥10 days. The majority of ringed/recaptured birds had depleted fuel reserves approaching emaciation, with the average muscle score of 1,7 and fat of 0,8 respectively. Refuelling was minimal and slow, despite available prey. These findings highlight Gavdos as a critical stopover for migrating bee-eaters, underscoring its conservation importance within the Natura 2000 network. Funded by NECCA.

Keywords: *Merops apiaster, ringing/recapture, duration of stopover, fuel depletion*

Can't Fly Upwind: Catastrophic Mortality of Migratory Birds on Gavdos Island in Spring 2024

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On April 24th, 2024, an unseasonal shift in wind direction and strength from SE to NW across the eastern Libyan and western Levantine Basin persisted for 13 days, until May 7th. These unfavourable conditions forced migratory birds to extend their stay in North African staging sites and/or endure prolonged, energy-draining flights over the sea. Waves of exhausted birds started arriving on Gavdos Island from April 25th with individuals mist-netted for ringing carrying fat and muscle scores below the metabolic threshold of 1, indicating severe energy depletion and potential physiological collapse. Compounding the crisis, the scarcity of food and water caused by an exceptionally dry winter and spring resulted in unprecedented mass die-offs through early May. Additional factors included intensive cat and rat predation, traffic collisions and diseases caused by immune-suppressive exhaustion. Locals described this event as the worst bird die-off in decades, with gardens and orchards littered with carcasses, prompting some residents to bury dozens of birds. The bird ringing team carried out a 2-hour carcass survey on May 3rd after ceasing the trapping efforts, recovering 105 complete carcasses of 21 species, along with dozens of partial remains suggesting widespread cat/rat predation. The most heavily affected species included *Sylvia borin*, *Muscicapa striata*, *Hirundo rustica*, *Phylloscopus sibilatrix*, and *Merops apiaster*. This event highlights the severe impact of extreme weather on migratory species and underscores the urgent need to improve habitat quality and protection at critical stopover sites like Gavdos. Funded by NECCA.

Keywords: *migration mortality, predation, cats, head-on winds, fuel depletion*

Winter Home Range and Territoriality of Common Buzzards (*Buteo buteo*) in Mediterranean Olive Landscapes

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The conservation and management of wildlife species rely on a sound understanding of their ecology and spatial behaviour. In this context, delineating their breeding and foraging habitats is essential for identifying habitat preferences, understanding selection processes, and assessing intra-specific interactions. Such information is critical for defining ecological hotspots that require targeted management, as well as for evaluating threats such as habitat loss and degradation. In the present study, we examined the spatial ecology and behaviour of Common Buzzards (*Buteo buteo*) radio-tracked in the olive groves of southern Crete. We focused on describing home range size and spatial distribution patterns of buzzards wintering in the Mesara plain between 2022 and 2025. The mean home range of 12 individuals was estimated at 53.8 ± 2.9 ha using 95% Kernel Density Estimators (KDE), while core activity areas (50% KDE) averaged 10.7 ± 2.9 ha (range= 2.8–37.8). Overlap between home ranges was less than 20%, indicating a strong territorial behaviour. During winter, home ranges contracted significantly to 30.8 ± 2.9 ha, and core areas decreased by approximately 40%, namely to 6.4 ± 1.5 ha (range: 2.7–11.9). Territorial overlap remained consistently low suggesting that Common Buzzards face ecological constraints in high-density areas such as olive groves during the winter. This pattern is most probably due to the influx of overwintering individuals supporting the existence of strong territoriality among both resident and migratory birds.

Keywords: home range; territoriality; common buzzard; olive grove; Crete

Parasitic Fauna of Two Native and One Alien Fish in the Evrotas River Basin (Greece): A Comparative Study

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Host–parasite dynamics between native and alien fish species remain underexplored, particularly in Mediterranean freshwater ecosystems, limiting our understanding of how parasitism influences biological invasions and native biodiversity resilience. This study examines the parasitic fauna of two threatened, endemic cyprinids of the Evrotas River basin (southern Greece), i.e., the Evrotas minnow *Pelasgus laconicus* and the Evrotas minnowroach *Tropidophoxinellus spartiaticus*, and of the invasive poeciliid *Gambusia holbrooki*. Fish specimens were collected in November 2024 from the Hound stream (Vassilopotamos basin, former tributary of the Evrotas R.) via electrofishing and examined macroscopically and microscopically for parasitic infestation. In both native species, numerous metacercarial stages of trematodes (family Diplostomidae) were found in fins, liver and intestine, while they all presented black spots on the skin. In contrast, there were no signs of infestation of the skin and of parasites in the internal organs of *G. holbrooki*. The results indicate that the local diplostomid trematodes exhibit host specificity, with the invasive *G. holbrooki* remaining non-infested, possibly profiting from an “enemy release” effect. The hypothesis that the alien fish may evade local parasitic hazards, which could provide it an advantage in competition and exacerbate its ecological impact, is supported by the absence of parasite spillover from the native to the alien species. This study reports the infestation of the two Evrotas native fishes by these parasites and their absence in the cooccurring alien fish; the possible effects of this "selection" on host-parasite dynamics and native biota are discussed.

Keywords: *Diplostomidae, metacercariae, native fish, host specificity, biological invasions*

Spying on dormice with artificial nests in protected areas of Northern Peloponnese

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Our knowledge on the distribution and ecology of the three dormice species - the Forest Dormouse (*Dryomys nitedula*), the Edible Dormouse (*Glis glis*), and the Hazel Dormouse (*Muscardinus avellanarius*) - in Northern Peloponnese, remains incomplete. In this context, this survey was conducted to collect dormice presence data and document behavioural traits in this region. Therefore, 126 wooden nest boxes were deployed at nine sites across seven Natura 2000 protected areas during the summer of 2023. Apart from direct observations of the species during nest checks, indirect signs of nest use (fecal presence and arrangement, nest building materials, nest architecture etc.) were recorded during three subsequent inspections (autumn 2023, spring/early summer 2024, autumn 2024). Forest and edible dormice frequently used the nest boxes, while no individuals or signs of the hazel dormouse were recorded, supporting previous indications of its relative scarcity in the Peloponnese. Additionally, the presence of the forest dormouse at Kertezi, and the edible dormouse at Mpoumpoukas, Mt. Erymanthos was recorded for the first time. Nest box usage increased gradually over time reaching 62.9% during the final inspection, while direct encounters ranged from 5 to 10 individuals per season check. These findings suggest that the continuous *in situ* nest presence may lead to their more extensive use by the local dormice populations. The data from this study will support monitoring and conservation efforts for these dormice species at one of the southernmost European limits of their distribution. Also, efforts to locate the Hazel Dormouse will continue in the future.

Keywords: *Glis glis, Dryomys nitedula, Muscardinus avellanarius,* protected areas.

Towards a barcode database for diversity of *Messor* ants in Bulgaria

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Accurate species identification is essential for resolving taxonomic uncertainties, particularly in morphologically similar insect taxa such as the ant genus *Messor* (Hymenoptera: Formicidae). In this study, we evaluate the effectiveness of DNA barcoding using the mitochondrial COI gene fragment to differentiate *Messor* species.A total of 95 ant specimens were sampled, 93 from the target genus and two specimens from *Aphaenogaster* and *Tetramorium* used as outgroups. The bulk of the material was collected in Bulgaria (69 specimens), with additional material from Greece (13 specimens), Turkey (5 specimens), Albania (4 specimens), North Macedonia (2 specimens), Montenegro (1 specimen), and Italy (1 specimen), providing broader genetic variability and geographic range.DNA extraction, amplification, and sequencing of the COI gene fragment were performed by the Canadian Centre for DNA Barcoding (CCDB) using the standard primer pair.All 86 sequences generated in the present study are deposited in the Barcode of Life Data System (BOLD) under the BGANT project, while voucher specimens are kept in the Zoological Collection of Sofia University (BFUS).As a result of our study, nine *Messor* species were recognized based on classical comparative morphology, while molecular analyses revealed 14 unique BINs (Barcode Index Numbers), suggesting the presence of cryptic diversity. Species delimitation was assessed using multiple analytical approaches, and phylogenetic relationships were inferred through Maximum Likelihood analysis.This study provides valuable reference material for future research and highlights the importance of applying integrative taxonomic approaches in ant biodiversity studies.

Keywords: the Balkans, barcoding, COI, Formicidae, Myrmicinae

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Connecting people & wildlife on the Balkan Green Belt in Greece and Bulgaria

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Since 1994, brown bears (*Ursus arctos*) have been documented in the transboundary region between Bulgaria and Greece, particularly from the Orvilos/Slavyanka Mountain range to the western Rhodope Mountains. In 1995, during the initial construction of the Drama–Gotse Delchev road axis, the Greek NGO ARCTUROS alerted the Ministry of Environment about the lack of an Environmental Impact Assessment (EIA). This prompted an expert mission and a subsequent ministerial directive mandating a complete EIA. Finalized in 1999, the EIA recommended an alternative route incorporating a transboundary wildlife overpass (ecoduct). Both governments adopted this measure, leading to the construction of the "Bulgarian and Greek Friendship" ecoduct. The 447m wide ecoduct was designed to maintain connectivity for large mammals, particularly brown bears. Despite its scale and intent, no prior assessment had evaluated the ecoduct's ecological effectiveness. This study presents the first systematic monitoring of large mammal activity in the ecoduct zone, employing volunteer-led biosign surveys, camera trapping sessions, and stakeholder interviews. This effort was supported by local army posts, border police, and the Greek Forest Agency; the latter even provided accommodation for the Greek-Bulgarian research team. Species detected include *Ursus arctos*, *Canis lupus*, *Capreolus capreolus*, and *Sus scrofa*. Our findings confirm use of the ecoduct by large mammals, highlighting its role in facilitating transboundary wildlife movement. Habitat suitability and connectivity models further emphasize the conservation value of the surrounding landscape. These results underscore the importance of post-construction monitoring and provide a foundation for targeted management strategies in this ecologically sensitive corridor.

Keywords: *large carnivores, brown bear, ecoduct, Iron Curtain, transborder, connectivity*

Connectivity Conservation Initiative for Fresh Drinking Water

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Ecological corridors are critical for preserving biodiversity and ensuring the resilience of ecosystems facing climate change. This study focuses on maintaining connectivity for two protected large carnivore species—wolves (*Canis lupus*) and brown bears (*Ursus arctos*)—between roadless core areas in the Konitsa municipality—specifically Mount Smolikas, Gyftissa, Tampouri, RA229, and RA308. Ensuring the integrity of these corridors is essential not only for the survival and mobility of these species but also for minimizing human-wildlife conflict and supporting long-term climate adaptation strategies. We assessed habitat suitability and corridor functionality under the prism of climate change, utilizing biosign surveys and key abiotic factors influenced by climate change, such as temperature and water availability along with human pressures and land cover. Subsequently, we prioritized corridors and implemented conservation actions to reduce the distance to water sources and improve access to freshwater, and enhance the long-term viability of these corridors for wolves and bears. A key intervention involved the restoration of two abandoned stone-made water fountains, strategically located away from human settlements, using natural materials and traditional techniques. These fountains now provide accessible freshwater for wildlife while preserving elements of the region's cultural heritage. In parallel, we promoted community engagement through participatory workshops, awareness campaigns, and volunteer activities aimed at fostering local stewardship. The project's key outcomes include the identification of climate-sensitive corridors, sustainable management of water resources, and strengthened community involvement in conserving vital ecological linkages across the landscape.

Keywords: *large carnivores, corridors, climate change, cultural heritage, roadless areas, community engagement*

Stress Responses of the European Ground Squirrel in Habitats Affected by Wind Farms – The *KATANEMO* Project

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Environmental changes induced by wind farms may act as potential stressors for both aerial and ground-dwelling organisms. The physiological response to such stress typically involves the release of glucocorticoid hormones. One of the endangered (EN, IUCN), endemic, and emblematic species of Greek fauna inhabiting open landscapes is the European ground squirrel (*Spermophilus citellus*). The aim of the *KATANEMO* project is to assess the impact of wind farms on the habitats of this species, providing critical data to inform evidence-based and targeted measures for its monitoring and conservation. To achieve this, seasonal trapping of individuals will be conducted on Mount Vermio in areas both with and without wind turbines. Fecal and hair samples will be collected for corticosterone concentration analysis using the ELISA method. In parallel, for the first time, thermal imaging will be employed to assess stress responses by analyzing the eye temperature of captured individuals using a thermal camera. The expected outcomes will shed light on the physiological effects of wind farms on a protected species, comparing a traditional hormonal analysis approach with an innovative, non-invasive imaging technique. *KATANEMO* aspires to contribute significantly to decision-making processes regarding the planning and placement of wind turbines, thereby supporting the optimization of biodiversity conservation strategies.

Keywords: *Spermophilus citellus*; Semifossorial mammal; Physiological stress response; Corticosterone concentration; Infrared thermography; Conservation strategies

Detecting stress-induced hyperthermia in European ground squirrels using infrared thermography: Implications for conservation physiology of an endangered species

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Stress-induced hyperthermia (SIH) is a well-documented physiological response in mammals subjected to acute stressors, characterized by an elevation in core body temperature and associated with peripheral vasomotor changes. Monitoring SIH in free-ranging populations is crucial for understanding stress physiology under natural conditions. However, traditional methods for monitoring mammals' physiology are often invasive, limiting their applicability in the field. Infrared thermography (IRT) has emerged as a promising non-invasive alternative, capable of detecting surface temperature changes across thermoregulatory regions known as "thermal windows." In this study, we examined the occurrence and magnitude of SIH in the European ground squirrel (*Spermophilus citellus*), a semi-fossorial mammal, by recording high-resolution thermal images during standardized short-term containment procedures designed to minimize handling effects. Ocular regions were targeted as primary thermal windows due to their sensitivity to internal thermoregulatory changes. Surface temperature variation was quantified across individuals, revealing significant increases consistent with SIH patterns described in other mammalian species. These findings demonstrate the utility of IRT in capturing physiological stress responses non-invasively and in real time. As a field-adapted technique, IRT offers valuable opportunities for expanding our understanding of thermoregulation and acute stress dynamics in wild mammal populations. Integrating such methods into conservation frameworks can enhance early stress detection, providing critical physiological indicators for at-risk populations such as the European ground squirrel.

Keywords: Physiological stress response, thermal windows, non-invasive methods, *Spermophilus citellus*

Changing the paradigm: loggerhead turtles (*Caretta caretta*) exhibit more complex post-nesting migration strategies than previously thought

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Like all other sea turtle species, loggerheads (*Caretta caretta*) occupy diverse marine and terrestrial habitats throughout their life cycle, undergoing vast migrations covering thousands of kilometers. Until recently it was thought that following the end of their reproductive season, adult males and females migrate directly back to their foraging/overwintering areas where they remain until they are ready to reproduce again. In the context of the EU co-funded project LIFE MareNatura aiming to identify important marine areas for megafauna species in Greece and Italy, ARCHELON researchers deployed 18 satellite transmitters on gravid female turtles in the Peloponnese and on Crete following their movements via the Argos satellite system. Preliminary data resulting from 15 transmitters still emitting signals suggest post-nesting migrations are more complex than previously thought. For example, 6 turtles went straight to spatially restricted neritic sites where they remain to this day. A second strategy, exhibited by at least 5 females, indicates that turtles shift among oceanic and neritic sites, spending weeks before moving on to a new site. A third post-nesting behavior, exhibited by 4 turtles, indicates wandering movements in the west Mediterranean basin, north Aegean and the Adriatic Sea. Our results indicate a different paradigm when it comes to post-nesting behavior, where turtles not only exhibit spatially restricted movements and wandering but also utilize both neritic and oceanic habitats. The ecological and environmental processes dictating these behaviors need to be identified and assessed as they may play a key role in future conservation efforts for the species.

Keywords: *migration strategies, satellite transmitters, conservation*

Examining the Impacts of Climate Change and Land-Use Change on Island Wildlife Communities

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Climate change and habitat degradation are causing rapid biodiversity losses,with significant impacts on ectothermic species, such as reptiles. Individual impacts of these two factors on reptile populations have been well-documented. However, their impacts are taking place simultaneously. In addition to global climate change, vegetation management through agricultural or livestock management activities can have profound impacts on landscapes, affecting temperature and water availability and subsequently, the occurrence of reptiles. To begin untangling the issues facing reptiles and make predictions regarding their response to climate and land-use change, we conducted visual encounter surveys across the island of Naxos, Greece. On surveys, we collected species diveristy and abundance data of reptiles, and modeled these as response variables to elevation, aspect, grazing intensity, primary habitat type, and dry-stone wall presense using linear modeling. We found that reptile diversity and richness were primarily driven by grazing intensity and dry-stone wall presence, with the highest diveristy found in areas with low-level grazing and dry-stone walls. This work serves as the prelimiary steps to build ecological niche models for reptiles in the Aegean Islands, with particular attention placed on species' thermal ecology. With more accurate models on an ecologically relevant scale, we can better guide habitat management to provide suitable habitat for reptiles to combat overall patterns of warming. In the case of the Aegean Islands, this may take the form of restoration of dry-stone walls and targeted or reduced grazing by livestock.

Keywords: *Reptile, Conservation, Island Biogeography, Modelling, Climate Change, Grazing*

Current status of fishes in Küçükçekmece Lagoon (NW Türkiye) under changing ecological conditions

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The aim of this study is to obtain up-to-date information on the fish fauna of Küçükçekmece Lagoon (İstanbul), which is under anthropogenic stress, particularly from pollution and habitat alteration, and to present the distribution and abundance of fishes within the lagoon. Seasonal samplings were carried out between September 2023 and August 2024, and fishing was conducted at five different stations within the lagoon using scientific gillnets and at two on the coastal sites using a seine net. A total of 17 fish species belonging to 11 families were identified. Only five species (*Atherina boyeri, Engraulis encrasicolus, Chelon auratus, Chelon ramada,* and *Mugil cephalus*) were captured with gillnets across the five lagoon stations. On the other hand, all 17 species were recorded in areas near the lagoon's connection to the Sea of Marmara using seine net. *Atherina boyeri* was the most abundant species in both fishing methods (1702 and 314 individuals, respectively), while *Salaria pavo, Hyporhamphus picarti, Neogobius fluviatilis, Gobius niger, and Sparus aurata* were each represented by a single individual. Following the cessation of river inflows, salinity levels in the lagoon increased (up to 12.99 ppt) and freshwater fish species disappeared, and with the exception of a few resident species such as *A. boyeri, E. encrasicolus* and three mullet species, the lagoon is predominantly inhabited by marine species, especially during spring and summer. The results also indicated that the distribution range of *H. picarti* has expanded into the study area, probably due to the impact of maritime transport.

Keywords: *Atherina boyeri, abundance, brackish water, fish fauna, salinity*

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Transboundary cooperation in the SW Balkan region for brown bear (*Ursus arctos*) habitat connectivity conservation

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Over the past twenty years, conserving landscape connectivity has received increasing recognition as a key strategy to protect biodiversity, maintain viable ecosystems and wildlife populations especially for wide-ranging species. Transboundary conservation of structural and/or functional habitat connectivity, especially when overlapping with parts of the distribution range of a large carnivore umbrella species, such as the brown bear (*Ursus arctos*), is of paramount importance for the species' conservation at a biological population level. Under the project "Tripoint Brown Bear" and its ongoing continuation "Transboundary Brown Bear Conservation" (Albania, Greece and N. Macedonia) and over a project area covering a total of 15,329 km^2 the aim was to identify hot spots of current and future bear habitat fragmentation problems using GIS spatial analyses tools. Identification of hot spots was based on four fundamental information layers: a) species distribution: bear presence data were collected in all scales and categories and a 1x1 km² raster was generated to establish a "density" map reflecting species distribution in (4) classes), b) suitable habitats (high resolution data of EUNIS habitat level 3 or forest map data were used), c) future linear grey transportation infrastructure (fenced highways, national roads, railways) using Open Street Map data (OSM), other infrastructure such as energy projects (wind, hydropower, solar) and recreation infrastructure, d) present and planned protected areas (National parks, Ramsar Sites, Biosphere reserves, Natura 2000 sites, Emerald sites). An overall synthesis generated a final map depicting bear habitat fragmentation scoring, with direct monitoring and conservation implications to the targeted species.

Keywords: *brown bear, conservation, connectivity, transborder populations, Balkan region*

Three aspects of *Pimelia* Fabricius, 1775 (Coleoptera, Tenebrionidae) species from Türkiye: Phylogenetics, cytogenetics and morphology

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The genus *Pimelia* which can be found in various ecosystems has a wide distribution comprising the Palaearctic, Afrotropical and Indo-Malayan regions. In Türkiye there are thirteen recorded *Pimelia* species most of which are members of the subgenus *Camphonota.* With this study we aim to provide the first comprehensive molecular information about the *Pimelia* of Türkiye combined with cytogenetic and morphological data. Phylogenetic analyses were conducted using the 829 bp long mitochondrial COI gene region (3' mt-COI). Bayesian analyses carried out to determine species boundaries under appropriate substitution models divided the *Camphonota* subgenus into 13 taxa. It was determined that *Camphonota* diverged from other subgenera in the dataset approximately 37-38 Ma ago. The clade constituting the subgenus *Camphonota* is also divided into 2 main lineages within itself. Giemsa, silver nitrate and fluorescent DAPI stained chromosomal plates of 18 *Pimelia* populations distributed in Anatolia, revealed the diploid number as 2n=18 ($8+Xy_p$) with some structural differences among them. In addition, the general morphologies of aedeagus structures, which are widely used in species identifications, were examined and evaluated with the molecular findings. The consistencies and discrepancies between these three aspects of *Pimelia* from Türkiye were determined for the first time and they will help to better understand the species boundaries.

Keywords: *Pimelia, Camphonota, pylogenetics, chromosome, morphology, COI*

Variation of dates of bird's spring arrival in eastern europe as a new ecogeographical rule

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After three classical zoogeographical rules (Bergman's, Allen's and Gloger's) many other ones became known. Along our studies of bird migrations in Ukraine and nearby countries, we paid attention to terms of bird arrival during long year periods in different locations of Eastern Europe. Early in the spring, birds can arrive in wide span of terms depending on weather conditions but late migrants arrive at terms that are more definite. Concerning Eastern European region, we have analyzed many year arrival terms of about 15 bird species with statistic methods. It occurs that coefficient of variation of terms of arrival depends on many year averages date of arrival: early arrival – large variation, late arrival – less variation. The many year average date of arrival depends on the latitude where the observations conducted: early arrival is usual at the South of the bird flyways and the late on the North. This regularity is common to all bird species in spite on their migratory status – early or late migrants. The rule gives the base to hypothesis of bird migration stimulation by exo- and endogenous factors and its balance change along their flyways.

Keywords: *birds, spring arrival, variation, geographical latitude, Eastern Europe*

Biogeography of future islands

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The response of continental islands to area change due to sea-level rise or subsidence has not received much attention, despite theoretical elaborations of relevant processes, such as supersaturation, relaxation, and extinction debt. The approach based on projecting past biotic changes based on area decline rates after glacial periods suffers from an inability to deal with cases of islands that were parts of extensive mainland, leading to utterly unrealistic assumptions on their starting species' sets. Here, we followed a different approach, using a projection of modern islands' area in the future, assuming a 200m rise of sea level. This work is conceptual, so it is irrelevant whether such a rise is realistic or not. Future studies can use realistic estimations of sea-level rise, as long as the respective resolution of species' distribution within islands is high enough to provide meaningful datasets. The parts of modern islands remaining as land after sea level 'rise' were considered as future islands, and the species that had been recorded therein were assumed to reflect their respective communities. We used data on terrestrial isopods from 20 central Aegean islands for which the resolution of species' records available gave meaningful results after GIS-produced sea-level rise. We excluded halophilic species, since we assume that these would not be affected by any sea-level change. We compared species communities, species-area relationships, and ecorichness of future and modern islands, and estimated 'extinction dept'. Results provide interesting insights to oversaturation-relaxation dynamics in continental islands.

Keywords: continental islands, ecorichness, extinction debt, relaxation, species-area relationship, terrestrial isopods

Combining methods for detection of bycatch hotspot areas of marine megafauna species in and around critical rookeries and foraging areas

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Bycatch, the incidental catch of non-target species, threatens marine megafauna such as sea turtles and sea birds in the Mediterranean region. Identifying bycatch hotspots is essential to guide mitigation measures and target audiences. In the Mediterranean Sea, Zakynthos Island in Greece is a major marine habitat for sea turtles, consisting of the second largest nesting area for sea turtles, and an important breeding and foraging habitat for sea birds. This work combined methodologies to identify fishing grounds and evaluate the bycatch hotspots in the significant marine habitat of Zakynthos, and propose mitigation measures to conserve and protect this economically and ecologically important ecosystem. The study determined two bycatch hotspots, evaluated the potential impact on sea turtles and sea birds, and discussed mitigation measures to reduce the impact of bycatch for the aforementioned species. Our approach and outcomes may well contribute to a science-based, adaptive management framework regarding the establishment or revision of Marine Protected Areas in the study area and elsewhere across critical marine habitats for sea turtles and sea birds.

Keywords: *Bycatch, Sea turtles, Sea birds, Satellite data, mitigation strategies, Ionian National Marine Park*

Seasonal monitoring of bats in two selected caves in Galičica National Park, North Macedonia

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Caves serve as critical habitats for bats, offering ideal conditions for roosting, breeding, and hibernation, as well as providing shelter and protection from predators. Therefore, monitoring both cave environments and bat populations is essential for bats' effective management and conservation. In 2023, we conducted seasonal monitoring of bat populations in two selected caves—Samotska Dupka and Leskoečka Peštera—located within Galičica National Park, North Macedonia. The aim was to assess the status of the bat populations and their seasonal use of the caves. Each cave was visited once per season, and we employed a combination of roost inspections, ultrasonic acoustic detection, and mist-netting to identify bat species and estimate colony sizes. Our results documented the presence of five bat species across the study sites: *Rhinolophus ferrumequinum*, *R. hipposideros*, *R. euryale*, *R. blasii*, and *Myotis blythii*. Species presence and population size varied seasonally. Samotska Dupka Cave was inhabited year-round and proved to be a significant hibernaculum for *Myotis blythii*, *R. ferrumequinum*, and *R. hipposideros*, with a minimum of 55 individuals observed during winter. Leskoečka Peštera Cave also hosted bats throughout the year; notably, a larger colony of 100–150 individuals, composed of *R. euryale* and *R. blasii*, was recorded during the autumn swarming period. This study provides the first seasonal assessment of cave use by bats in North Macedonia. Continued and expanded monitoring in other key caves within Galičica National Park could support the development of targeted management strategies for the conservation of bats and their cave habitats.

Keywords: bats, caves, seasonal use

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Reassessing the taxonomic validity of *Aegaeobuthus gallianoi* (Arachnida: Scorpiones) as an endemic scorpion species of Crete

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Until recently, *Aegaeobuthus gibbosus* (formerly known as *Mesobuthus gibbosus*) was the only representative species of the scorpion family Buthidae in Greece, the distribution area of which includes the island of Crete. In 2018, a new morphological species of yellow scorpion, *Aegaeobuthus gallianoi*, was described based on a single specimen from eastern Crete, which served as the holotype for the species. In this study, we investigated the molecular phylogenetic relationships of *Aegaeobuthus* species in Crete using two mitochondrial markers, 16S rRNA and COI. The molecular analysis was conducted on 49 specimens from 36 different locations around the island, including the Lasithi Plateau (type locality of *A. gallianoi*) and Xerokampos, where the presence of *A. gallianoi* has been recorded. The mitochondrial DNA (mtDNA) trees derived from two phylogenetic methods (Maximum Likelihood and Bayesian Inference) revealed three major clades on the island of Crete (eastern, central and western clade). The *A. gallianoi* specimens clustered within two of the three clades (eastern and central) together with *A. gibbosus* specimens. Although our analyses were based on only two mitochondrial genes, the species delimitation approaches, such as PTP, ASAP, and STACEY, challenged the taxonomy of *A. gallianoi* and call into question the taxonomic validity of the latter species. These findings encourage further investigation of the genus' diversity in Crete and Greece utilizing data from additional populations and genetic loci.

***Keywords*:** Crete island, scorpion, endemic, mtDNA, phylogeny, *Buthidae*

Small Islands, Big Insights:
Improving our knowledge on the biodiversity of underexplored micro-territories

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Within the Mediterranean Basin, hosting exceptional levels of species richness and endemism, small islands constitute biodiversity hotspots of their own, shaped by unique evolutionary and ecological processes. Their isolation and limited surface highlight them as ideal natural laboratories for studying colonization, adaptation, inte/inter-specific competition and species-habitat interactions. To date, the biological heritage of many Mediterranean islets is still poorly investigated. For over a decade, the NGO PIM Initiative worked at improving the ecological knowledge and conservation management of small (<1000 ha) uninhabited islets of the Western Mediterranean. More recently, this mission has expanded eastwards. In the last years, multidisciplinary field expeditions focused on the Greek islets have been carried out in close collaboration with local scientists and institutions: in 2023 in the inner Ionian Archipelago including insular areas such as Meganisi, Kalamos, Kastos, Atokos and the satellite islets around them; in 2024 in Diaporia and Lagouses islets of the Saronicos Gulf (islet groups between Salamina - Aegina - Poros and the Peloponnese), while in 2025 in Antimilos, Cyclades. The detailed biological inventories (reptiles, seabirds, invertebrates, vascular flora) issuing from these field missions allowed to record for the first time many organisms, to point out the presence of several rare and endemic species, and to detect and document the heavy impacts of human activities (overgrazing, tourism, urbanisation, invasive species). Our findings highlight not only the high and often underestimated biological value of these tiny and fragile ecosystems, but also their vulnerability to global change. Our field campaigns recommend the importance of a collaborative, transboundary approach to better integrate small islands into regional conservation strategies. Though small in size, these insular areas are key living sentinels of Mediterranean biodiversity.

Keywords*: biological heritage, field inventories, Mediterranean small islands, scientific research*

Genomic study of the genetic structure and molecular ecology of endemic seabird species of the Mediterranean

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Seabirds are key indicators of marine ecosystem health, as their population dynamics reflect changes in the state of the marine environment. Scopoli's shearwater (*Calonectris diomedea*) is one of the most abundant seabird species, endemic to the Mediterranean and wintering in the central and south Atlantic. It is currently classified as Least Concern by the IUCN, yet its populations are experiencing a negative trend due to multiple anthropogenic pressures. Despite previous studies on the population structure of the species, comprehensive genomic data remain scarce, particularly for colonies in the Eastern Mediterranean. The present study aims to bridge this gap by employing genome-wide data to examine the population structure and adaptive variation of Scopoli's shearwater across the Mediterranean, with a special focus on the underrepresented Eastern Mediterranean. The main objectives include whole genome resequencing of individuals from colonies across the Mediterranean, assessing genetic connectivity and differentiation among populations, and the investigation of adaptive variation linked to environmental and biological parameters. To achieve this goal, samples will be collected from key breeding colonies of the focal species in the Ionian and Aegean Seas, and will be analysed combined with existing specimens from collaborating institutions spread around the Mediterranean basin. This study will provide a more robust picture of genetic differentiation and connectivity across the species' range, while shedding light on the local adaptation that Eastern Mediterranean populations exhibit, by detecting signals of selection that could be crucial for the species' resilience to environmental change.

Keywords: *Calonectris diomedea*, *population genomics*, *whole-genome sequencing*, *Eastern Mediterranean*, *adaptive variation*

Towards Reliable eDNA Monitoring of Marine Megafauna: Challenges in Assay Transferability and Optimization

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Molecular techniques have revolutionized biodiversity monitoring, particularly for marine species that are challenging to observe directly. Quantitative PCR (qPCR) is a highly sensitive method that allows the detection of species in environmental samples from traces of their DNA. Within the framework of the LIFE MareNatura Project, we aim to scan the Ionian, South Adriatic, and Aegean seas for six EU priority marine mammal and turtle species, using species-specific eDNA assays. Our goal is to track the target species and identify critical habitat hotspots essential for their conservation. To address this, we are currently testing and optimizing qPCR assays on our focal species. This process highlights the need for a more standardized and transparent approach in eDNA assay development to ensure cross-laboratory reproducibility. Although conclusive field results are pending, this work lays essential groundwork toward establishing a reliable molecular toolkit for monitoring elusive marine species in Greek waters. Our efforts contribute to the long-term goal of integrating molecular approaches into conservation strategies, especially where conventional methods are difficult to apply.

Keywords: *environmental DNA, quantitative PCR, marine mammals, turtles, reproducibility, conservation*

Sea turtle nesting in Rhodes: Re-assessed after 35 years

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Greece hosts the largest number of loggerhead sea turtle (*Caretta caretta*) nests in the Mediterranean. Since its foundation in 1983, ARCHELON has worked for the study and conservation of sea turtles in Greece. In 1988 and 1989, ARCHELON assessed sea turtle nesting activity along 34 km of beaches in southern Rhodes, Dodecanese. During regular beach surveys, from beginning of June until end of August, nine nests in 1988 and 21 nests in 1989 were identified, most predated subsequently by foxes. To explore the status of this small nesting population, we surveyed in June 2024 those same beaches for 20 days confirming 30 loggerhead and one green sea turtle (*Chelonia mydas*) nests. This is the first record of a green turtle nest in Rhodes, which, together with four nests recorded on Crete, suggest a westward expansion of its breeding range. Additional sporadic surveys in July and August 2024 revealed more loggerhead nests, which allowed for an overall estimation of approximately 100 nests along these beaches. The observed increase of nests and the finding of a green turtle nest are possibly associated with increased temperatures noted in the Mediterranean as a result of climate change. Intermittent assessments of sea turtle nesting activity in unmonitored areas inform on long-term population fluctuations and possible breeding range shifts, very important for updating conservation strategies in a changing environment. The 2024 field surveys were supported by the TUI Care Foundation.

Keywords: *conservation, Caretta caretta*, *Chelonia mydas*, *climate change, breeding range shift*

Spring Stopover Ecology: Fuel Deposition in Five Passerine Species on Antikythera Island

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During migration, refueling efficiency at stopover sites is critical for birds' survival and migration success. This study investigates fuel deposition rates (FDR) in five passerine species — *Acrocephalus arundinaceus*, *Acrocephalus schoenobaenus*, *Luscinia megarhynchos*, *Phylloscopus sibilatrix*, and *Sylvia borin* — using long-term ringing data from Antikythera Island, a key stopover after the Sahara and Mediterranean crossing. We estimated fuel load (FL), FDR, and potential flight range, assessing whether Antikythera serves as an effective refueling site or a migratory sink. Using Generalized Additive Mixed Models (GAMMs), we analyzed the influence of intrinsic (fuel load, stopover duration, arrival timing) and environmental factors (precipitation) on FDR. Results revealed significant interspecific and interannual variation in FDR. Species like *L. megarhynchos* exhibited consistently higher fuel loads and readiness for departure, while *P. sibilatrix* showed declining trends over time. FDR was negatively associated with initial fuel load and positively influenced by stopover duration, though benefits plateaued with extended stays. The timing within the season also impacted refueling rates, with late-arriving birds refueling more rapidly. Precipitation, used as a proxy for food availability, showed limited influence. Our findings highlight species-specific strategies and environmental influences on refueling performance, emphasizing Antikythera's role as a critical but variable stopover site. Understanding these dynamics is essential for conservation planning, particularly under changing climatic conditions affecting Mediterranean stopover habitats.

Keywords: bird migration, stopover, fuel load, Mediterranean habitat, generalized additive mixed models (GAMM)

Monitoring of plant host associations in wild bees: a case study of plasterer and leaf-cutter bees in Bulgaria

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Despite numerous sampling efforts over the last century, the apoid fauna of Bulgaria remains insufficiently studied and lacks a clear overview of its diversity, which is among the highest in Europe. This lack of understanding is furthermore hindering the collection of ecological data on rare and local species, an important prerequisite for the effective protection of bees in particular. In this study, the megachilid and colletid fauna of four study sites, representing different natural and semi-natural habitats, was surveyed using standardized transect walks, whereby all bees belonging to the two families were collected and their floral visits were recorded. Flower abundance was noted during each survey and pollen for a reference collection was taken from the identified species. The surveys were conducted over a period of two years for one of the sites, while the rest of the locations were visited for one year only. A total of 216 plant and 101 bee species were identified at the four study locations, with 233 individual plant-pollinator associations observed at a species level. A comparison with the monitoring results from the field site at the Besapari Hills during the 2023 and 2024 seasons shows both greater diversity of plant and bee species, as well as higher number of recorded associations. Two species, *Hoplitis galichicae* A. Müller, 2016 and *Osmia mustelina* Gerstaecker, 1869, are reported for the first time from Bulgaria. These results accentuate the rich wild bee diversity in Bulgaria and can be constructive in the planning of future monitoring projects.

Keywords: Megachilidae, Colletidae, plant-pollinator networks

Cataloguing and Digitizing Marine Biodiversity from the Ionian Sea: A Taxonomic and Conservation Assessment of the Helmis' Natural History Museum Collection

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Natural history museums are essential repositories of ecological and taxonomic data, especially when regional collections capture localized biodiversity that is often under-documented. This study investigates the marine specimens from the Ionian Sea preserved at Helmis' Natural History Museum in Zakynthos Island, Greece. The aim was to catalogue and digitize the museum's marine biodiversity collection and evaluate its conservation and scientific value. A total of 1,400 photographs were collected, and a comprehensive database was created containing metadata on taxonomic classification, sampling origin, preservation method, and conservation status. A total of 224 taxa which belonged to six marine animal phyla (Porifera, Cnidaria, Mollusca, Arthropoda, Echinodermata, and Chordata) were identified from 318 examined specimens, most of which originated from fisheries bycatch, primarily from the southeastern waters off the island. The phylum Mollusca was the most represented and particularly the classes Gastropoda and Bivalvia. Most of the identified taxa (62%) are firstly reported from the marine waters and habitats of Zakynthos, while 45 species are protected by international legislation, 12 taxa are listed in the IUCN Red List (four Critically Endangered, two Endangered, two Vulnerable, four Near Threatened), and two constitute non-native species. These findings highlight the importance of local natural history collections as biodiversity archives and underline their potential in supporting regional environmental assessments, conservation science, non-formal environmental education and taxonomic research in the Mediterranean basin.

Keywords: *Database, Repository, Data rescue, Taxonomy, Zakynthos Island, Mediterranean Sea*.

The endangered Butterfly *Polyommatus orphicus* (Lepidoptera, Lycaenidae) in the mountains of Eastern Macedonia

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Polyommatus orphicus Kolev, 2005, is a Balkan-endemic and threatened butterfly species closely associated with high-altitude grassland ecosystems. This study presents field survey results from summer 2024 in the Falakro and Frakto mountains of Eastern Macedonia, northern Greece. The species was absent from Falakro, even in historically known locations, while it was confirmed present in Frakto. Simultaneously, its larval host plant *Onobrychis alba* was found to be locally extinct in Falakro, suggesting the collapse of key plant-insect interactions. Our observations indicate that the local extinction of *P. orphicus* from Falakro is likely driven by the combined effects of prolonged drought, intensive grazing, and possibly recent wildfires. These pressures contribute to the degradation and fragmentation of mountain habitats, threatening both floral and faunal biodiversity. Effective conservation of *P. orphicus* requires integrative management approaches, including the protection and possible reintroduction of *O. alba,* reduction of grazing pressure, and the establishment of micro-reserves in sensitive grassland areas. This case underscores the importance of conserving both insect and plant species simultaneously, particularly in fragile upland ecosystems undergoing climate- and land use-driven changes.

Keywords: *Polyommatus orphicus*, *Onobrychis alba*, Mountain grasslands, Biodiversity, Climate change, Insect conservation

Twenty years later: Revisiting the status of Eleonora's Falcon (*Falco eleonorae*) in Greece

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Undoubtedly, Eleonora's falcon (*Falco eleonorae*) is an emblematic bird species for Greece, as more than 80% of its global population breeds on Greek islands. Twenty years after the last survey (2004–2006), a national population assessment was carried out in 2024, coordinated by the Hellenic Ornithological Society, allowing for a detailed re-evaluation of the species' population status across different regions. The research followed standardized census protocols, with 30 field ornithologists surveying approximately 3,650 km of coastline across 1,000 islands, islets, and rocky formations. The results revealed a total of 18,946 individuals—a nearly 7% increase from the previous count of 17,660—indicating an expected fluctuation in the population. However, a decline in breeding pairs was observed in certain colonies compared to previous data. This may be partly attributed to increased human presence and tourism-related activities, although specific threats remain unclear. Systematic monitoring of the species is essential to assess breeding success and identify potential threats. This will support the prioritization of habitat conservation efforts and ensure the effective allocation of resources.

Keywords: *Falco eleonorae*, population status, Greek islands, bird national survey

Click, trill, cork, flap and…action, assessing passive acoustic monitoring of Western capercaillie (Tetrao urogallus) in Rila National Park, Bulgaria

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The Western capercaillie (*Tetrao urogallus*) is a polygynous grouse (family: Phasianidae) of boreal and high altitudinal conifer forests in northwestern and central Palaearctic region. The population at the Rila-Rhodope mountains in Bulgaria and Greece form an isolated population at the southernmost limit of the species' distribution in Europe. This population is of conservation concern and there is a need to have affordable and efficient tools to monitor its population trends. This study assesses the effectiveness of passive acoustic monitoring (PAM) protocols to detect activity at leks – traditional display grounds where males gather, during the mating season and females mate with one or a few high-ranking males. Monitoring the number of active leks is a good indicator of the distribution and relative abundance of a population, as the species is cryptic during the rest of the year. We placed an autonomous acoustic sensor from March to June 2024 at each of three lek sites on Rila Mountain known to be recently active. The sensors were scheduled to record for 10 min per half an hour around the clock (48 KHz sampling rate). We identified putative male capercaillie calls using a publicly available neural network detection algorithm (BirdNET), and manually reviewed all results to describe the calling activity of the species throughout the breeding (lekking) season. We recorded low to zero calling activity at two leks sites. At the one active lek, mating calling activity started in late March, peaked in April, and ended in early June. Although the findings are preliminary, they demonstrate that PAM is a valuable, low-cost tool to monitor the status of historical leks, to detect currently unknown lek sites, and – potentially – the relative abundance and population trend of the species.

Keywords: *Tetrao urogallus, PAM, Bioacoustics, Rila National Park*

Sexual dimorphism of the rock shrimp *Palaemon elegans*

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The rockpool shrimp *Palaemon elegans* is a small (6-7cm) transparent shrimp with wide geographical distribution and survival in a variety of coastal habitats (rockpools). Recent Keys (Pleocyemata, Caridea, Palaemonidae) have cleared previous confusion concerning the morphology of *Palaemon elegans* with other species. No hermaphroditism has been reported in this species as in other carideans; *Palaemon elegans* is gonochoristic with typical caridean sexual dimorphism. The size differences of two sexes (males smaller than females) are used as an initial morphological characteristic in studies focused on several comparisons (behavior, temperature tolerance) between the two sexes. At the end of such trials, sex is confirmed stereoscopically with the presence or absence of the appendix masculina on pleopod 2 (Caridean, Palaemonidae). We collected 50 rockpool shrimps from a rocky area of the Saronic Gulf (N 37º 47’ 18.7’’, E 23º 53’ 02’’) and studied macroscopically and stereoscopically (sacrificed with 75% ethanol) sexual characteristics, such as: (a) males: appendix interna of pleopod 1, appendix masculina of pleopod 2, gonopore on pereopod 5 (b) females: gonopore on pereopod 3. In addition, we compared the percentages of male and female individuals identified by each method using the McNemar's test. The difference in the aforementioned estimation between the two methods with the McNemar’s test was not statistically significant (P= 0.58). To summarize, those findings indicate that an initial sex separation by size in this species is reliable while sexual characteristics shown in detail in several stereoscopic photographs could further contribute in that.

Keywords: appendix masculina, gonopore

Changes in Avian Communities During Pine Forest Regeneration After Wildfires: A Passive Acoustic Monitoring Approach Across Temporal and Seasonal Gradients

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Wildfires are important modifiers of natural ecosystems. Understanding their long-term impact on biodiversity is particularly important for designing and assessing ecosystem management strategies. In this study, we used passive acoustic monitoring (PAM) methods to study the avian communities at four Aleppo pine (*Pinus halepensis* Mill.) forests on the Sithonia peninsula of northern Greece, having different fire burning history (unburnt for >20 years, burnt in 2001, 2009, and 2018). At three monitoring stations at each site, we programmed an AudioMoth acoustic sensor to record the soundscape for 10 minutes every half-hour round the clock for 10 days per season, across all four seasons (sampling rate 48 KHz, medium gain). The identification of vocal bird species was done in two steps: first using the BirdNet algorithm (v2.4) to identify putative species, and then having an expert review the calls. We used Bray-Curtis dissimilarity and non-metric multidimensional scaling (NMDS) to describe the bird community at each site and season. We report on the overall avifaunal diversity and key indicator species of each stage of regenerating pine forests. Also, we examine how seasonality affects site differences and propose optimal timing of monitoring protocols using PAM in the future.

Keywords: *Avian communities, Passive acoustic monitoring, Soundscape ecology, Mediterranean ecosystems, Biodiversity monitoring*

The revival of a *Thiessea* (Gastropoda: Helicidae) in Kasos Island and its consequences in the biogeography of the south-eastern Aegean Archipelago

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The Aegean archipelago is characterized by its very rich terrestrial malacofauna, nearly half of the total richness of Greece (more than 420 species, 60% of them are endemic). Also, many genera are highly differentiated in the islands i.e. *Mastus*, *Deroceras*, *Zonites*, *Metafruticicola, Lindbergia* and *Thiessea*. The genus *Thiessea* is represented by 16 species which are all endemic of the Aegean and the nearby Greek mainland. One of them, *T. pieperi*, endemic of Kasos Isl., was known only by very few old shells, and it was supposed that it got extinct due to human activities. However, during our survey of Kasos Isl. in January 2025 we found it alive and we confirmed its taxonomic status, as a distinct species. The revival of *T. pieperi*, the presence of certain species on Kasos and on the islets between Kasos and Astypalaia along with the richness and diversification of terrestrial gastropods on the Aegean islands and combined with paleogeography and human history leads us to expand the Cycladic zoogeographic area further south.
The study of the terrestrial gastropods of Kasos island was part of the project: “Study of two Critically Endangered terrestrial gastropod species in Karpathos island” funded by NECCA.

Keywords: *Mollusca, Island Zoogeography, Cyclades, Dodecanese*

Wildlife Rehabilitation Centre admissions as indicators of avian breeding responses to temperature fluctuations

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Many bird species reproduce earlier when spring temperatures are higher, yet collecting field data on multiple species over large geographical areas remains challenging. Near the start of each breeding season, wildlife rehabilitation centres (WRCs) regularly admit juvenile birds of dozens of species across regional or national scales. However, it remains unknown whether these admissions follow similar patterns in response to temperature fluctuations. Given the wide taxonomic and geographic coverage of WRC admission data, we examine whether avian juvenile admissions correlate with spring temperatures. We focus on ten common urban bird species, including both resident and migratory species, using data from over 10,000 admitted juveniles collected over ten breeding seasons at ANIMA, a prominent WRC in Athens, Greece. We compare the onset of admissions to mean spring temperatures. Preliminary results suggest that temperature fluctuation effects are species-specific, with migratory species particularly affected, as admissions tend to start earlier in hotter years. Establishing WRC admissions as proxies for the seasonal effects experienced by wild bird populations could provide a valuable tool for monitoring phenological responses at large scales, especially for species where field data collection is limited. As extreme climatic events intensify with climate change, such approaches will be essential to predict shifts in breeding behaviour and to inform future conservation strategies.

Keywords: *climate change, reproduction, ecological monitoring*

A first approach to study the functional diversity of ground & darkling beetles (Carabidae & Tenebrionidae) on the Aegean islands

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The Aegean is an island complex characterised by a rich diversity of biotopes and species. This combination makes it an ideal region for studying functional diversity. Beetles (Coleoptera) from the families Carabidae and Tenebrionidae are dominant components of the Aegean soil fauna. Due to their differing physiology and lifestyles, they encompass a broad range of ecosystem functions. This study examines the functional diversity of these organisms, focusing on the temporal and spatial succession of species across island biotopes and the corresponding ecosystem functions they perform. The research was conducted on 12 Aegean islands (Naxos, Paros, Antiparos, Andros, Tinos, Mykonos, Milos, Serifos, Sifnos, Kos, Patmos, Kalymnos), where extensive pitfall trap sampling took place over eight months. The collected specimens represent all major biotopes within the study area. Morphometric traits of the specimens were digitally measured using a stereo microscope, resulting in 22,620 measurements from 870 individuals. Analysis of a portion of this comprehensive dataset revealed that biotopes with the highest species richness do not necessarily exhibit the greatest functional diversity, as indicated by the Functional Richness (FRic) Index. In fact, greater functional diversity is often observed in biotopes where harsh environmental conditions limit competition from other animal taxa. In such environments, the ecological niches of the studied beetles expand, allowing them to fulfil a broader array of ecosystem functions.

Keywords: *Functional Diversity, Carabidae, Tenebrionidae, Aegean, Morphology, Ecology*

Phylogeographic insights into *Crematogaster sordidula*: Population structure of the Sordid Cocktail Ant shaped by past climate changes

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The current biodiversity crisis has intensified the need to understand the evolutionary and ecological processes that shape and maintain biodiversity. Insects, key components of ecosystems, require more attention in this context. Robust knowledge of their evolutionary adaptations and past responses to climate change, shaped by geological events, is essential for refining predictions and guiding effective conservation strategies. We address these questions by focusing on *Crematogaster sordidula*, one of the most widespread and abundant ant species across the Mediterranean. Belonging to a highly diverse genus that expanded during Tertiary and Quaternary climatic fluctuations, this species provides a powerful model for studying biogeographic and evolutionary dynamics in a region of high habitat complexity. Using ultraconserved elements (UCEs) from 123 individuals, we reconstructed population-level phylogenies with both concatenated and coalescent-based methods. Genome-wide SNPs were used to infer population structure, while a time-calibrated phylogeny allowed us to link divergence events to historical climatic and geological changes. Our results reveal strong east–west structuring, with a highly complex population structure in the eastern Mediterranean region, reflecting habitat complexity and Pleistocene climatic oscillations. The genome-wide data was also used to infer the differentiation process for island lineages during periods of long-term isolation on remote islands, such as Crete. As the first phylogeographic study on Mediterranean ants, this work fills a critical gap in insect biogeography and reveals key mechanisms of lineage diversification. These findings contribute to a broader understanding of biodiversity maintenance and offer guidance for conservation efforts in one of Europe's most threatened hotspots.

Keywords: *insects, Mediterranean biodiversity, lineage diversification, UCEs, Pleistocene climatic oscillations, island biogeography*

Zoo controlled avian research and Husbandry Practices for Eastern Black-eared Wheatears: A Scalable Framework for Collaborative Species Preservation

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Zoological institutions increasingly contribute to avian research and conservation, including studies on taxa rarely held in captivity such as Western Palearctic passerines. This report presents husbandry observations from the temporary captivity of three Eastern Black-eared Wheatears (*Oenanthe melanoleuca*) at Attica Zoological Park during the autumn season. All individuals were adult males, housed separately in custom-made wooden enclosures within a well-ventilated indoor space that allowed exposure to direct sunlight for several hours per day. Birds were fed a high-protein live insect diet and monitored daily for health and physical condition. No ectoparasites were detected upon visual inspection throughout the captivity period. Body mass was recorded at regular intervals. All individuals exhibited an initial decline in body weight during the first week, followed by gradual recovery and surpassing of baseline weight by the third week. A transient increase in mass due to water retention was observed in all cases during the third week, with initial manifestation in the abdominal region; this condition resolved without intervention. No signs of infectious disease or behavioral abnormalities were documented. Birds exhibited stable condition overall and demonstrated rapid adaptation to the captive environment, requiring minimal pre-release acclimatization. These findings underscore the practical and ethical viability of short-term captivity for small migratory insectivorous passerines and highlight the potential of zoological institutions to support controlled avian research under appropriate husbandry protocols.

Keywords: *Eastern Black-eared Wheatear, Oenanthe melanoleuca, passerine husbandry, short-term captivity, avian research, zoological institutions.*

Illuminating Insights into Urban Invasion Dynamics in a Wide-spread Invasive Gecko *(Hemidactylus turcicus)*

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Invasive species pose significant threats to native biodiversity and ecosystems. Artificial light at night (ALAN) is one novel environmental variable that urban species encounter that elicits a variety of response behaviors in species. To better understand how ALAN may influence urban invasive species, we evaluated the relationship between light intensity (lux) and habitat use for the widespread Mediterranean House Gecko (*Hemidactylus turcicus*). We surveyed 11 cities across the central United States, to determine if and in what manner this species is using artificial light (lux). We assessed if artificial light is used as a heat source or if artificial light presents increased foraging potential. We recorded several variables including light intensity, wall temperature, arthropod composition and abundance, and age of gecko. Despite sampling occurring in a large latitudinal range along the introduction path of *H. turcicus* we found no discernable latitudinal-related trends. We found that the primary predictor of gecko abundance is lux, suggesting that some benefit is occurring. Gut content analyses recovered evidence of dietary ontology and size differences in prey between age groups of geckos. These results suggest that invasive species can use traditionally negative aspects of urbanized environments to their benefit.

The Persian squirrel at the westernmost edge of its range: current knowledge and emerging conservation priorities

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The Persian squirrel (*Sciurus anomalus*) represents a species of exceptional ecological importance in Greece, yet detailed knowledge about its distribution, threats, and conservation needs has been scarce. Recent research has advanced our understanding of its spatial ecology, habitat preferences, and vulnerability, particularly on Lesvos Island, the westernmost limit of its global range. Habitat suitability models, distribution mapping, and field-based den site assessments have revealed a strong dependence on traditional olive groves and other broadleaved habitats, while identifying key threats such as habitat fragmentation, deep pruning practices, and predation by feral cats. However, significant gaps remain regarding population trends, ecological connectivity between subpopulations, daily activity rhythms and foraging behavior, as well as reproductive parameters. These knowledge deficits are paralleled by notable conservation shortfalls, with many core habitats located outside Natura 2000 sites and a general absence of targeted conservation measures. In light of these, conservation priorities should focus on the conservation of traditional agroecosystems, managing invasive species, and integrating spatial ecology into regional conservation frameworks to ensure the long-term persistence of *S. anomalus* in Greece.

Keywords: spatial ecology; traditional olive groves; conservation gaps; Lesvos Island; den site selection

Modelling habitat suitability and identifying expansion risk areas for the invasive Coypu (Myocastor coypus) in Greece

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The coypu (*Myocastor coypus*) is a semi-aquatic rodent recognized as an invasive species of increasing concern across Europe. In Greece, recent evidence indicates a worrying expansion of established populations, particularly around wetland ecosystems and lowland river systems. However, systematic spatial assessments of habitat suitability across the country remain scarce. In this study, we developed a habitat suitability model based on more than 500 verified presence points across the country. Using a comprehensive set of environmental predictors - including vegetation productivity, water and wetness extent, riparian and land cover features, imperviousness density, and soil texture - we applied a Maximum Entropy modeling framework to identify suitable habitats. Environmental layers were standardized to a uniform resolution and projection, and highly correlated variables were filtered through correlation analysis to ensure model robustness. Results highlight the primary importance of aquatic habitats and riparian corridors, with coypus favoring areas of high wetness and low to moderate imperviousness. Suitability maps reveal extensive high-risk areas beyond current known distributions, especially around lowland wetlands and agricultural drainage systems. These results emphasize the urgent need for early detection and targeted management strategies to contain further expansion and mitigate the impact of this invasive species on vulnerable ecosystems in Greece.

Keywords: Biological invasions, species distribution modeling, maxent, semi-aquatic mammals

Wildlife–vehicle collision risk for small and medium-sized mammals in a Mediterranean biodiversity hotspot

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Wildlife–vehicle collisions (WVC) are a significant conservation concern for insular mammal populations, especially on ecologically diverse Mediterranean islands. On Lesvos Island, Greece, we systematically surveyed WVC along the 488.7 km primary road network over a five-year period (2018–2022), focusing on five terrestrial mammal species: *Vulpes vulpes*, *Martes foina*, *Erinaceus roumanicus*, *Mustela nivalis*, and *Sciurus anomalus*. A total of 135 surveys were conducted during spring, summer, and autumn, following a randomized and standardized protocol. Transects were driven at low speeds during two daily intervals (08:00–12:00 and 18:00–22:00), with all carcasses georeferenced, taxonomically identified, and removed to avoid recounting. We applied Kernel Density Estimation to identify areas of high roadkill density and conducted Getis-Ord Gi* and Anselin Local Moran's I analyses to detect statistically significant clusters and spatial outliers. These spatial tools were complemented by species-specific behavioral profiles to interpret WVC patterns in relation to habitat and seasonality. Results revealed persistent mortality hotspots in central and southeastern Lesvos. Spatial clustering was consistent across years, with a marked increase in WVC frequency in 2021 and 2022. Species-level differences aligned with ecological traits: *S. anomalus* roadkills were concentrated near olive groves, reflecting its arboreal and habitat-specific behavior; *E. roumanicus* was scarcely detected due to seasonal torpor; *V. vulpes* and *M. foina* showed broader distributions, indicative of their generalist and highly mobile nature; while *M. nivalis* appeared sporadically, consistent with its small size, secretive behavior, and narrow home range. By combining long-term field data with spatial statistics, this study delivers the first island-wide, multi-year assessment of mammalian road mortality on Lesvos. The clear identification of high-risk zones and species-specific vulnerability provides a critical evidence base for targeted mitigation strategies, contributing to both biodiversity conservation and the development of ecologically sensitive road infrastructure in Mediterranean insular landscapes.

Keywords: Road ecology; spatial analysis; insular mammals

Thermal dynamics and thermophysiological adjustment in juvenile *Sciurus anomalus* during short-term captivity: indications of social buffering and behavioral modulation

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Thermoregulatory responses during early captivity are critical physiological indicators of welfare and acclimatization in juvenile mammals, particularly in species of conservation concern. The Persian squirrel (*Sciurus anomalus*), occurs at the westernmost limit of its distribution on the island of Lesvos, where two orphaned juveniles were recovered from an olive tree cavity and subjected to short-term housing prior to transfer to a licensed rehabilitation facility. In order to non-invasively monitor thermophysiological adaptation in this transitional context, we employed infrared thermography over a ten-day period, acquiring bi-daily images from key anatomical regions. Although the individuals were housed together from the beginning, a notable behavioral transition occurred on day 5, marked by the emergence of affiliative behaviors, including social play and mutual grooming. Thermal data were analyzed with respect to this behavioral shift, focusing on (i) inter-individual temperature convergence (ΔT) as a proxy for physiological synchrony, (ii) intra-individual thermal variability as an indicator of regulatory stability, and (iii) core-to-peripheral thermal gradients to assess thermoregulatory efficiency and stress modulation. Our findings indicate a reduction in ΔT and a decrease in thermal variability following the onset of active social behavior, suggesting the presence of thermo-social buffering. Peripheral regions showed diminished fluctuation after day 5, potentially reflecting reduced sympathetic arousal and enhanced thermal homeostasis. These results highlight the potential of infrared thermography to detect subtle physiological changes in response to environmental and social cues, and provide new insights into the interplay between behavioral modulation and thermoregulatory adjustment in a vulnerable arboreal rodent.

Keywords: thermal homeostasis, behavioral plasticity, stress physiology, arboreal rodents, captivity acclimatization, conservation physiology

A call for action on Lemnos Island's wild rabbit overpopulation: Challenges, opportunities, and a strategic path forward

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The wild rabbit (*Oryctolagus cuniculus*) represents a growing conservation and land management concern on Lemnos Island, where its uncontrolled expansion threatens agricultural productivity, native vegetation, and overall ecosystem integrity. Although the species' impacts, such as crop damage and soil disturbance, are widely recognized by local communities and reflected in recurring state compensation payments, critical data on population density, distribution, and burrow locations remain insufficient. This lack of accurate ecological information has prevented the development and implementation of a coordinated, science-based management and long-term monitoring strategy. Here, we synthesize the available spatial, ecological, and socio-economic data to assess the scale and complexity of the problem and to outline a pathway toward effective intervention. Key challenges include the species' ecological flexibility, its extensive distribution across the island, the lack of habitat suitability assessments and population estimates, and the absence of a coordinated monitoring and management framework. Nevertheless, several opportunities exist for action: targeted population control, habitat-informed planning, the integration of spatial ecology with field-based efforts, stakeholder engagement in collaborative decision-making, and the development of a conservation strategy grounded in robust empirical data. Addressing this issue requires a strategic, state-supported response to mitigate ecological and economic impacts, protect biodiversity, and restore balance to the island's agroecosystems. A comprehensive, evidence-based management framework is essential for achieving sustainable outcomes in this vulnerable insular landscape.

Keywords: *Oryctolagus cuniculus*; introduced species; population control strategies; science-based management; stakeholder engagement

Assessing stress responses in the Eastern broad-toothed field mouse during handling: A survival analysis of escape behavior and physiological traits

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Understanding the stress responses of small mammals during handling is critical for improving animal welfare and ensuring data reliability in ecological research. In this study, we assessed the physiological and behavioral responses of the Eastern broad-toothed field mouse (*Apodemus mystacinus*) following capture and handling. Individuals were categorized as first-captures or recaptures and subjected to standardized handling before being placed in a dark, enclosed box. Surface body temperature was recorded using infrared thermography, and behavioral responses were scored based on latency to leave the box. To analyze time-to-event data (latency to movement), we applied Kaplan-Meier survival analysis and compared survival functions between first-captures and recaptures using the Log-Rank test. Additionally, we employed Cox proportional hazards regression to assess the influence of initial body temperature, handling duration, and capture history on the probability of leaving the box. Results showed that recaptured individuals exited the box significantly earlier than first-captured individuals, suggesting habituation to handling. Cox regression analysis revealed that both higher initial body temperature and longer handling durations were associated with increased likelihood of movement. Notably, first-captured individuals frequently exhibited freezing behavior, remaining immobile despite high surface temperatures, indicating acute stress responses. Our findings highlight the importance of distinguishing passive freezing from active escape behaviors when interpreting stress in small mammals. The study emphasizes that integrating physiological and behavioral data, along with appropriate survival analysis methods, provides a more accurate assessment of handling-induced stress responses.

Keywords: *Apodemus mystacinus*, infrared thermography, Kaplan-Meier survival analysis, Cox proportional hazards model

Silent predators in the city: Quantifying the conservation impact of domestic cats on urban wildlife in Greece

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Free-ranging domestic cats (*Felis catus*) constitute one of the most globally widespread and ecologically disruptive invasive predators, exerting disproportionate pressure on native vertebrate populations, particularly within fragmented and human-dominated environments such as urban and peri-urban ecosystems. While their impact has been extensively documented elsewhere, empirical data from Mediterranean Europe remain scarce, despite the region's growing urban biodiversity vulnerabilities. In this study, we conducted a systematic assessment of cat-induced wildlife injuries using admission records from a licensed rehabilitation center (ANIMA) in Greece over a three-year period (2022–2024). A total of 981 confirmed cat-related cases were analyzed in relation to species identity, age class, seasonality, geographical origin, and rehabilitation outcome. Descriptive statistics were used to assess temporal and seasonal trends, while a generalized linear model (binomial error distribution) was implemented to evaluate the influence of age class, season, and region on release probability. Results showed that most admissions involved small-bodied urban-adapted birds, primarily *Streptopelia decaocto*, *Passer domesticus*, and *Turdus merula*. Cat-related injuries peaked during spring and summer, coinciding with key reproductive and fledging periods. Only 42% of individuals were ultimately deemed suitable for release, reflecting high levels of mortality or permanent impairment. Statistical modelling identified age and season as significant predictors of outcome ($p < 0.001$), with juveniles and nestlings exhibiting markedly lower survival odds. These findings reveal a persistent and underrecognized conservation threat in urban Greece and underscore the value of wildlife rehabilitation datasets for quantifying anthropogenic impacts and informing evidence-based biodiversity management in urban environments.

Keywords: invasive species, wildlife rehabilitation data, urban ecology, vertebrate conservation

Artificial barriers affecting river fish in Mediterranean and tropical climate zones: Proposal for a collaborative research initiative

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Although river ecology and restoration initiatives have had a long history of study in cold temperate areas, concern in Mediterranean and tropical climate areas has lagged behind. Mediterranean rivers and streams are more similar to tropical systems, defined primarily by irregular drought and extreme flooding cycles, being located in a transition between dry tropical and temperate climates. In contrast to cold temperate areas, aspects of Mediterranean-climate river biodiversity, both aquatic and riparian, are more similar to tropical systems, also supporting high endemism. Artificial longitudinal barriers, including dams and culverts and other anthropogenic breaks in natural connectivity are now expanding rapidly in these systems. Since scientists and policy makers in both the Mediterranean basin and many countries of the Global South have limited experience in inventory, assessment and prioritization for restoration with respect to barrier fragmentation we propose a collaborative research initiative. Following a bibliographic review, we propose research proposals, focusing on fish as flagships for conservation; these include: a) the study of fish community and population responses to barriers in varied contexts; b) Developing tools for the structural taxonomy, assessment and documentation of barriers and their biophysical impacts; c) Promoting best practice in the design of effective restoration measures (barrier demolition, fish-passes, etc.); and, d) Promoting citizen science, training and awareness schemes. We believe a new generation of scientists, engineers, and managers must develop multidisciplinary skills and a "natural history" literacy, to influence sociopolitical and cultural conditions in issues related to artificial barriers in running waters. This proposal sets specific targets for initiating such a collaborative framework based on this review and experiences within this group of co-authors.

Keywords: longitudinal artificial barriers, dams, restoration, fish, bioassessment, conservation awareness

Birds as indicators of habitat restoration targets at Artemis Lagoon, Attiki Greece

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Artemis Lagoon (37°59'22.8"N 24°01'03.8"E) is a small coastal lagoon in Eastern Attika, surrounded by urban sprawl and affected by severe human disturbance. Here we map the habitat characteristics and interpret values for wildlife focusing on birds as a biodiversity proxy group. Citizen science surveys (eBird) are analysed over 29 years (183 species recorded in 787 checklists). We grouped the species data into 7 guild categories and tested this using GAM models. The model explains 87 % of the deviance in annual abundance (adjusted $R^2 \approx 0.31$) and indicates strong over-dispersion, so a negative-binomial error with a log link was appropriate. Relative to the reference group "gull_tern_fish_eating", several guilds show markedly lower mean counts: raptors ($\beta \approx -4.86$, $p < 0.001$), herons ($\beta \approx -3.57$, $p < 0.001$), waterfowl grazers ($\beta \approx -2.09$, $p = 0.007$), and insect-eating passerines ($\beta \approx -1.83$, $p = 0.019$); moreover, shorebirds are marginal ($p = 0.079$), while the heterogeneous "Other" group does not differ. The analysis revealed that gull–terns, passerines, and waterfowl display the most complex temporal patterns, whereas raptors and shorebirds follow simpler (nearly linear) trajectories. Overall, guild identity is a major determinant of abundance and each guild has experienced a statistically significant, guild-specific trajectory over the study period. Artemis Lagoon reveals a high importance as a staging area for a large variety of wetland birds, including many specialists that require specific wetlands habitats. Migratory wetland species are of special interest and should guide restoration. We propose ecological restoration initiatives relating to the needs of wildlife and in order to co-exist with the increasing numbers of human visitors at this site.

Keywords: Coastal lagoon, ecosystem restoration, urban wetland, aquatic ecosystem, monitoring, ornithology

Echolocation-related Single Nucleotide Polymorphisms Reveal Convergent Evolution in Veterbrates

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Echolocation is a biological sonar system whereby animals emit sound pulses and interpret returning echoes to navigate and forage when vision is limited. This capability has evolved independently in distantly related groups—such as bats, toothed whales, certain shrews, and some birds—demonstrating convergent adaptation to similar ecological pressures. To explore genetic signatures linked to echolocation, we performed comparative genomic analyses of multiple echolocating and non-echolocating vertebrates. Whole-genome sequences from representative bats, cetaceans, and insectivores were aligned against the hippopotamus reference genome. We applied generalized linear models and predictive algorithms to identify single nucleotide polymorphisms (SNPs), determine their coding potential, and flag nonsynonymous changes likely to affect protein function. BLAST comparisons with additional species further validated our findings. SNP patterns clearly segregated echolocating versus non-echolocating taxa, supporting convergent molecular evolution. Notably, nonsynonymous variants in genes involved in audio-visual processing (e.g. *SLC24A1*, *NOD1*, *SERPING1*) were enriched in echolocators. Echolocating species also shared derived polymorphisms in genes linked to immune defense (*SASH1*, *NOD1*), regulatory pathways (*G6PD*, *CREB3L2*, *MYO1A*), neural development and synaptic function (*PAIP1*), and ATP metabolism (*MAP3K19*, *GABRQ*). Conversely, non-echolocators retained ancestral alleles in phototransduction-related genes (*SLC24A1*), consistent with reliance on vision. Our results uncover novel candidate loci underlying echolocation and highlight how distinct vertebrate lineages have recruited similar genetic changes to meet the demands of biosonar. Further functional assays will be required to elucidate how these mutations modulate sensory and neural mechanisms to produce convergent echolocation abilities.

Keywords: *Echolocation, Single nucleotide polymorphisms (SNPs), convergent evolution*

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