



**INTERNATIONAL CONGRESS ON THE ZOOGEOGRAPHY AND
ECOLOGY OF GREECE AND ADJACENT REGIONS**

ABSTRACTS



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

**13th ICZEGAR, 7-11 October 2015
Irakleio, Crete, Greece**

Organized by the: Natural History Museum of Crete, University of Crete
Institute of Marine Biology, Biotechnology & Aquaculture,
Hellenic Centre for Marine Research

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PREFACE

Thirty seven years have already passed since 1978 - the year that the first International Congress on the Zoogeography and Ecology of Greece and the Adjacent Regions (ICZEGAR) was organized by the Hellenic Zoological Society.

During these years, hundreds of scientists have found a hospitable and friendly environment to present their research on different aspects of biodiversity of the Eastern Mediterranean. The congress by itself affected zoogeographical and ecological research in the region, attracting many young scientists, educating them in modern trends by dozens of invited speakers and establishing closer collaboration among the scientific community of the area.

This volume includes 184 abstracts of 74 oral presentations and 110 posters that were accepted for presentation at the 13th International Congress on the Zoogeography and Ecology of Greece and Adjacent Regions. The aim of this book of abstracts is to present current issues, referred to the Eastern Mediterranean region, to the international scientific community. Abstracts are arranged per presentation mode, in alphabetical order of the first author. An index of all authors can be found at the end of this volume. The international nature of this congress is well reflected by the participation of 583 authors from 31 countries and 149 research institutes and universities.

The Organizing Committee would like to express its special thanks to the invited speakers for their prompt response to our invitation, namely: Adalgisa Caccone (Yale University , USA), Katerina Harvati-Papatheodorou (Eberhard Karls Universität Tübingen), Bella Galil (National Institute of Oceanography, Israel), and Christopher Meyer (Smithsonian Institution National Museum of Natural History, USA).

Hellenic Zoological Society

The Hellenic Zoological Society is a non-profit organization established in 1980 in Athens. Its membership stands at the moment at more than 300 members from Athens, Thessaloniki, Patras, Crete and other parts of Greece as well as from abroad. All persons that have a documented scientific activity in zoological subjects can become members. Anyone who is interested in the aims of the Society can become associate member.

The aims of the Society are the study of the geographic distribution (Zoogeography), the Ecology and the Systematics of the animals that live in Greece, the conservation of the fauna of Greece and the study of relevant problems.

In order to achieve these aims, the activities of the Society are the collection of the scientific literature on the fauna of Greece, the promotion and coordination of all matters related to the fauna of Greece, the provision of information to the authorities, the exchange of information, the organization of symposia, congresses, talks and discussions, the publication of books, studies, journals and the assistance of every kind of activity that leads to the achievement of the aims of the Society.

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INVITED LECTURES

Giant Galápagos tortoises: the phylogeography of a charismatic adaptive radiation

Adalgisa Caccone

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Giant Galápagos tortoises represent the last surviving group of giant tortoises with multiple species showing genetic and morphological divergence in what is referred to as the *Chelonoidis* species complex. Although these charismatic animals represent a textbook of island radiation and play a fundamental role in preserving the island ecosystem, one third of them have gone extinct, since the arrival of humans to Galápagos in the late 1800's, with the majority of extant lineages having experienced dramatic population reductions despite ex situ and in situ preservation efforts.

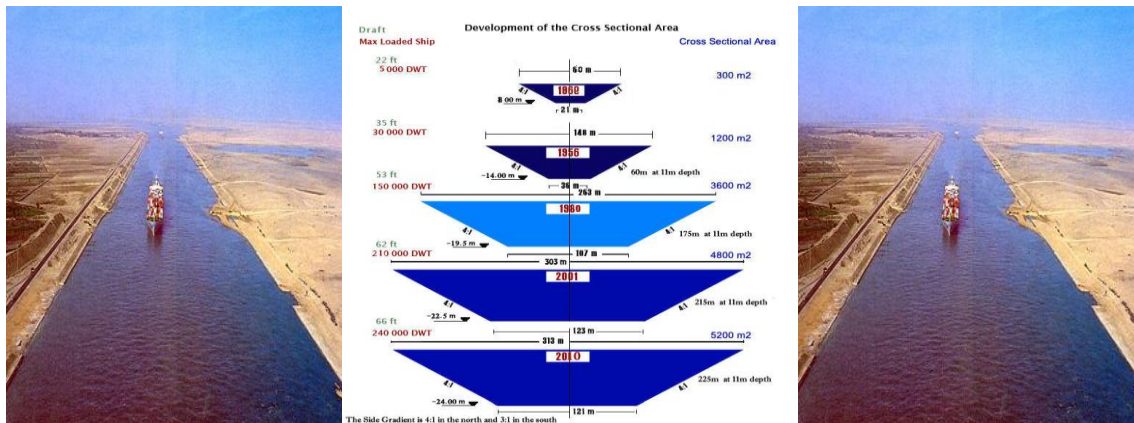
Currently there are 16 named species. Morphologically they vary mostly in the carapace shape, which come in three morphs ("saddle-back", "dome", and "intermediate"). These shapes are heritable and associated with life history and behavioral differences such that individuals from the different carapace morphs do not co-occur naturally, with each morph corresponding to a species on a different island or part of an island. Tortoises with saddleback carapaces have small bodies and long necks and limbs assumed to improve their fitness to the xeric conditions of low-elevation coastal areas. Tortoises with dome carapaces are larger than saddlebacks and are typically found in mesic highlands associated with cloud capture. Genetic data confirm the distinctiveness of most of the *Chelonoidis* species and their monophyletic origin, provide insights on the mode and tempo of the colonization of the Galápagos and on the evolution of the domed and saddleback morphs, and allowed the gathering of important baseline data to guide conservation efforts.

In this communication we present findings from the genetic and genomic data on this species complex, and discuss them in the context of the history of colonization of the islands and their relevance to understand the role of processes, such as lineage fusions and fission, in shaping the diversification patterns observed in this species complex.

The environmental impacts of the enlargement of the Suez Canal

Bella Galil

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On August 2015, Egypt inaugurated the *new* Suez Canal, doubling its capacity by creating a new waterway parallel to the current channel. The enlargement of the existing Suez Canal will result in increasing rates and numbers of invasions from the Red Sea with a diverse range of deleterious effects on the Mediterranean marine biodiversity, as well as the ecosystem structure and functioning, with implications to the provision of services to humans.

Global trade and shipping are vital to society, however, international agreements also recognize the urgent need for sustainable practices that minimize unwanted impacts and long term consequences. Given the sensitivity and specificity of the Mediterranean Sea, a project of this size and potentially negative environmental consequences, required a transparent and scientifically sound Environmental Impact Assessment. **None was made public.**

To-date, over 450 species of macrophytes, invertebrates and fish are considered to have entered the Mediterranean Sea through the Suez Canal, of which number 90 have been recorded in five or more countries. Some of these species have had significant impacts. Examination of the temporal and spatial extent of these introductions to date may indicate their future course under increased propagule pressure and temperature.

The Marine Directive aims to achieve *Good Environmental Status (GES)* of the EU's marine waters by 2020. The Directive sets out among the qualitative descriptors 'Non-indigenous species do not adversely alter the ecosystem' - how are the Mediterranean countries to comply?

Human Evolution and the Role of South-Eastern Europe: Dispersal corridor or Refugium?

Katerina Harvati-Papatheodorou

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Human evolution in Europe is among the most hotly debated aspects of paleoanthropology today. In the last 15 years, new discoveries and interpretations of the European human fossil record have drastically changed our views. Even as they have provided new information, however, these advances have generated new questions. The identity and place of origin of the earliest Europeans; the evolution of the distinctive Neanderthal lineage; the timing of, and reasons for, the Neanderthal extinction; the possible late survival of archaic human species; and the potential interactions between archaic humans and early modern *Homo sapiens* remain unresolved. In this framework critical evidence is missing from South-Eastern Europe. This is the gateway through which both early and later human populations migrating into Europe repeatedly passed, and a crossroads between Europe, Asia and Africa. It is also one of the three European Mediterranean peninsulae, acting as a refugium for fauna, flora and human populations during glacial times. Evidence from this region is therefore essential for testing hypotheses about the course of human evolution Eurasia.

Lessons from the Moorea Biocode Project

Christopher P. Meyer

Smithsonian Institution National Museum of Natural History, USA

The Moorea Biocode Project (MBP) is a voucher-based approach to inventory all macrobiotic species in a tropical ecosystem. The ultimate goal of the project was to create a highly resolved digital catalogue of the biodiversity of the island including both specimen images and DNA barcodes. This digitization of biodiversity provides a foundation for ecosystem monitoring and documentation at unprecedented resolution. The project engaged over 200 scientists and benefited greatly because of existing collaborative field stations and participatory government support. Organizationally, the biota was divided among seven taxonomic teams: terrestrial vertebrates, terrestrial invertebrates, plants, fungi, marine vertebrates, marine invertebrates and algae, with a designated leader for each major focal group. An executive committee was established to determine major decisions, and annual meetings were held to track progress and strategize approaches. Over the course of five years, these taxonomic teams were deployed in expeditionary fashion to search targeted habitats from the limits of diving depths to the peaks of the highest mountains. A centralized database was created to aggregate information, and validation tools were developed to minimize demands on the informatics personnel. These informatics products are now being used beyond the MBP. Overall, more than 6,200 collecting events yielded over 50,000 specimens from at least 7,000 species. Included among the highlights of the project are the doubling of capacity to identify unknowns from mixed environmental samples and the revelation of fine grained and unexpected diversity in trophic interactions. The project also established cooperative links with traditional knowledge, served as a model of other multi-national collaborations as far as permits and agreements and seeded the Genomics Observatory Network with its emphasis on place-based research. The scale and scope of this project was enormous and only in hindsight did we realize our more systemic challenges. Many lessons were learned in the process of this endeavor that would benefit other similar efforts. First, the project would have greatly benefited from a clearly agreed upon data release policy at the outset. The diversity of approaches by the various taxonomic teams set up a situation that made it difficult to find mutually agreeable terms. Second, while the project built critical field and laboratory information management systems, better performance and progress reporting tools would have allowed the various team leaders to provide oversight and prioritize data cleanup efforts. Third, a more quantitative approach to documenting diversity would have allowed better estimates of completeness of our approach. Lastly, project management would have benefited with a more adaptive budgeting landscape ensure the best use of resources. Despite room for improvement, the success of the project demonstrates the feasibility and benefits of such an all taxon inventory.

ORAL PRESENTATIONS

Monitoring Dalmatian pelicans by satellite telemetry - first results

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Starting in 2012, we equipped 17 Dalmatian pelicans (11 immature/6 adults, 4 ♀♀/13 ♂♂) with GPS/GSM transmitters at Lake Lesser Prespa, Greece, where the species' largest breeding colony in the world. Main goals were to study site occupancy, seasonal occurrence patterns and time-budgets, estimate home range size, trace main flight corridors, identify stop-over and wintering sites and document mortality causes. Nine of the transmitters provided long-term data, from 8 months to more than 2 years. A total of 363,286 GPS positions were received. None of the birds bred. Unexpectedly, no clear occupancy patterns emerged as each bird seemed to follow an individual strategy of site use especially during the breeding period: on the one end an individual travelled between 7 different wetlands during 1 month covering a distance of 672 km -measured as a straight line- while at the other end, another spent more than a year in a single wetland. The importance of the extensive network of wetlands mainly in N. Greece was stressed, as the annual home range of each bird included on average 7 wetlands. In total 19 Greek and 5 Turkish wetlands were used during the study period. All transmitter data confirmed older findings coming from marked birds that Dalmatian pelicans in SE Europe form a meta-population which spreads over a large number of wetlands in more than 7 countries. High, human-related mortality was documented as two of the birds were shot and another two died from collisions with electric power lines.

Ontologies and Linked Open Data in the LifeWatch Greece Research Infrastructure

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We present our work in the LifeWatchGreece infrastructure (ESFRI) on providing a conceptual interpretation of biodiversity datasets, with focus on a detailed, comprehensive modelling of the biological observation processes itself and its products. In the complex and heterogeneous biodiversity domain the data providers usually use their own schemata to describe their data which are mainly based on vocabularies of terms (e.g., Darwin Core) that describe the domain of interest through a column-based structure. One of the disadvantages of such a flat structure is that they leave implicit information/associations that characterize the domain entities to the user intuition, hampering the access and retrieval of, not only data, but also knowledge. To face such an issue, we adopted an ontological approach based on the CRM family of semantic models such as CRM-sci and MarineTLO. The first results, through a strong empirical verification via real data, show that these semantic models that offer high-level abstractions through classes and properties: i) capture and enhance the formal representation of Darwin Core records, providing

an unambiguous representation of facts that characterize the underlying domain, ii) elicit tacit knowledge and add expressivity and semantic structure to the domain entities, increasing the expressive power and automated access to relevant data of the research process and iii) enable for mechanical integration of factual knowledge of information from other sources (WoRMS, FishBase and SeaLifeBase were considered) successfully, empowering the building of a global knowledge network for the biodiversity domain, for the purpose of supporting the integration of data and models.

Keywords: Ontologies, Biodiversity Open Linked Data, Data integration

Biodiversity and biogeographical patterns of the epigeal freshwater shrimps (Atyidae, Palaemonidae) and amphipods (Gammaridae) in Greece

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The study of freshwater invertebrates' diversity and the delineating of their biogeographical patterns aim to draw conclusions on the historical, long-term evolutionary processes of freshwater biota, on their ecological interactions with the abiotic elements and on the determination of future conservation policies. Among the invertebrate taxa, freshwater shrimps and amphipods have been characterized as target groups of exceptional interest, due to their dominant role in the benthic communities and their wide use as bioindicators. In Greece, until recently, the taxonomy of the freshwater shrimps remained largely unsettled, mainly because of the cryptic speciation and the lack of molecular analyses. Moreover, the information on amphipods' diversity and distribution remains little, scattered and doubtful in many cases. Our objective is to gather and provide firstly, all the available information, including the last revisions of some genera and secondly to reveal throughout the current bioregionalisation the biogeographical patterns of the studied taxa. Based on the final constructed faunistic list, the resulting compositional dissimilarity matrix was undergone hierarchical clustering analysis by means of UPGMA linkage method and KGF penalty function analysis. In total, seven shrimp and 22 amphipod species were studied from 82 freshwater surface ecosystems. For each studied taxon, five biogeographical regions emerged and are given comparatively. The combination of the shrimps' and amphipods' geographical distribution in the surface freshwater ecosystems of Greece was applied and discussed on the basis of their common zoogeographical patterns along with endemism and comparisons with relevant data from the broader region.

Preliminary reproductive biology aspects of the narwal shrimp *Plesionika narval* in the Dodecanese Islands, SE Aegean Sea

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Plesionika narval is a widespread species of the Pandalidae family, commonly found in the Atlantic and Indian Ocean, Australia, the Red and the Mediterranean Sea. Some reproductive biology aspects were studied through data collected during six monthly experimental surveys carried out in the Dodecanese area (south-eastern Aegean Sea) during the period November 2014 to May 2015 at a depth range of 10-150m. A total of 1985 shrimps within the size range of 6-20mm in carapace length (CL) were measured. Overall, mean size (CL) of females (mean $CL_F=13.40$ mm) was higher than males (mean $CL_M=11.94$ mm). Accordingly, the mean size of ovigerous females ($CL_{OV}=14.02$ mm) was higher than that of the non-ovigerous females ($CL_{NON-OV}=13.08$ mm). Ovigerous females were observed during the whole study period. Specifically, the highest proportion of ovigerous females was found in April (74%) and May (98%). The smallest size of egg-bearing females was 9.79 mm CL, probably attributed to a non-selective mesh size (12mm). Sex ratio showed a clear predominance of females in the shallow depth zone (10-25m). Gonadosomatic index was estimated monthly in order to confirm the peak of the spawning season. Difference in mean GSI was found between months, the highest of which (peak of spawning) was observed in May. Females with fully developed ovaries were collected during the whole studied period indicating a prolonged reproduction. The present work was carried out within the framework of PLESIONIKA MANAGE project, co-financed by the Greek Ministry of Rural Development and Food and the EU under the OPF 2007-2013.

Keywords: Pandalid shrimps, sex ratio, gonadosomatic index, Eastern Mediterranean Sea

LifeWatchGreece: Construction and operation of the national Research Infrastructure in the framework of the LifeWatch ESFRI

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The LifeWatchGreece Research Infrastructure (LWG RI), funded by the GSRT, is coordinated by the Institute of Marine Biology, Biotechnology and Aquaculture (HCMR) and includes 49 partner institutions. The overall objective of the project is to fulfill the vision for the Greek LifeWatch RI, establishing it as the biodiversity Centre of Excellence for South-eastern Europe. The specific objectives are: (a) To ally all the Greek scientific human potential, in order to achieve a world-class excellence national LifeWatch Centre, with exemplar management structures, legally registered, and with adequate interface for collaborative schemes for its continuation after state funding; (b) To develop complex virtual domains through a number of background e-Services which facilitate both the data contributors and users, and virtually ally the dynamic teams that will be continuously collecting data at the entire territory of the state; (c) To construct a number of virtual labs (vLabs)

where large scale science can be carried out at all possible levels. These vLabs will help scientists and other users to answer the “why” and “how” questions and to adequately assist environmental managers and policy makers, to adopt the biodiversity concept in the decision-making process; (d) To build capacity at the national level through a network of activities, including human potential mobilization, supporting and promoting the use of the Infrastructure, and enhancing organizational development. Finally to disseminate information, scientific knowledge and experience gained to the public and to liaise the Network's ideas and practices to the activities of targeted groups and of the society at large.

Keywords: Biodiversity, Research Infrastructures, e-Services, vLabs, data observatories

Introduction to the Greek Taxon Information System: Construction of the Preliminary Checklists of Species of Greece

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The Greek Taxon Information System is an application of the LifeWatchGreece Research Infrastructure (ESFRI) that has resumed efforts to compile a complete checklist of species reported from Greece. So far, a list of 35,000 valid species (and subspecies) has been assembled from previous projects (e.g. Greek Biodiversity Database; PESI: European Register of Marine Species, Fauna Europaea, and Euro+Med Plantbase), with an initial estimation of over 50,000. A new database will be set up in the LifeWatchGreece Infrastructure. Such an effort is necessary as a requirement for all signatories of the Convention on Biological Diversity, such as Greece since 1994. The first step was to build and publish Preliminary Checklists validated by taxonomists on the basis of their expertise and secondary literature. This procedure has revealed taxonomic groups under different status of knowledge in Greece: (a) well covered (e.g. Pisces, Lepidoptera); (b) not updated (e.g. Sipuncula, Porifera); (c) never listed (e.g. Chaetognatha, Brachiopoda); and (d) never studied (e.g. Ctenophora, Tardigrada). The publication of preliminary checklists is expected to increase the visibility and usability of the database not only to the scientific community but also to the broader domain of biodiversity management, especially in cases when no such a checklist had been published. Specialists who validated the checklists will be cited as taxonomic editors for every record in the database and as authors in the relevant publications in an effort to acknowledge their contribution. The LifeWatchGreece Infrastructure is open to scientific collaboration with taxonomists who are interested in contributing to this effort.

Keywords: biodiversity, taxonomy, global species databases, biodiversity management, data management

Molecular Phylogeny of Turkish Brown Trout (*Salmo trutta* L.) based on Control Region of Mitochondrial DNA sequences

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An extensive sequence analysis of approximately 1012 bp of the mtDNA control region from 242 brown trout individuals from 34 localities, representing drainages of Caspian, Black, Aegean, Marmara and Mediterranean Seas and the Persian Gulf, together with the reference sequences drawn from GenBank have been used with the aim of determining genetic structuring and a comprehensive phylogeographic resolution of brown trout across Turkey. A total of 58 mtDNA haplotypes were determined and 33 were novel and reported for first time in this study. Of 34 populations, 14 have more than one and most have unique mtDNA haplotypes. The reconstruction of phylogeny by MP, NJ, BA and ML methods has revealed similar tree topologies of haplotypes belonging to the main phylogenetic brown trout lineages. Sequence data of mtDNA control region has support the presence of Danubian (DA), Adriatic (AD), Tigris (TI) and *marmoratus* (MA) lineages in Turkey. Phylogeny and phylogeography of the brown trout populations have been discussed in regard to climatic and geological history of Anatolia.

Keywords: Phylogenetics, Phylogeography, Turkey, Anatolia, Population Genetics, mtDNA

The biogeographical facets of marine ecosystem change: Kos, Aegean Sea

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Coastal marine ecosystems are changing world-wide under the action of global and local stressors; spread of alien species constitutes a further driver of change, especially in the Eastern Mediterranean, where Red Sea species come in through the Suez Canal. Studies are becoming available that measure rate and extent of ecological change, but almost no information exists about the biogeographical consequences of changing biodiversity patterns. We compared data collected in 2013 and in 1981 in the shallow coastal marine ecosystem of Kos, an island in the SE Aegean. In these 30+ years, both sea surface temperature and human pressure increased, causing heavy modification in the structure of benthic communities. A total of 120 conspicuous species were inventoried by time-based visual census, including 31 fishes, 57 invertebrates, 2 seagrasses and 30 algae. From a biogeographical standpoint, species were grouped in 7 chorological categories: 1) Boreo-Lusitanian; 2) Atlantico-Mediterranean; 3) Endemic; 4) Mauretanian; 5) Circum(sub)tropical; 6) Tropical Atlantic; 7) Indo-Pacific. The relative frequency of Boreo-Lusitanian and Atlantico-Mediterranean species decreased between 1981 and 2013, while that of Tropical Atlantic species increased; the most striking difference, however, was the massive appearance of Indo-Pacific immigrants. These results provide an unequivocal measure of the so-called “tropicalization” of the Mediterranean Sea. Among the Indo-Pacific newcomers, the two herbivorous fishes *Siganus luridus* and *S. rivulatus* were responsible of the near extirpation of the previously luxuriant algal cover, therefore acting in turn as major direct drivers of ecological change.

Home range of the resident Greylag goose population, in Lesser Prespa Lake, Greece

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The Greylag goose (*Anser anser rubrirostris*) population in Prespa is, so far, the only viable breeding population of any goose species in Greece. It varies between 167 and 253 individuals and is one of the few sedentary goose populations in Europe. Since 2012, 52 geese were individually marked with neck collars and 9 with Bluetooth/GPS transmitters to assess survival rates and year-round spatial distribution. The kernel method was used to estimate their home range with the adehabitatHR package in R. The annual home range (95% kernel) of three birds varied from 7.24 to 16.77 km², the smallest ever recorded for a goose population in Europe. It extends mainly around two ponds at the northern part of Lake Lesser Prespa and the surrounding marsh vegetation and pastures. A tiny area of about 0.75 km² is used for moulting, which lasts from 3 May to 20 June. It was disclosed that many geese graze also at night and this might be attributed to disturbance by human activities in the restricted pasturelands used for grazing by the birds. A combination of direct field observations and transmitter data showed that the geese are forced to move longer distances to suitable foraging areas in summer, autumn and winter, while in spring they remain within a much smaller area. Precipitation regime and bean-culture practices may affect availability of forage. This population should be treated as a discrete conservation unit with an outstanding conservation value due to its presumed isolation in a very restricted space.

Monitoring vole diversity in intensified agro-ecosystems through large spatial scale analyses of Barn owl prey use

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Mediterranean agro-ecosystems are hosts for both diurnal and nocturnal raptors. Taking under consideration the importance of preserving top predators in conservation planning and management, it is eminent that the main factors shaping their ecological needs must be explored. In the largest agro-ecosystem of Greece, the Thessaly plains, one major factor essential for top avian predators' conservation, is the knowledge of resources which form their trophic niche. That niche is mainly formed by small mammals and specifically voles which function as optimum prey. Monitoring small mammals though through live trapping is time consuming, with low trapping success (10%-15%) and can only be applied in small scale studies. In addition, Thessaly plains cover an extension of more than 5.000 km² which extend to four different geographical prefectures. These facts pinpoint to the need of a different large scale approach in order to realize a meaningful monitoring of vole diversity and abundance.

Extensive Barn owl diet analysis from 2004 to 2008, identified a total of 12.000 prey items belonging to 4 different vole species in large spatial scale context from 31 different regions covering the total of Thessaly agro-ecosystem. Multivariate approaches through RDA, CA and CCA including various environmental factors which define the agricultural mosaic (crop types, seasonal crop changes, soil types, extension cover, perimeters of land parcels, lengths of roads and rivers) managed to give deep insights in the trends of vole distribution, diversity and abundance.

Vole presence and abundance was significantly correlated with underlying environmental gradients, temporal changes also outlined main effects upon certain species' distribution and numbers, diversity α and β was calculated, and sympatry/allopatry patterns were revealed. These holistic results would not have been possible to reach with any other small mammal monitoring approach, with the additional benefit of clear conservation targets that can be set based on that multivariate large spatial scale approach.

Keywords: trophic niche, agricultural ecosystems, ordination methods, voles, *Tyto alba*

Colonisation of the Karla reservoir by pelicans

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Filling up of the newly constructed Karla reservoir with water commenced in 2009 and is still ongoing. We have been counting pelicans at Karla reservoir once or twice a month since June 2012 to monitor the colonisation rates by the two species of pelican. In the few censuses available prior to this date, either no pelicans or less than 15 Dalmatian pelicans (DP) were recorded. A maximum of less than a 100 DP was recorded in Karla in 2012. Their numbers rose gradually following a clear seasonal fluctuation pattern and exceeded 1000 within 2015. Only in December-March adult numbers exceeded immatures. In 2011 there was possibly an unsuccessful breeding attempt, but in 2012 a p. of immature birds bred successfully. In 2013 breeding pairs rose to 12-18, in 2014 to 53 and in 2015 exceeded 100 with breeding success around 1 young/pair. The first Great White Pelicans (GWP) appeared in July 2012 and their numbers, which peak late summer-autumn, rose gradually to exceed 500 birds in August 2014. In June 2015 9 pairs made nests, laid eggs and incubated them before abandoning them in a few weeks. This is the first time GWP nesting is recorded in SE Europe outside Prespa and the Danube delta. Available evidence shows that Karla might have been colonised by immature birds from both the Prespa and Kerkini colonies. Karla has become the most important wetland in Greece for immature DPs and a wetland of high importance for migrating GWPs within 6 years after flooding.

Keywords: Dalmatian Pelican, Great White Pelican

Assessment of a coralligenous assemblage in Korinthiakos Gulf, Ionian Sea, SW Greece

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Marine sciaphilous assemblages on biogenic substrate mainly built by red calcareous algae, i.e. the coralligenous habitats, are a highly important, diverse and sensitive Mediterranean bioherm that remains remarkably understudied in the eastern Mediterranean. Herein we profile a coastal coralligenous assemblage in an area with steep bathymetry and moderate hydrodynamism, following the guidelines of the ongoing CIGESMED project. The site is located in the North Peloponnese and is characterized by a steep rocky drop-off where coralligenous assemblages predominate deeper than 15 m. Along a 100 m horizontal transect set up at 25 m depth, we performed topographic mapping and assessed the composition of biotic cover non-destructively through analysis of 50x50 cm photoquadrats. A total of 50 taxa of sessile invertebrates and macroalgae were identified, 25 of which being sponges. The latter group was also predominant in terms of coverage, followed by calcareous red algae, scleractinian corals, and bryozoans. Conspicuous taxa included *Agelas oroides*, *Spirastrella cunctatrix*, *Chondrosia reniformis*, *Peyssonnelia* sp., and *Hoplangia durotrix*. Although the gorgonian *Eunicella cavolini* is present in the wider area, no erect anthozoans were recorded along the studied transects. Moreover, compared to similar sites studied in the Western Mediterranean, the high abundance of erect sponges (*Axinella cannabina*) at the upper stratum and the function of the coralline alga *Peyssonnelia* as the main frame builder instead of *Lithophyllum* and *Mesophyllum*, were striking differences. This work enhances existing knowledge regarding coralligenous communities in the Eastern Mediterranean and underlines the necessity for further surveying and monitoring initiatives.

Keywords: marine, benthos, benthic assemblages, calcareous rhodophytes, invertebrates, Mediterranean Sea

***Angiostrongylus chabaudi* in European wildcat: first evidence of definitive host**

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Angiostrongylus chabaudi (Strongylida, Angiostrongylidae) is a parasitic nematode that has been described for the first time by Biocca in 1957, from the pulmonary arteries of six European wildcats (*Felis silvestris silvestris*) in central Italy. Since then, this parasite remained practically unknown until recently, when immature parasites identified as *A. chabaudi* have been reported from one wildcat and two domestic cats in Italy. The present report describes the first record of *A. chabaudi* in Greece. Moreover, this is the first known case of patent angiostrongylosis by *A. chabaudi*. At the necropsy of a road-killed wildcat found near the lake Kerkini, in the municipality of Serres (Macedonia, Greece), nine slender nematodes (six females and three males) were recovered from the right ventricle of the heart. The morphological characteristics of the parasites were consistent with *A. chabaudi*. The parasites were mature adults and in the uterus of females numerous eggs were present. Moreover, first stage larvae (L1) with the typical *Angiostrongylus*-like morphology (362-400 x 15-18.5 µm, kinked tail with dorsal spine and notch) were detected in the faeces of the animal. The animal was negative for any other cardio-pulmonary parasite. Genetic examination of adult parasites and L1s and evaluation of any histopathological lesion are currently ongoing. This is the first description of *A. chabaudi* L1 and thus, the first confirmation that this nematode reaches sexual maturity and reproduces in European wildcats. Therefore, it is ultimately confirmed that this felid is a definitive host of *A. chabaudi*.

Keywords: pulmonary arteries, parasites, nematodes, morphology, Felidae

***Dirofilaria immitis* (heartworm) in a golden jackal (*Canis aureus*) in Greece**

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Dirofilaria immitis is a parasitic nematode that inhabits the pulmonary arteries and the right ventricle of the heart of its hosts. It has an indirect life cycle and it is transmitted by mosquitoes. Dog is its main host but it is also a parasite of wild canids, cats and other carnivores. This parasite is of zoonotic importance, causing pulmonary dirofilariosis in humans. In Greece, *D. immitis* is enzootic and canine dirofilariosis or heartworm disease is very prevalent in the north and sporadic in the southern country. The role of wildlife in the epizootiology of the disease in Greece needs to be studied. Golden jackal (*Canis aureus*) is characterized as “endangered” in the Red Data Book for Greek Vertebrates, and it experienced a large-scale population decline in the past 3 decades. A young female golden jackal was found road killed in the area of Kerkini lake, in the municipality of Serres (Macedonia, Greece). At necropsy, four *D. immitis* (3 females and 1 male) were found in the pulmonary arteries. Modified Knott’s test performed to the hemorrhagic fluid found in the abdominal cavity was positive for *D. immitis* microfilariae (1st larvae). Dirofilariosis is a disease with major impact on the animal’s health and fitness, and can lead to death. In terms of conservation status of the species, such parasitic diseases may have important consequences for populations that are endangered. Moreover, wild animals likely represent an important reservoir of the parasite in nature and play a critical role in the epizootiology/epidemiology of dirofilariosis.

Keywords: pulmonary arteries, parasites, nematodes, epizootiology, wildlife

Ringling studies of the golden oriole *Oriolus oriolus* (Aves: Oriolidae) during passage through Antikythera Island, southwestern Greece

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The aim of this study is to provide baseline data on the phenology, stopover condition, morphometrics, and fat storage of the golden oriole in the eastern Mediterranean during autumn and spring migration. The migration phenology of the species described for the first time in Greece.

Golden orioles were mist-netted in Antikythera Island. Spring passage through Mediterranean takes place between mid April and late May, and autumn passage between late August and late September. In the spring we caught many more birds than in autumn, 631 and 44 respectively. This shows that the spring migration involves much greater numbers than the autumn.

In total 675 golden orioles were trapped and ringed during 7 spring migration seasons and 5 autumn seasons. The range of wing length of the species was 140 - 178 mm, and the tarsus 19.5 - 26.4 mm. Fat scores were found much higher in autumn than in spring. Fat does not differ between sexes or ages. Males were found to weigh more than females. There is also seasonal variation in weight, as birds weigh more in autumn (61 - 104 gr) than in spring (46.2 - 88 gr). Muscle scores do not differ between sexes or season.

Males were found having larger wing length than females. No difference was found in the tarsus length neither between sexes nor between ages.

There was only one control, ringed on 26 April 2002 on Gavdos Island (south of Crete). The bird was caught on the 15th of May 2003 (after 381 days).

Phylogenetic relationships within Porcellionidae (Isopoda, Oniscidea)

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Despite numerous morphological studies, phylogenetic relationships among isopod genera remain largely unknown, and even relations among families have not been robustly resolved. Several recent molecular phylogeny studies have indicated that genetic variation among isopod taxa is very large and often incongruent with established taxonomy. There is strong evidence that many genera and families might not be monophyletic.

We have initiated a large scale molecular phylogeny of terrestrial isopods, and herein we present the first results on the phylogeny of Porcellionidae, based on both nuclear and mitochondrial DNA markers. Porcellionidae is among the richest terrestrial isopod families, including 326 species in 19 genera, with a global distribution.

We used specimens from a very representative sample of Porcellionidae genera, either collected in the field or borrowed from museum and/or private collections. We also used several taxa as of other families as outgroups.

A combination of different primers was used for the amplification of 18S and 28S nuclear, and 16S mtDNA gene fragments, which were sequenced after common PCR procedures. We applied Maximum Likelihood and Bayesian Inference methods to calculate phylogenetic trees, and we also calculated genetic distances among genera.

This work will be further enriched by more genera and families in the near future, so as to obtain soon a detailed phylogeny of all Oniscidea.

Monitoring Gray Wolf Packs in Northern Turkey: Preliminary Results of a Long Term Camera Trapping Survey

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Camera trapping has become widely applied method for monitoring large carnivores; those particularly are rare, elusive species during last decades. The method also becomes a useful tool for conducting studies on other large mammals when the data desired to be collected under compelling circumstances such as dense vegetation cover and rugged terrain which all make almost impossible to carry out direct observation techniques. In this connection, we performed a monitoring study using camera trapping in mountainous and forested habitats of Northern Turkey to reveal wolf (*Canis lupus*) activity in 4 different study sites in the province of Kastamonu, which is located in the Black Sea Region of Anatolia. Although all study sites have some unique landscape characteristics, they usually show main features of the Northern Anatolian conifer and deciduous forests ecoregion of Turkey. In this context, since 2013, we set up 62 camera trap stations in total and achieved 2582-recorded events for 13 large mammal species during more than 10.000 camera-trap nights. Within this period, 183 of collected records have been belonged to wolves. Analyses on activity pattern of wolves in the study sites shows that nocturnal activity is ~60% and wolves are also active during the daylight. According to the preliminary results of this ongoing study, group sizes of wolves do not exceed 4-5 individuals although, all study sites provides suitable habitats for viable wolf population.

Digging for gold: data archaeology in the framework of the LifeWatchGreece infrastructure

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Historical publications and expedition logbooks contain a tremendous amount of valuable biogeographic data, but these manuscript data are of little use to researchers attempting to perform comprehensive large-scale studies. The information in these publications is unstructured, hidden in free text, not annotated with metadata and thus not retrievable. However, the historical record of biodiversity is of paramount importance as baseline information for assessments and for prediction of future trends. The LifeWatchGreece infrastructure has therefore started an initiative to identify, document and digitize historical (pre-1945) data and mobilize them into global biogeographic databases. An inventory of historical publications containing marine biogeographic data from the Mediterranean Sea and terrestrial biogeographic data from Greece was created, containing up to now over 450 identified publications. For the actual digitization process, the publications were prioritized according to a variety of criteria ranging from taxonomic, geographic and temporal coverage to the level of detail of information, language constraints and accessibility (electronically / in libraries). The prioritized datasets were documented extensively with metadata and the data are being digitized and transformed into a standard format (DarwinCore). Quality control procedures are being applied to the data before they are published online into global biogeographic databases such

as the Ocean Biogeographic Information System (OBIS) and the Global Biodiversity Information Facility (GBIF). Up to now, full metadata for over 80 historical datasets are already available online through the LifeWatchGreece portal, and the actual data are growing, slowly bridging the gaps in Mediterranean biogeography.

Keywords: historical data, marine biogeographic data, terrestrial biogeographic data, Mediterranean Sea, Greece, Darwin Core

Analysis of *Montenegrina* (Gastropoda: Clausiliidae) co-occurrences infers high niche similarity below the genus level

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Rock-dwelling gastropods contribute substantially to the species diversity of karst areas of the Mediterranean Basin. This group is characterized by low capability of active dispersal, considerable morphological diversity, high proportion of narrow-range endemic and/or sporadically distributed taxa. Their phylogeny is little known and it is intensely debated how, and to what extent, adaptive and non-adaptive mechanisms contribute to their evolution. Our objective was to find evidence for altered niche preferences within rock-dwelling gastropod genera at different stages of their phylogeny. We used Balkan taxa as study system with main focus on *Montenegrina*, a genus of known phylogeny, which is therefore suitable for comparisons of intra-generic lineages. First, we demonstrated by Niche Identity and Niche Equivalency tests (Maxent) that macroclimatic requirements do not differ significantly between the various *Montenegrina* lineages. Then, we tested whether or not there is any niche differentiation beyond macroclimatic requirements. To this end, we compared the ratio of observed co-occurrences of different *Montenegrina* lineages, and also of *Montenegrina* and other rock-dwelling snail genera where distributions are simulated assuming random distribution and independence across taxa. We have observed less than expected co-occurrences between *Montenegrina* lineages, indicating that (mostly allopatric) distribution of *Montenegrina* results not only from random chance. We propose the lack of niche differentiation as the most likely explanation for the hindrance of congener co-occurrences.

Keywords: rock-dwelling gastropod, distribution simulation, niche modeling, Balkans

Integrative taxonomy in handling species-rich and mass - occurring taxa - diversity of Chironomidae in geologically young lake and associated old spring system – the outline of the project

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Chironomidae is one of the richest in species family of animals in the world. Until now more than 5,000 species were described. Chironomids inhabit various freshwater ecosystems and due to very abundant populations, play a prominent role in energy flow in freshwater ecosystems. Chironomids possess dispersal stage which leads to colonization of new habitats in short time. Chironomidae collected in large numbers pose major problem in basic and applied biodiversity research: **identification to species by morphological diagnostic features is usually difficult, time consuming and expensive**. Some of the greatest challenges in taxonomy and systematics are related to a mixture of **small size, low abundance, and rarity of some species**.

Skadar Lake is the largest lake in the Balkan Peninsula with approximately two-third (229 km²) of its surface belonging to Montenegro and about one-third (142 km²) to Albania. The lake extends in the NW-SE direction, and it is approximately 44 km long with a surface area that seasonally fluctuates between 370 km² to 530 km². The characteristic feature of Lake Skadar's water balance is high inflow from a number of temporary and permanent karstic springs, some of which (called 'oko') are sublacustrine and in cryptodepression. **The Skadar Lake system is a well-known hotspot of freshwater and endemic biodiversity. The origin of the lake is dated to 1274 – 1197 BP. However, the time of origin and diversification of the local faunal or floral elements remain uncertain.**

Chironomid fauna of Skadar Lake and its system of springs is poorly investigated. Own preliminary studies presents 78 chironomid species occurring in Lake Skadar based on Chironomidae pupal exuviae identification. Material was collected during spring and autumn expeditions. This very young lake is fed by geologically old system of springs, which has its origins in Pliocene. This makes it a very interesting model that allows testing different assumptions about the biogeography and phylogeny of Chironomidae.

- Taking into account the habitat selectivity of chironomids known from literature, it can be assumed that the **lake and surrounding springs are inhabited by different chironomid communities**.
- It may be also assumed that the **fauna inhabiting such a young lake consists primarily of species widespread in Europe** with high potential for dispersal, or at least widespread all over the Balkan Peninsula. On the other hand **fauna of old spring may also consist of species with much older origin, including local endemics**.

A comprehensive study based on three life stages, morphological and molecular characters will allow to evaluate which stage reflects best the local level of Chironomidae diversity. It will also enable assessing level of cryptic diversity within the already known morphospecies and detecting species new for science.

Behavioral and anatomical reproductive traits under post-copulatory sexual selection in the land snail *Cornu aspersum*. Phenotypic plasticity or local adaptation?

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Several reproductive traits of the simultaneously hermaphroditic land snail *Cornu aspersum* (former *Helix aspersa*) appear highly variable among and within populations of diverse habitats. In this study we discuss the potential action of post-copulatory sexual selection in *Cornu aspersum* with respect to diverse ecological parameters. We also discuss difficulties and biases in interpreting results from complex data sets (ecological, behavioral and anatomical variables). Reproductive traits of four population from Crete (Chania, Lasithi) and two population from Epirus (Arta) were studied. Observations and measurements were performed on adult snails of unknown mating history collected from the field and allowed to mate freely in laboratory conditions. Our results indicate that populations that experience different sperm competition intensity vary in their mating behavior and eventually in their anatomical reproductive traits. Interestingly, as simultaneous hermaphrodites, both roles (male and female) appeared to be potential targets of post-copulatory (sperm competition and cryptic female choice) sexual selection within and among populations of diverse habitats. These differences among populations could be interpreted as local adaptations or caused by phenotypic plasticity.

Keywords: reproductive traits, sperm competition, cryptic female choice

Testing basic island biogeography theory using ants in an urban environment

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According to the theory of island biogeography (TIB), species number is expected to increase as the available establishment area increases. In order to test this hypothesis in an urban environment such as Athens, ants are considered an appropriate bioindicator. Ten (10) 'islands' (stations) with distinct flora assemblages surrounded by urban structures (e.g. roads, blocks of flats, parking lots) were chosen on an east-west direction transect across Athens metropolitan area. They all had differences in their topography characteristics such as area size, altitude and flora composition. Using hand collecting and pitfall trapping ants were collected within a six month period. In total, 47 ants species belonging to 17 genera were identified. Correlation analyses to each station factors resulted in clusters of similarity between habitat types of certain station size groups. Indeed, the size of each station was the most significant factor for species richness. So, even in an extreme urban environment such as that of metropolitan Athens, the general principle of the TIB stands.

Lakes as islands: Biogeographic patterns of gastropods in Balkan and Anatolian lakes

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The present study explores the underlying mechanisms that shape the distribution patterns of freshwater gastropods in Balkan and Anatolian (Turkish) lakes. A total of 195 lacustrine gastropods were recorded from 53 lakes. The species–area relationship (SAR) was explored using the power (log–log) model. Gastropod biotas were assessed for nested patterns using the nestedness metric based on overlap and decreasing fill (NODF). Beta diversity and similarity patterns across the lakes were estimated using the similarity, richness difference and species replacement (SDR) simplex approach. A significant SAR was identified for gastropod species richness of the studied lakes. The surface area of the available lakes explained 52% of the variance in species richness and the z value was 0.24, a typical value for continental islands. The complete dataset was significantly nested (NODF = 14.98) but the degree of nestedness was relatively low as a result of the high number of endemic species. The exclusion of 131 single-lake endemics (SLE) increased nestedness (NODF = 31.865). SDR simplex diagrams revealed a high percentage of species replacement and differences in species richness therefore leading to increased beta diversity regardless of the SLE. The results support a high degree of lake isolation. The weak biogeographic connections between the lakes may be the result of dispersal limitations and the evolutionary history of the species involved. Furthermore, the rich and endemic gastropod faunas of the lakes affirm their relatively long history.

Keywords: endemic species, species–area relationship, nestedness, SDR simplex.

Carabid assemblages along an elevation gradient on Mt. Troodos (Cyprus)

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Elevation biodiversity gradients are among the major macroecological patterns that have attracted research interest for a long time, but their causality and generality still remain ambiguous. Several confounding factors, such as habitat variation, geometric constraints in distributions, available area variation, are interacting and blur effects of elevation.

We aim to contribute to this line of research with data from the insular Mediterranean Mt. Troodos of Cyprus, the highest mountain of the island (1,953m a.s.l.) which represents the oldest landmass that emerged from the sea bottom some 10 Ma, as a result of submarine volcanic activity. It is covered mainly with pine forests, *Pinus brutia* at lower elevations and *P. nigra* above ca. 1,200m, and its higher parts (>1,500m) are covered by snow usually for 2-3 months in winter / early spring.

We focused on ground beetle assemblages of the family Carabidae, whose taxonomy and fauna are well known for Cyprus. Pitfall traps were placed at a total of 11 sampling stations located from 900m to the top, at 200m elevation intervals. One transect was placed on the eastern and one on the western slope. Sampling was performed in two different seasons, autumn and late spring, periods of peak diversity for Mediterranean Carabidae.

Results are evaluated in relation to elevation, slope orientation, habitat, and abiotic factors (temperature and relative humidity) measured with data loggers in each sampling site. A total of 30 species were found, most of which at the highest elevation, while the highest abundance was found at 1,300m east.

"Mother's curse and an ongoing Speciation? The paradigm of *Lepus europaeus*"

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The European brown hare (*Lepus europaeus*) is a game species with cosmopolitan distribution. Phylogeographic studies have revealed two major mtDNA haplogroups, the European and the Anatolian, whose geographical distribution is well separated, except a restricted hybridization zone in northern Greece and Bulgaria. This indication of the development of a mechanism of reproductive isolation, is also supported by the impaired reproductive success after crossing the two haplotypes in captivity. This study was set to identify whether “mother’s curse”, i.e. incompatibility between the nuclear and mitochondrial genome in energy production, is the underlying mechanism of the reproductive separation between the haplogroups. Genomic resources were generated with NGS technologies. Mutations of the genes involved in cellular energetics, namely the glycolysis, Krebs cycle and the OXPHOS machinery, were mapped and compared between the two haplogroups. The first two are governed solely by nuclear-encoded genes whereas the latter demands the efficient cross-talk of nuclear- and mitochondrial-encoded genes. A total of 510 mutations differentiating the two haplogroups were identified in the genes involved in energy production. The genes of OXPHOS complexes exhibited a two-fold higher rate of differentiating mutations per nucleotide compared with those of Krebs cycle and the glycolysis. Within the OXPHOS, Complex IV presented the highest rate of differentiating mutations, unlike Complex II comprised only of nuclear genes that accumulated mutations at the same rate with the genes of glycolysis and Krebs cycle. mtDNA drives fast the differentiation of OXPHOS machinery between the haplogroups providing a plausible cause of reproductive separation in action.

Cross-community scaling of macro invertebrate guilds: Decoding deviation from metabolic expectation into potential mechanism

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Body size is a fundamental property of organisms related to many individual traits with cascading influences on population and community abundance and energy use. These latter have been described as size-distribution relationships at population and species levels (local or global size density relationships, LSDR and GSDR respectively) or at guild and community levels (cross community scaling relationships, CCSR), with $-3/4$ expected scaling exponents.

Real guilds/communities commonly show much higher scaling exponents in aquatic ecosystems, particularly when dealing with benthic macro-invertebrates, suggesting a hierarchical dominance of large species.

Here, we present an experimental test of the mechanisms underlying the observed deviation of CCSR exponent from the expected $-3/4$ scaling exponent in macroinvertebrate guilds. Particularly we test two main hypothesis: (i) if observed deviation is related to body size positive dependency on energy flow within aquatic ecosystems; and, (ii) if observed deviation is determined by body size dependency of resource exploitation efficiency.

These hypotheses were tested on benthic macroinvertebrate guilds of fifteen lagoon ecosystems in the Mediterranean and Black Sea. We used secondary production data as proxy of energy flow and hierarchical energy partitioning to address resource exploitation efficiency of macroinvertebrate guilds. The results are going to be presented.

Keywords: body size, abundance, energy flow, secondary production.

Environmental awareness of Greek teachers

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For many researchers it is important to understand people's pro-environmental behavior and explain how psychology can improve ecological behavior. The global environmental crisis is an undeniable reality connected with lack of environmental awareness and environmental education. Starting with this deficit, the aim of this research is to identify the environmental awareness of Greek teachers who teach Environmental Education. Environmental consciousness consists in environmental knowledge, attitudes, and behavior. Primary data were obtained from a randomly selected sample of 100 teachers. Respondents' connection with nature was measured with: a) the CNS scale, which measures individuals' trait levels of feeling emotionally connected to the natural world, b) the EID scale, measures aspects such as the scope and importance of individual interactions with nature. For this purpose, a combination of applied methodological research techniques were used. The approach combines of applied methodological research like item analysis, evaluation of Cronbach α , Principal Component Analysis with Varimax rotation and Cluster Analyses together with logistic regression. The average score of the CNS was 57.24 (± 7.159) with minimum total score 21 and maximum 68 and a-Cronbach was 0.772. The PCA led to three factors. The average score of EID was 97.08 (± 12.239) with minimum total score 64 and maximum 120, as a-Cronbach was 0.9. The PCA in EID scale led to six factors.

Air arthropod community in the different agroecological zones of the Cretan olive orchards, as determined by environment and farming practices

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Olive trees are cultivated in different agroecological zones, predominately plain and hilly ones, differing in terms of elevation, landscape structure, pedoclimatic conditions and biotic factors. In this study, air arthropod community was monitored seasonally, in olive orchards located in Messara valley, Crete, Greece. The aim was to explore the response of air arthropods to specific management practices, abiotic factors and landscape, in hilly and plain agroecological zones. Monitoring took place weekly, for five weeks per season within a period of two years, using transparent, sticky traps, hanged in the canopy of the olive trees. Management practices, like insecticide use, canopy management and soil cover status, as well as climate conditions and landscape complexity, were also recorded. A counter group of functional taxa was defined, with respect to biological pest control and another including the main olive tree pests. Comparison between agroecological zones was performed as well as multivariate analyses using management practices, landscape complexity and climate conditions as explanatory variables. Hymenoptera, Diptera and Coleoptera were the most abundant taxa. Statistical differences of arthropod assemblages, functional subgroup, pests and diversity indexes were found significant in all seasons. Agroecological zones explained a low proportion of total variability of the air arthropod community and appeared as less decisive factors affecting community composition. Climate conditions, landscape and farming practices applied, proved to be the main explanatory factors, with temperature, landscape complexity, relative humidity, and canopy density appearing to be important drivers of air arthropods variability.

Keywords: air arthropods, olive, agroecosystem, agroecological zone, agrobiodiversity, functional

The Iranian plateau is a hotspot of genetic diversity in the house mouse (*Mus musculus* L.)

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The phylogeography of the house mouse (*Mus musculus* L.) is only partly understood, essentially because of a sampling bias towards its most peripheral populations in Europe, Asia and the Americas. In order to understand better the species distribution, nineteen nuclear markers (microsatellites) from 963 individuals were genotyped. Samples came from all across Eurasia with an emphasis on the putative Middle-Eastern centre of dispersal of the species. Our approach confirmed the clear distinction of the three best described peripheral subspecies, *M. m. musculus*, *M. m. domesticus* and *M. m. castaneus*. A large diversity was found in the Iranian populations, which have had an unclear taxonomic status to date. In addition to samples with clear affiliation to *M. m. musculus* and *M. m. domesticus*, two genetic groups in Central and South East Iran were found. These two groups are as distinct from each other as they are from the south-east Asian *M. m. castaneus*. These groups were previously also found to harbor primarily distinct mitochondrial haplotypes. We proposed that the Iranian plateau is home to two more taxonomic units displaying complex primary and secondary relationships with their long recognized neighbours. This central region emerges as the area with the highest known diversity of mouse lineages within a restricted geographical area, designating it as the focal place to study the mechanisms of speciation and diversification of this species.

Diversity and origin of freshwater gammarids from Crete and Peloponnese – preliminary results

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The Mediterranean Region is known as one of the most precious biodiversity hotspots in the world. However, majority of studies upon Gammaridae of the region focused mostly on marine species, leaving aside the freshwater fauna. So far, around 120 freshwater species of two genera, *Gammarus* Fabricius, 1775 and *Echinogammarus* Stebbing, 1899, have been reported from the area, with only 15 known from the Mediterranean islands. Given the very high cryptic diversity discovered recently in European gammarids and relative scarcity of studies upon insular species, we conclude that number of species already reported both from the mainland and from these islands may be underestimated. Our main goal is to reveal the diversity, phylogenetic relationships and origin of freshwater gammarids inhabiting Crete, a large Mediterranean island of continental origin, and Peloponnese, mountainous peninsula at the southernmost end of the Balkans.

Based on the materials collected in 2011, we have revealed presence of at least five freshwater species on Crete. Based on morphology four of them could be identified as the members of *Echinogammarus* already known from Crete. Also we have revealed presence of one species new for science and belonging to *Gammarus*, genus that has not been reported from Cretan freshwaters so far. Additionally, we revealed presence of at least eight freshwater species of *Gammarus* present on Peloponnese. Interestingly, we could not confirm presence of any species reported from the peninsula, except *G. pulex*. Molecular species delimitation methods based on mitochondrial markers (COI and 16S) and SEM supported their distinctness.

The first simultaneous counts in the Greek and Turkish parts of the Evros/Meric delta reveal its true value for wintering waterbirds

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Shared between Greece and Turkey, the Evros/Meric River delta is among the most important wetlands for wintering waterfowl in the Mediterranean. We present the combined results of the first counts of wintering waterbirds (under the International Waterfowl Census) carried out simultaneously in the two parts in 2012-2015. They are discussed in comparison with those of previous, uncoordinated counts, carried out in 1993-2011. Fifty nine species occurred regularly and eleven were observed irregularly. The three most numerous species were *Anas crecca*, *Anas platyrhynchos* and *Anas penelope* summing up to 80% of all birds. Total numbers of birds present in the delta ranged from 71,741 to 227,566. The average number of birds for the whole delta equals to 20.4% of all birds counted in Greece and to 9.3% of all birds in Turkey. The high between-year variation, especially in the Greek part, is noteworthy and can be probably attributed to fluctuating weather conditions in adjacent regions to the north. Seven out of the nine most numerous species were almost exclusively encountered in Greece and two in Turkey. On average, 81,9% of birds were observed in the Greek part and 18,1% in the Turkish. This may be attributed to the higher habitat diversity in the Greek part, the presence of an extensive non-hunting zone and the considerably scarcer human presence. Finally, the simultaneous counts emphasized the interdependence between the two parts by corroborating the empirical knowledge about daily movements of some species between the two parts for foraging and roosting.

Keywords: IWC, Greece, Turkey, *Anas crecca*, *Anas platyrhynchos*

Tales of gecko tails – evolution and biogeography of tail autotomy in insular and mainland *Mediodactylus kotschy*

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Tail autotomy (=loss) is an anti-predator mechanism of lizards. Since islands often lack predators tail autotomy may be reduced in insular lizard populations. We studied how insular conditions affect tail autotomy tendency (measured as the percentage of animals dropping tail during our field work) and population-level damaged tail rates (DTR) of the gecko *Mediodactylus kotschy* across 40 insular and six mainland populations in Greece and Israel. We predicted higher DTR and increased tendency for autotomy will characterize less isolated (temporally and spatially; since longer isolation in reduced predation environments is expected to reduce autotomy), denser populations experiencing, increased predation (presence and richness of predators, and especially vipers) and reduced interspecific competition. We recorded snout-vent and tail lengths as well as tail condition of 698 adult geckos in the field. We collected predictor variable data in the field and from the literature. Surprisingly, DTR of mainland geckos are lower than in islands, while autotomy tendency is similar. Higher DTR are associated with high density, as expected, but also with lower predation (and especially absence of vipers) and low inter-specific competition regimes. We found no effect of isolation in insular populations. Autotomy tendency increases in denser populations and where *Podarcis* lizards exist. Our findings suggest that intra-specific competition is very important to the evolution of tail autotomy. We suggest predation affects these traits by reducing intra-specific competition rather than by direct selection pressure as usually thought. Gecko tails show contrasting evolutionary responses to those of sympatric *Podarcis*.

Keywords: anti-predator mechanism, competition, islands, lizards

To meet modern taxonomical approach: developing molecular tools using short mitochondrial fragments from archival specimens

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Biodiversity protection, preservation and inventorization are leading concepts in modern biology. However, species identification and precise recognition of taxa still remain the key problems in basic and applied studies. It is indisputable that during the last 250 years, traditional taxonomy accumulated knowledge that was incorporated into every aspect of current research of biodiversity. Thus, current taxonomy is based exclusively on the typological species concept, following the International Codes of Nomenclature (Zoological, Botanical, Bacteria, etc.). Barcoding initiative lent insight into potentials of molecular methods to provide better taxonomic resolution in species recognition efforts. This is especially true after declining number of traditional taxonomic practitioners in past 30 years, which launched the molecular tools application in species characterization as a certain approach in future studies.

If we consider determination of any organism at the species level to be primarily based on traditional taxonomic methods, applying molecular methods to define genetic content of barcoding region (mtCOI gene) of archived type specimens should be treated as a method of choice for precise identification. Having in mind that DNA in archived specimens is usually more or less defragmented at a certain degree, employing methods of PCR amplification and sequencing of short mitochondrial fragments may lead to clarification of nomenclatural doubts accumulated in the past. In addition, the use of prior genetic information to identify short phylogenetically informative amplicons offers a useful approach for molecular phylogenetic analyses especially when *de novo* collected material is not available or feasible.

Keywords: barcoding region, short mitochondrial fragments, archived type specimens, molecular phylogeny

Biogeographic history and diversification events among the Greek *Trachelipus* species

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The terrestrial isopod (Isopoda, Oniscidea) genus *Trachelipus* includes mostly stenoecious animals living in humid habitats, such as dense forests and around inland waters. Phylogenetic relationships within the genus are still largely unknown because robust analyses have started to appear only relatively recently. Species-level taxonomy has been based mainly on a few morphological characters, including some secondary sexual characters of males, although recent analyses based on molecular markers have indicated that species definitions based on morphology may underestimate the true levels of divergence among populations. Furthermore, within several other genera or species groups of Oniscidea, morphological characters do not provide clear-cut taxonomic resolution, thus, many changes in the interpretation of nominal species have appeared in the literature. Herein, we provide a comprehensive phylogenetic analysis of seven (7) *Trachelipus* spp. distributed in Greece using a population-level approach. We employ one nuclear (NaK ATPase α -subunit) and two mtDNA markers (COI and 16S rRNA), and in order to estimate the chronology of diversification events among species and populations we implement a calibrated molecular clock using several alternative scenarios in BEAST. Our results reveal incongruence with current taxonomy. Populations considered conspecific appear to cluster in different clades with large genetic distances among them and, at the same time, different species' populations do not show significant phylogenetic and/or genetic differentiation. Phylogeographic patterns corroborate to the established palaeoevents in both mainland and insular Hellenic region.

Keywords: phylogeography, genetic divergence, molecular clock, evolution, Greek palaeogeography

Prevalence of the parasite *Anguillicola crassus* in the European eel (*Anguilla anguilla*) in lagoons, rivers and lakes in Northern and Western Greece

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Anguillicola crassus is a parasitic swim bladder nematode of the European eel *Anguilla anguilla*. It is originated from SE Asia and reached Western Europe in the early eighties via consumption or restocking. It has spread quickly through several countries, not only causing problems to eel farms but also infecting a rapidly increasing percentage of the natural eel population. A total of 1,343 yellow and silver stage eels were collected from River Evros (456) and Lake Vistonida (279) in Northern Greece and from Amvrakikos Gulf (53) and Messolonghi-Aitoliko lagoons (549) in Western Greece, from 2012 to 2015. The mean total length and the mean total weight were found 601 mm (SD ± 6.9) and 672 g (SD ± 23.0) for the silver eels and 576 mm (SD ± 4.3) and 440 g (SD ± 12.6) for the yellow eels, respectively. The prevalence of *A. crassus* was found in the 28% of examined eels. Furthermore the prevalence was found to be 20% in River Evros, 64% in Lake Vistonida, 25% in lagoons of the Amvrakikos Gulf and 17% in the Messolonghi-Aitoliko lagoons. According to the principal components analysis, two significant groups were found. The first group, which is characterized by high parasitic burden and high values for the Fulton index, includes the Vistonida and Evros eel population and the second group includes Messolonghi-Aitoliko lagoons population, which differentiates from the rest due to the Ocular and Fin index.

Determining The Future Distribution of Endemic Species Under Climatic Changes; an example from the Eastern Black Sea Region of Anatolia

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Anatolia is an important geographic region by the means of its location, variability of its topographic structure, diversity of its climatic structure and its richness of biodiversity. Determining the future distributions of species, especially endemic ones, in Anatolia under the climatic changes is an important research interest for biodiversity and conservation. Anatolian endemic bush cricket *Isophya rizeensis* Sevgili, 2004 (Orthoptera: Tettigoniidae) is an ideal model organism for modelling future distributions with its narrow distribution area and locations of its distribution area. BIOCLIM, GARP and MAXENT Ecological Niche Modelling (ENM) methods are used in this study. Three different carbon emission scenarios (A1b, A2a, B2a) from Intergovernmental Panel on Climate Change 4 (IPCC4) are tested for the years 2020, 2050 and 2080 for predicting future distribution. All ENM results showed that there may be risk of extinction in the future for the model organism. The results of this study indicates that it is important to identify the future distribution of endemic species in Anatolia for future planning and applications of conservation biology.

Keywords: Ecological Niche Modelling, *Isophya rizeensis*, Distribution, endemic, climate change, conservation

Phylogeny and phylogeography of the Roughtail Rock Agama *Stellagama stellio*

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The Roughtail Rock Agama, *Stellagama stellio* (L., 1758), is distributed in the east Mediterranean and Near East regions. The morphological variation of the species throughout its range has led to the description of seven subspecies: *S. s. stellio* (Greece, Turkey, Syria, Lebanon, Israel, Jordan), *S. s. daani* (Greece and Turkey), *S. s. cypriaca* (Cyprus), *S. s. vulgaris* (Egypt, Sinai), *S. s. brachydactyla* (Jordan, Saudi Arabia, Sinai, Israel), *S. s. picea* (Jordan, Syria, Saudi Arabia) and *S. s. salehi* (Sinai, Israel). Despite extensive research on the morphology-based taxonomy of the species, the validity of the subspecies and the relationships among them have not yet been sufficiently resolved. A preliminary attempt to explore the phylogeography of the *S. stellio* complex using molecular markers showed the taxon to be a well supported monophyletic clade that diverged during the Messinian leading to six major subclades. Five of these generally correspond to the morphologically recognized subspecies, while two of the subclades do not fit to any currently named taxon. Here, we expanded the analysis including more than 150 representatives from almost the whole range of the species' distribution. Five partial sequences of two mitochondrial (ND4, 16S) and three nuclear (NKTR, CMOS, MC1R) genes were targeted and phylogenetic (Maximum Likelihood and Bayesian Inference) and phylogeographic (BEAST) approaches were implemented. Taxonomic implications regarding the status of the various subspecies and the distribution of the phylogenetic lineages in view of the known palaeogeography of the region are discussed.

Keywords: Agamidae, *Laudakia*, Bayesian Inference, Maximum Likelihood, East Mediterranean, Near East

Arboreal adaptations in Eurasian Harvest Mice *Micromys minutus*

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Mammalian arboreality dates back to the early diversification of major extant clades and, currently, arboreal habits are encountered in many metatherian and eutherian orders. This diversity indicates significant fitness benefits related to food acquisition, competition, predation, and ultimately longevity, as a result of the successful exploitation of the arboreal habitat. This is achieved by specific morphobehavioral adaptations that facilitate stability and movement along and across arboreal substrates. Eurasian harvest mice represent one of the smallest extant arboreal mammals and present an interesting model for examining arboreal behavioral adaptations at a small body size. For these purposes we filmed, at 240 fps, the locomotor behavior of six adult male *M. minutus*, on four substrate sizes (2 mm, 5 mm, 10 mm and 25 mm), and three movement directions (45° descent, horizontal, 45° ascent) at the Nowe Zoo, Poznań, Poland. Our analyses of gait parameters showed that *M. minutus* is capable of efficient progression upon the finest of arboreal substrates. Thus, Eurasian harvest mice tended to be more diagonal in gait (moving contralateral feet in tandem), moved their feet at lower frequencies and assured firm grasps on the substrates, walked relatively slowly, and covered shorter distances when substrate diameter decreased. These behaviors suggest similarities with other larger arboreal mammals and indicate that behavioral constraints imposed by the architecture of the arboreal habitat may be universal. Accordingly, this implies that arboreal behavioral patterns may be related to early mammalian evolutionary processes that have assured their success in forested habitats.

Keywords: arboreality, Eurasian harvest mouse, gait, locomotion, *Micromys minutus*, Rodentia

Aspects of breeding performance of Scopoli's Shearwater colony on Stamfani Island (Strofades island group, Ionian Sea) during the period 2008-2012

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This study describes the chronology of main events in the breeding cycle of Scopoli's Shearwater (*Calonectris diomedea*) colony on Stamfani Island, including the evaluation of breeding performance and the influence of ecological factors (e.g. experience of breeders and nest site characteristics) on breeding success. The colony of Stamfani Island revealed a high degree of breeding synchrony and nest site tenacity of Scopoli's Shearwater. The data obtained by monitoring 516 nests during five consecutive years (2008-2012), showed a breeding success up to 0.65 ± 0.12 fledging per nest per year. In addition, hatching success (chick hatched successfully per egg laid) was 75.62 ± 7.98 % and fledging success (fledging young per chick hatched successfully) was found 86.22 ± 8.59 %. These results seemed to be influenced positively as the breeding experience of the pair is increasing. Furthermore, no correlation was revealed between the rate of breeding success and the type of nest site as well as the orientation and the dimensions of the main entrance of each nest.

Keywords: *Calonectris diomedea*, Procellariiformes, Strofades Islands, breeding performance, National Marine Park of Zakynthos

Conservation of the declining Griffon Vulture *Gyps fulvus* population in Cyprus through reinforcement with individuals from Crete

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The reinforcement of the declining Cypriot Griffon vulture population with individuals from the large Cretan population, materialized through project GYPAS (Sep 2011-Jan 2014), a 'Cross Border Cooperation Program Greece-Cyprus 2007- 2013', co-funded by the European Regional Development Fund and national funds of Greece and Cyprus. It was led by the Game & Fauna Service in Cyprus, and partners were BirdLife Cyprus and the Department of Forests in Cyprus, and the Natural History Museum of Crete and Gortyna Municipality in Crete. During the implementation of the project, 25 Griffon Vultures (from a rehabilitation centre) were sent to Cyprus. After a year's stay in acclimatization cages built next to feeding stations, birds were released in the wild, together with two chicks born in Limassol zoo. All birds were marked with metal rings, and plastic PVC rings and wing tags, with identical codes. In addition 15 birds were fitted with backpack GPS / GSM loggers and 1 VHF transmitter. An important monitoring tool was the use of wildlife cameras at feeding stations so to resight the marked (and unmarked resident Cypriot birds) and to monitor survival of the released birds. All but two of the released birds have been photographed.

This is the first conservation effort of its kind in Cyprus, and preliminary results are very positive. Ultimately, the goal is to release a large enough number of birds so to re-establish a viable population, given that the limiting factors responsible for its decline cease to be important.

Spatial and temporal variation of *Branchiostoma lanceolatum* larvae (Cephalochordata) in a hypoxic bay

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A 12month zooplankton survey (September 2008 to August 2009) in the hypoxic, stratified and seasonally eutrophic Amvrakikos Gulf (western Greece) revealed the presence of larvae of the cephalochordate *Branchiostoma lanceolatum*. The larvae were found in almost all sampling occasions, except September and February, and presented their peak of abundance in April (426.8 ind m⁻³). The oxygen depletion in the deeper depth layers affected their vertical and horizontal distribution. Thus, their abundance was greater in the subsurface layers (10-15 m and 15-20 m) which accounts for the well oxygenated thermocline layer. An east to west increase of the abundance in the deeper layers was associated with the severity of oxygen depletion. The lower oxygen limit for their presence seems to have been 2 mg l⁻¹ which account for hypoxia. A size-specific depth distribution was noticed, with larger larvae residing in deeper strata. A diel vertical migration of the larvae in the summer was noticed, with a day ascent in shallower depths and a night descent in deeper strata. There was strong correlation in space and time between the larvae and *Ceratium* sp., indicating probably a trophic relation, although other phytoplanktonic taxa may also play a significant role to the survival of the larvae in this particular ecosystem. The results suggest that, during their planktonic state, the *B. lanceolatum* larvae utilize the water stratification within the Amvrakikos Gulf by inhabiting the depths within or close to the thermocline, where they can satisfy their oxygen and energy demands while being protected from predation.

Molecular and morphological evidence for two well supported *Nalassus* (Coleoptera, Tenebrionidae) lineages from Turkey

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The genus *Nalassus* Mulsant, 1854 is represented in Turkey 9 cold adapted subalpine species belonging to *Helopecerodes*, *Helopondrus* and nominative subgenera. With the aim of providing new insights on *Nalassus* phylogeny, extensively sampled specimens from Turkey and including Caucasia were studied using molecular and morphological characters.

Phylogenetic relationships were inferred using mitochondrial *cox1* and nuclear *Mp20* loci. Parsimony and Bayesian analyses resolved two well supported *Nalassus* lineages consistent with SEM analyses. In addition to formerly recorded species, four new clades which have specific morphological characters and geographic distributions were also obtained.

Keywords: *Nalassus*, Helopinae, Tenebrionidae, Phylogeny, Molecular Systematics, *cox1*, *Mp20*

Phylogeography of the *Mediodactylus kotschy* (Reptilia: Gekkonidae) in the Eastern Mediterranean region using ddRAD-tag genomic data

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Mediodactylus kotschy is a small gecko widely distributed on the islands of the Aegean archipelago and the adjacent Balkan and Anatolian mainland. The species' distribution range extends from southern Italy and across Greece to the Aegean islands, Cyprus, Turkey, Syria, Israel, Lebanon, Albania, FYROM, Bulgaria and Crimea. Due to the great variation that *M. kotschy* exhibits a large number of subspecies have been described, 17 of which are reported from Greece. The only available genetic data for this species is based on a single mtDNA marker and resulted in a partially resolved phylogenetic tree. According to this, several highly distinct genetic lineages were recognized, however with no correspondence to the current taxonomy. In this study we used the ddRAD tag (double digest Restriction-site Associated DNA) method, aiming to investigate the phylogenetic relationships and phylogeography of *M. kotschy* in the eastern Mediterranean region. Our approach resulted in a completely resolved phylogenetic tree that allows us to discuss the phylogeographic history of the species and suggest possible biogeographic scenarios. It was also confirmed that the morphologically described subspecies are not congruent with the obtained molecular phylogeny, underlying the need for a taxonomic revision (or re-evaluation).

Keywords: Aegean, Bayesian Inference, Maximum Likelihood, Next Generation Sequencing (NGS), Taxonomy

Population dynamics of the barnacle *Chthamalus stellatus* from Pagasitikos Gulf

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The sessile barnacle *Chthamalus stellatus* follows distinctive distributional patterns on European intertidal zone. Barnacle stocks were monitored on June 2014 to June 2015, based on monthly or semimonthly basis, in two locations NW and NE at the Gulf of Pagasitikos (Plakes and Agios Stefanos). Samplings were performed at two stations, in each location, along two transects. The transects were randomly selected in each station and two levels were chosen on the intertidal zone in order to estimate the abundance and the spatial dispersion of *C. stellatus*. At least 80 individuals were scrapped off the hard substrate by the randomly placed frames technique (10 × 10 cm). Temperature and salinity were measured in situ using a salinometer. Overall, 2511 individuals were collected and the basal length (BL), basal width (BW), operculum length (OL), operculum width (OW), height (H) and weight (W) were estimated for each individual. Size – frequency distribution analysis was unimodal and the most of individuals were located at the cluster of 7 mm. The highest basal length (BL) was recorded in November for station Plakes (13.31 mm) and in May for station Ag. Stefanos (14.3 mm). The mean population density of *C. stellatus* was recorded at station Plakes 47.37 % and at station Ag. Stefanos 31.72 %. All the measurements showed statistically significant differences among the month. All the examined morphometric relationships followed negative allometry. It was observed that the basal length (BL) constitutes the decisive factor for a predictive morphometric model.

Dogs contributing to wildlife conservation: First anti-poison dog units in the Balkans

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Owing to their remarkable olfactory system, dogs are used to locate a range of scents. Specially trained dogs may significantly reduce the amount of time spent searching for a given target. Thus, scent-detection working dogs are successfully being employed in the conservation efforts of many endangered species worldwide. Poison baits are considered a critical threat to vultures in Europe, including globally endangered Egyptian vulture, and have resulted in rapid population declines and contraction of distribution ranges across the continent. In 2014, two anti-poison dog units were created in Greece³ aiming to carry out patrols in the countryside targeting, among others, the timely detection of poison baits and animals to prevent further poisonings. Priority was given to patrols in areas where new incidents had been notified by authorities and citizens, but were also conducted in areas regularly used by Egyptian vultures where poison events had been recorded in the recent past. Poison incidents were confirmed in 31 of 129 patrols, resulting in 49 dead animals and 36 poison baits. The most commonly poisoned species was the dog followed by the fox. The main drivers for the use of poison baits were: predator extermination, stray dog population control and human conflicts. Toxicological analysis revealed three pesticide's active substances: Endosulfan, Carbofuran (both banned in Greece) and Methomyl. The anti-poison dog units proved to be an innovative and effective preventive action that also proves the extent of illegal use of poison baits. Many scavengers, including Egyptian vultures, were potentially saved from a certain death.

This action is carried out in the frame of the LIFE+ project for the conservation of the Egyptian vulture in Bulgaria and Greece under the title "Return of the *Neophron*" which was launched in October 2011. It is a joint initiative of the BSPB – BirdLife Bulgaria, HOS – BirdLife Greece, WWF Greece and the Royal Society for the Protection of Birds. The project is carried out in key Natura 2000 sites in Bulgaria and Greece until the end of 2016. Its overall objective is to prevent the extinction of the Egyptian vulture in both countries, by identifying and acting on the causes of breeding failure and low survival rates.

Keywords: Working dogs, poison baits, Egyptian vulture.

Thermal biology of the colour polymorphic bush cricket *Isophya riseensis*: testing the thermal melanism hypothesis

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In this study, thermal biology of *Isophya riseensis*, a colour polymorphic bush cricket species endemic to North-eastern Turkey was investigated for the role of melanism in thermoregulation. The degree of melanism decreases with altitude in *I. riseensis*, in contradiction with the thermal melanism hypothesis. Because of this pattern and its endemic state *I. riseensis* is an exceptional model organism for testing thermal melanism. To investigate the relation between thermoregulation and colour polymorphism, first we measured body temperatures in the field. Additionally, the heating rates of different colour morphs were compared in laboratory. The samplings were done in June, July and August of 2012. Temperature excess (T_{ex}) values that measured in the field did not differ between different colour morphs. Moreover, controlled heating experiments with 3 different degrees of artificial radiation (50 w/m², 150 w/m², 300 w/m²) levels showed that there is not any significant relation between the degree of melanism and heating rates. These results indicate that thermal adaptation does not have significant role in the formation of colour polymorphism in *Isophya riseensis*.

Keywords: *Isophya riseensis*, thermal melanism, colour polymorphism, thermoregulation.

Wetland suitability and connectivity for trans-Saharan migratory waterbirds

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To complete their life cycle waterbirds rely on scattered and often ephemeral wetlands along their migration route. However, further degradation of remaining wetlands habitats might lead to a configuration and size of stopovers that is no longer sufficient to ensure long-term survival of waterbird populations. By identifying optimal conservation targets to maintain overall habitat availability *en route*, we can accommodate an as yet absent functional connectivity component in management frameworks for migratory waterbirds, such as the Ramsar Convention and the EU Natura2000 Network.

Using a directional graph-based habitat availability metric (Equivalent Connected Area) we determined the functional connectivity of wetland networks for seven migratory waterbirds with divergent habitat requirements. Analyses were performed at two spatial scales, both spanning the Mediterranean Sea and centered around Greece. We quantitatively determined the overall connectivity of species-specific habitat networks and identified wetland sites that are crucial for maintaining well-connected networks. Based on expert estimates of Flight Initiation Distances, we accounted for human disturbance by species-specific disturbance buffers.

We showed that networks for both spatial extents were relatively well-connected and identified several wetland sites in Greece and Libya as important for upholding connectivity. The application of disturbance buffers resulted in an overall decrease of the network's connectivity. Additionally, a combined network can be developed for a limited set of species accounting for their autoecological requirements. Migratory waterbirds could benefit from targeted management in few specific wetland complexes. Deterioration of these sites in Greece and Libya will have disproportionate consequences to the waterbird populations they support.

LifeWatch Greece data-services: On supporting metadata and semantics integration for the biodiversity domain

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One of the main characteristics of biodiversity data is its cross-disciplinary character and the extremely broad range of data types, structures, and semantic concepts which encompasses. Even if we focus on the data of a specific area (i.e. Greece), they remain widely distributed and unconnected. For this purpose in the framework of LifeWatch Greece we designed and implemented a set of data services that aim to: i) support cataloguing and publishing all the relevant meta-data information of the Greek biodiversity domain, ii) integrate data from heterogeneous sources by supporting the definitions of appropriate models, iii) efficiently discover biodiversity data of interest and enable the answering of complex queries that could not be answered from the individual sources. The aforementioned services allow the providers to express their metadata in a schema agnostic way; the provider is able to submit metadata according to their local format (e.g. Darwin Core) and these are automatically transformed with respect to the underlying centralized schemata of the infrastructure for gaining the advantages that semantic models offer. Particular focus was given on the architecture and the contents of the infrastructure for being able to serve clients, even if some of its parts are temporarily inaccessible.

Keywords: Data integration, Biodiversity Metadata, Data discovery

Rostral irregularity of *Penaeus (Farfantepenaeus) aztecus* in Greek waters

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The northern brown shrimp *Penaeus (Farfantepenaeus) aztecus* Ives, 1891, is an estuarine and oceanic littoral decapod naturally distributed along the western Atlantic. It has been reported in the Mediterranean Sea since 2010 and in 2013 in Thermaikos Gulf (N. Aegean Sea), where few individuals appeared in the shrimps' catches. This year, it represents 16% and 20% of the total abundance and biomass of the shrimps' catch respectively. According to literature, *P. aztecus* rostrum is armed with two ventral and five to eleven (usually 8-10) dorsal teeth. From the daily commercial catches (6th to 9th July 2015) of *P. aztecus* collected in Methoni area, individuals with unusual teeth number in both not damaged rostral sides were recorded. Apart from the usual two rostral ventral teeth, individuals with zero (2.3%), one (1.2%) and three (0.6%) ventral teeth were recorded. Individuals having one or three ventral teeth, had only nine (100 %) dorsal teeth while other specimens having no ventral teeth, appeared three (25%), five (25%), six (25%) and eight (25%) dorsal teeth, equally. It seems that individuals with one and three ventral teeth appeared the same dorsal teeth with those having two ventral teeth while individuals with zero ventral teeth had fewer dorsal teeth (3-8). Rostral variability is commonly found in many shrimps, related to sex, sexual maturity and size. The number of teeth on the rostrum can vary widely, due to damage and incomplete regeneration. This latter characteristic could be considered as the most important reason for the rostral irregularity.

Keywords: Decapods, Mediterranean, Penaeidae, meristic characters.

Impact of a productivity gradient in an oligotrophic environment. A benthic scope

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The aim of this study was to assess the possible effects of nutrient enrichment of the water column on benthic macroinvertebrate communities. The study stations reflected the productivity gradient in a set of high, medium and low productivity areas throughout the Aegean Sea. The selection was based on surface chlorophyll derived from remote sensing data. Water column variables including chlorophyll-a (Chl-a) and Dissolved Oxygen (DO) were assessed *in situ* using a CTD profiler calibrated with samples taken by means of Niskin bottles, and benthic geochemical variables were determined in cores obtained by means of remote sampling. Samples for macrofaunal analysis were obtained from all sampling stations. Our results showed that despite the high Chl-a content in the water column, the DO at the benthic boundary layer was in all cases above standard hypoxia levels. On the other hand the change in productivity was reflected on sediment redox regime but the benthic diversity remained unaffected.

Keywords: macrofauna, benthos, productivity gradient impact, diversity, ecological status

Tail regeneration induces changes in the digestive efficiency of lizards

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Tail autotomy is a widespread tactic among lizards. The shed tail distracts the predator, permitting lizard's escape. Despite the obvious benefits, caudal autotomy entails energetic costs. Tail regeneration induces energy re-allocation to fuel tissue reconstruction and thus organism directs energy away from other functions, such as somatic growth. To provide the required energy lizards should adopt appropriate adjustments in a suite of physiological traits including digestion. Digestive efficiency is an important link between the gut physiology and the ecological aspects of energy budgeting. Apparent digestive efficiency (ADE) is defined as the ability to absorb energy through food and depends on gastrointestinal motility, enzymatic activity and gut passage time (GPT). In this study we induced tail autotomy in lizards belonging to four *Podarcis* species (*P. erhardii*, *P. milensis*, *P. gaigeae* and *P. muralis*) aiming at clarify the impact of tail regeneration on ADE. We presumed that tail regeneration, with the ensuing losses of caudal fat reserves, would induce shifts in ADE and GPT. ADEs of proteins, lipids and sugars were examined in lizards in two phases, pre- and post-autotomy. ADE_{proteins} and GPT increased significantly. On the contrary, ADE_{sugars} and ADE_{lipids} either remained stable or marginally reduced. We believe that the ADE_{proteins} rise should be attributed to the high demands for proteins for tissue-build up. Protein digestion is a time-consuming procedure and the higher GPT ensures the flawless amino acid absorbance from the digestive track.

Differences of soil fauna communities under four tree species

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The differences of soil fauna communities were studied under four tree species in the campus of TEI Crete, at the western end of Herakleion city during a period lasting ten weeks (16 April 2015 to 25 June 2015). The tree species were olive tree, carob tree, pine and eucalyptus.

For this study were used sixteen pitfall traps, with propylene glycol as liquid. Under the small grove of each plant species placed four pitfall traps. The collection of specimens and the replacement of the liquid were conducted weekly. The soil fauna was studied at different level of taxonomy, according the accessibility to identification, the abundance etc. The total number of captured taxa was 60. The total number of captured animals was higher than 12,500. This work is mainly focused on 14 taxa, the most plentiful, as they had concentrated more than 11,500 specimens. The four clusters of captures were compared via ANOVA and post hoc tests. The biodiversity was measured by using Shannon index.

With two exceptions, Formicidae and Araneae, the other twelve taxa {the infraclass Acari, the orders Diplopoda, Isopoda, Opiliones, Diptera, Hymenoptera (excluding Formicidae), the suborders Homoptera (according the old classification) Poduromorpha and Entomobryomorpha (both of Collembola) and the families Helicidae (Gastropoda), Anobiidae, Melyridae (both of Coleoptera)} presented statistically significant differences between the four groves of sampling. Two of the clearest preferences were the connection of Diplopoda with pines, as also of Isopoda with carob trees.

Keywords: soil fauna, biodiversity, pit fall traps

Using bacterial community data to test ecological hypotheses with the R virtual laboratory (RvLab)

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Over the last years, and since new technologies came to the fore, scientists have been trying to test whether well known ecological hypotheses, that have been established for macroorganisms, can also be applied to microorganisms. Such an example is the concept of biogeography, a longstanding debate in the field of microbial ecology.

One quite challenging concept that could also be tested is the hierarchical-response-to-stress hypothesis (HRSH) which was established on the notion that at the increasing levels of stress, species disappear first, then genera and eventually higher taxa towards the azoic conditions, at the extreme pollution. Another interesting concept is the Taxonomic Sufficiency Concept (TSC); TSC advocates that, at least in marine communities, the macrobenthic composition patterns deriving from taxonomic levels higher than species can be similar, if not identical, to those deriving from the species level in severely disturbed conditions. In more detail, community patterns deriving from species composition are considered to be largely affected by natural environmental heterogeneity, whereas those deriving from higher phylogenetic/taxonomic categories may reflect gradients of contamination with a higher degree of certainty.

In order to test whether bacterial community patterns comply with the taxonomic sufficiency concept and the hierarchical-response-to-stress hypothesis, sequencing data from various habitats (ranging from pristine to contaminated) were downloaded from the MG-RAST Metagenomics Analysis Server and the subsequent analyses were performed at the RvLab, which has been developed within LifeWatchGreece Research Infrastructure (available at: <http://biocluster.her.hcmr.gr/Rvlab/>).

Keywords: RvLab, Hierarchical-response-to-stress hypothesis, Taxonomic Sufficiency Concept, Bacteria, Metagenomics

Associating Organisms With Their Environment: Automated Literature Mining and Interactive Metadata Extraction

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Biodiversity literature and data constitute a vast public resource open to mining and knowledge extraction. Associating organisms to key features of their life, for example the environment in which they live in, their feeding mode or their breeding habits, is cornerstone in explaining biodiversity patterns and informing ecological decisions. A biology expert may possess such pieces of knowledge for specific taxonomic groups and geographic areas. It is questionable, though, how that knowledge could be passed on to others and how it could be integrated with information on other locations/organism groups. The LifeWatchGreece Literature Mining virtual LAB aims to: (a) extract species - environment associations from global biodiversity knowledge/literature collections; (b) support the interactive annotation of specimen, genomics, and metagenomics records with standardized metadata describing the environmental context of a species. A modular approach is followed to implement such aims. It is based on the following literature mining and information extraction collaboratively-built components: 1) SPECIES (<http://species.hcmr.gr>) and ENVIRONMENTS (<http://environments.hcmr.gr>), two dictionary-based taggers supporting the identification of NCBI Taxonomy taxa mentions and Environment Ontology terms, respectively, in text; 2) the ENVIRONMENTS-EOL pipeline mining of the Encyclopedia of Life (<http://eol.org>) for organism - environment associations; 3) the EXTRACT (<https://extract.hcmr.gr>) interactive annotation tool that escorts researchers during web browsing and supports environmental metadata extraction from web-pages via a single click.

The main features, development approaches and key applications in the biodiversity/metagenomics areas will be presented.

Keywords: named entity recognition, biodiversity literature, interactive curation, environment ontology, ncbi taxonomy, metadata annotation

Stopover ecology and time allocation of the Woodchat Shrike (*Lanius senator*) in Antikythira, Greece

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Every spring a huge numbers of Woodchat Shrikes have to cross the Sahara desert and the Mediterranean Sea heading to their breeding grounds. Stopover sites where birds rest, refuel, avoid predators, and find shelter from adverse weather, are of crucial importance for the outcome of their migration. The mechanisms of stopover habitat selection by migrating birds are still poorly understood, depending not only on landscape context and habitat patch characteristics, but on the particular energetic conditions and needs of individual birds. Moreover, such information is useful for the study and conservation of predator species, such as Eleonora's Falcon, that depend their diet on these migrating birds.

Therefore, we studied the habitat selection, home range and time allocation on the Woodchat Shrikes on the island of Antikithira, in Greece, during the spring migration season, after having crossed the Sahara barrier. To investigate micro-habitat selection, diurnal time budget and changes in time allocation within the spring migration season, telemetry methods (light weight radio transmitters), color ringing, and visual behavioural observations were used. These data were fed into a home range and habitat selection analysis. Furthermore, behavioural observations of random individuals were conducted in order to examine the birds' time budget during this stopover. We also examined the correlation of the behaviour with parameters like the weather conditions, the vegetation, the date or the time of the day. Motionless and foraging were the most presented behaviours recorded. Additionally, Shrikes showed a preference for high maquis plants. All results are discussed in detail, in conjunction with the species' ecology.

Exploring wetland biodiversity on Crete and Cyprus: Ground beetle (Coleoptera: Carabidae) communities at small coastal salines & mountain temporary ponds

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Wetlands are undoubtedly among the fastest degrading ecosystems not only in the Mediterranean, but also globally. Wetlands in the islands of the eastern Mediterranean are among the less known ecosystems, in terms of invertebrate diversity. Even, when attracting scientific attention, research efforts focus on avian communities. However, in order to elucidate aspects of invertebrate diversity, we focused on terrestrial arthropod diversity. We studied small wetland areas, both coastal salines and mountain temporary ponds, in Crete and Cyprus. We sampled 8 sites, 7 on Crete (5 coastal salines + 2 mountain temporary ponds) and one saline in Cyprus, using pitfall trapping. Sites on Crete were scattered all over the island from east to west, and sampling was bimonthly from September 2014 till September 2015. An amount of 12,803 carabid individuals, belonging to 130 different taxa has been analysed so far, in terms of species richness, distribution patterns and assemblage composition. On Crete, 24 taxa were collected on the mountain wetland areas and 78 in coastal salines, while 15 were new records for the island, while in the Larnaka saline 35 taxa were recorded. In general, coastal wetland areas showed higher biodiversity values than the mountain ones, with exceptional high numbers in Almyros wetland (Crete, $H=3.643$) and Larnaka saline (Cyprus, $H=2.545$), with $H=1.296$ being the smallest one recorded in the Petres wetland. Only two endemic taxa with saline/wetland affinities were observed on Crete (*Bembidion minoum* & *B. subcostatum creticum*) and one in Cyprus saline of Larnaka (*Daptus acutus*).

Prey - predator interactions: can lizards identify snakes?

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Predation risk and escape from the predator are known to shape several morphological and behavioral traits in animals. The ability of understanding a dangerous and effective predator represents a key-component upon risk assessment. In this study we focused on the ability of a prey species (the Aegean wall lizard, *Podarcis erhardii*) to identify the effectiveness of given predator (different snake species). We used lizards from islands with minimal (Anafi) and high (Naxos) predation pressure and snakes that were venomous (nose-horned viper, *Vipera ammodytes* and the cat snake, *Telescopus fallax*) and non-venomous (leopard snake, *Zamenis situla*). Prey and predator individuals participated in a staged behavioral experiment that took place in a specially designed terrarium where animals had only visual contact. Lizard-snake interactions were taped and then analyzed to sketch out different ethograms. The main behavioral traits that were recorded were categorized as “tongue flick”, “digging” and “head tilt”. Statistical analyses of the observations showed that Naxos lizards are more alert compared to their Anafi peers and are also able to identify the venomous snakes and react more keenly to their presence. Furthermore, Naxos lizards developed distinct behavioral responses (tail waving and tail jerk) that reflect their previous exposure to the predators and the use of antipredatory tactics such as tail autotomy.

Molecular Phylogeny of the Balkan *Podarcis* (Sauria, Lacertidae) using ddRAD-tag genomic data

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Wall lizards of the genus *Podarcis* (Sauria, Lacertidae) are the predominant reptile group in southern Europe and currently comprise 23 recognized species. Mitochondrial DNA data have shown that the Balkan *Podarcis* species form a distinct group that is further sub-divided into two subgroups: the subgroup of *P. tauricus* with *P. tauricus*, *P. milensis*, *P. gaigeae*, and *P. melisellensis*, and the subgroup of *P. erhardii* with *P. erhardii*, *P. levendis*, *P. cretensis*, and *P. peloponnesiacus*. *Podarcis muralis*, which is also distributed in the Balkans, is not clustering with any of the above mentioned subgroups. In an attempt to explore the Balkan *Podarcis* taxonomy and to investigate the evolutionary history of the species, we employed phylogenetic approaches on ddRAD-tag (double digested Restriction site Associated DNA sequencing) genomic data. With this novel and efficient Next Generation Sequencing (NGS) genotyping approach we were able to obtain hundreds of thousands genomic loci randomly distributed throughout the genome. The revealed phylogenomic relationships support the monophyly of both aforementioned subgroups. However, the presence of several new distinct phylogenetic lineages within each subgroup renders taxonomical re-evaluation of the Balkan group indispensable. Thus, our data stress the need for a reconsideration of the systematics of the Balkan *Podarcis* and assist to overcome difficulties that classical taxonomy has encountered at the species level. The existence of multiple phylogenomic lineages within the Balkans sheds light on the evolutionary history of the group and allows the formulation of a more detailed phylogeographic scenario.

Keywords: Bayesian Inference, Maximum Likelihood, Phylogenomic analyses, Reduced representation NGS, Systematics, Wall lizards

Recent observations of *Montivipera xanthina* on the Dodecanese islands with comments on species regional IUCN Red List status in Europe

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The Dodecanese islands represent a group of 12 large and more than 150 smaller Greek islands in the Aegean Sea, of which only 16% are inhabited. The overall area of the Dodecanese covers 2714 km². Occurrence of *Montivipera xanthina*, the Ottoman viper (widely distributed in Turkey), is restricted in Greece to the northeastern mainland, and also some of the Eastern Aegean islands and the Dodecanese. Intensive transects were performed in September 2013, June and July 2015 on islands of Symi, Tilos, Kalymnos, Pserimos, Leros, Kos, Lipsi, Arki, Patmos, Ikaria and Samos. On average, 3 days were spent on every island. Vipers were predominantly searched for using localities previously reported in the literature and, when not available, experienced judgement was used to search new areas. Ottoman vipers were observed on Symi, Leros, Samos, Patmos and Lipsi, but not on the other islands. Preliminary comparison of localities with and without vipers pointed that microhabitats where vipers were found have more developed vegetation and higher humidity. This suggests that suitable habitats for the survival of the Ottoman viper on Greek islands are relatively scarce and the species may be in local decline regarding distribution and population size. According to the last regional IUCN Red List Assessment for Europe, *M. xanthina* was assigned as LC, as Turkey was geographically included in European region. New IUCN geographical division excludes Turkey from Europe, greatly restricting the distribution of the Ottoman viper in Europe, which suggests elevating its regional conservation status.

Keywords: Ottoman viper, Greece, distribution area, regional conservation status

Phylogenomics and the Comparative Method Reveals Evidence of Strong Selection in Reproductive Character Displacement

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When partially isolated allopatric populations meet in secondary contact natural selection can rapidly lead to speciation in order to reduce costly reproductive interferences. Climatic oscillations during the Quaternary have the potential to create such opportunities especially along mountain belts and this mechanism is thought to be especially important throughout Anatolian mountains. Divergence resulting from direct selection on reproductive isolation usually leaves a characteristic signature of phenotypic divergence called reproductive character displacement (RCD). However other forces apart from selection can also cause this pattern therefore care must be given in separating pattern from process. Here we show that even in the absence of direct experimental data the phylogenomics and the comparative method can be a useful tool in evaluating the evolutionary processes behind observed patterns of variation. Using this framework we look for evidence concerning the process of RCD in cricket species endemic to Anatolian mountains by evaluating both divergence patterns and the role of selection therein. We find positive results concerning RCD resulting from selective pressures acting directly to minimize reproductive interferences. Most notably we document relatively higher divergence rates in reproductive characters vs. non reproductive characters, strong selection towards multiple phenotypic optima and strong asymmetries in divergence between species. The patterns and processes outlined in this paper support a model of evolution consistent with divergence after secondary contact and carry important information for processes underling Anatolian diversity.

Keywords: RAD sequence, reinforcement, asymmetric character divergence, evolutionary rates, *Phonochorion*, Caucasus.

The issue of wildlife poisoning in East Crete and examination of local interest groups intention to engage in anti-poisoning actions

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The illegal use of poisoned baits against vermin is a harmful practice for the environment and biodiversity status. In addition, it can be a potential source of negative effects for public health. However, poisoned bait use is still a common practice in the Mediterranean region, where it primarily affects avian and mammalian scavengers which are most susceptible to secondary poisoning. In an effort to assess human-wildlife interactions and address wildlife poisoning, we conducted a survey of specific social groups (hunters, stockbreeders, environmental officers, veterinaries, local citizens) in the island of Crete (Greece) and investigated their intention to engage in anti-poisoning actions and non-lethal methods of predator control. Surveys results indicate that although barriers in effective biodiversity governance have created mistrust between local environmental authorities and local residents, the main rural groups related to illegal use of poisoned baits are willing to support alternative methods to address predation impacts. Therefore, in order for conservation objectives to be achieved more sustainably, ecological perspectives need to be addressed so that a social shift towards biodiversity protection becomes possible.

Keywords: environmental crime, biodiversity, conservation, environmental behavior

‘Be quick or be dead’: a study on the escape behavior of the lizard *Acanthodactylus schreiberi*

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The lizard *Acanthodactylus schreiberi* Boettger, 1878 (Lacertidae) is distributed in Cyprus (with the endemic subspecies *A. s. schreiberi*) and in coastal areas around Turkey, and is considered as Endangered A2c; B2ab(i,ii,iii,iv) by IUCN. Its generic name derives from the ancient Greek “ἄκανθα=thorn/spike” and “δάκτυλος=finger” meaning “spikes on the fingers”. These spikes are actual protruding scales, giving the lizard very good traction, mainly on sandy substrates. *A. schreiberi* is known to rely on its speed to capture prey and escape from predators.

In this work, we investigated whether certain morphological traits are associated with sprinting performance and if different sex and age groups (males, females, juveniles) vary in this performance. We recorded morphological characters from 35 individuals and on a custom racetrack we performed predation simulations, in order to record the escape behavior with the use of a digital camera (at 240fps). Afterwards, recordings were used to calculate the maximum velocity, acceleration and the distance traveled from the ‘predator’. In addition, to find if autotomy alters the escape behavior and performance, we performed post-autotomy trials of the same experiment. Before experiments, lizards were left for some time in a terrarium with a heat source, in order to obtain their preferred temperature.

Our first results showed that escape behavior differs significantly between adult males on one hand and juveniles and females on the other. These are the first such studies on *A. schreiberi*, so the upcoming results will provide novel information on the biology and ecology of the species.

Mitochondrial DNA Sequence Variation In Roe Deer (*Capreolus capreolus*) In Turkey

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The main aim of the present study was to investigate the position of roe deer (*Capreolus capreolus* Linnaeus, 1758) populations, which is one of the most important herbivore mammals of our country, in terms of phylogenetic situation and genetic diversity both in Turkey and in the world. In this scope, for the project of constituting National DNA and Cell Bank, DNA samples are obtained from muscle and blood samples of 20 roe deer individuals which are shot within hunting tourism or captured as fawn/injured/dead. 266 bases portion of mitochondrial cytochrome b gene of these DNAs are amplified with PCR method by using specific primers. The number of 4 haplotypes are acquired from these sequences. Haplotype diversity is founded as 0,6053 and nucleotide diversity is founded as 0,00265. It is observed that 3 haplotypes are mutated from a haplotype called HAP1 with one base change for each. cyt-b sequences that belong to Europe are taken from GenBank in order to compare the roe deer populations in Turkey and Europe. These haplotypes are aligned according to 266 bases. Among these haplotypes, the French haplotype overlaps with HAP1 completely. The most distant haplotype changes 11 bases. Neighbour Joining, Maximum Likelihood and Median Joining trees are formed with these haplotypes. When Turkey and Poland's populations are compared, it is seen that pairwise differences are not high and gene flow values are low

Keywords: Roe deer, mtDNA, cyt-b, genetic variation, Turkey, phylogeny

Factors influencing egg volume in geckos: a study case from the Cyclades Archipelago, Greece

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Insular species are thought to evolve slow life histories, decreasing clutch size and increasing egg sizes in order to adapt to low predation and high intraspecific competition pressures. We tested the influence of characteristics of 11 Cyclades Islands and one mainland site on egg and clutch volumes of Kotschy's gecko (*Mediodactylus kotschy*).

We predict that egg size increases with isolation and marine subsidies, and decreases in the presence of competitors and predators, with increasing island area, and with heavy parasite loads.

We tested these predictions on 150 eggs laid by 88 gravid *M. kotschy* females under the same controlled conditions at the University of Athens. Clutch and egg volumes increased with mother size and in the presence of the Turkish gecko (*Hemidactylus turcicus*). Interestingly, the presence of *Podarcis* lizard species had no significant effect on neither clutch nor egg volume. Mite (but not ticks) loads were negatively related to egg volume. Predator presence and marine subsidies were negatively correlated with egg volume and clutch volume correspondingly.

We suggest that *M. kotschy* in the Cyclades archipelago largely follows the island syndrome in relation to egg volume. The negative influence of marine subsidies, the positive influence of *H. turcicus*, the lack of influence by island area and isolation and the differential way predator species and parasite load affect each trait are surprising. We suggest that egg volume and clutch size should be viewed as complementary traits and studied together in order to fully examine life histories.

Records of non indigenous marine species in Porto Marina (Egypt)

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The Mediterranean Sea, for non indigenous species (NIS), is not part of their original distribution area. This sea is the major region affected by the introduction of NIS from the Red Sea and the Indian Ocean through the Suez Canal, which is the major way of introduction. Therefore, countries located in the eastern part of the Mediterranean are the most affected.

Other access ways are rather related to human activities such as aquaculture, aquariology, ballast water and shipping. This latter activity is the main vector of introduction of NIS, particularly in commercial and touristic ports.

In the framework of MAPMED project, we investigate the occurrence of marine NIS in Porto Marina lagoon located within Marina El Alamein Tourist Resort at about 100 Km West Alexandria. Nine sites were randomly selected inside this lagoon and surveyed for the presence of any marine NIS during December 2013. Several methods were used (scuba diving, snorkeling, visual observation and traps) at depths between 0 and 8 m. Other data were obtained through fishermen operating in the area.

A total of fifteen marine NIS were currently identified using WoRMS Taxon List. These include 5 Mollusca: 1 Polyplacophora, 1 Gastropoda and 3 Bivalvia; 3 Crustacea: 1 Stomatopoda and 2 Decapoda; 1 Ascidiacean and 6 Pisces Actinopterygii belonging to 3 orders Perciformes, Clupeiformes and Bercyformes with 4, 1 and 1 species, respectively. *Thalamita poissonii* and *Symplegma brakenhielmi* were reported for the first time along the Mediterranean coasts of Egypt.

Diet composition of the Eurasian Black Vulture (*Aegypius monachus*) in Thrace, NE Greece

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We studied the diet of the Black Vulture in the National Park of Dadia-Lefkimi-Soufli Forest in relation to the long operation of a “vulture restaurant”, a management tool contributing to the conservation of necrophagous birds but affecting their behavioral parameters. We analyzed pellets and food remains collected from nesting trees to estimate the contribution of food supplied at the “restaurant”, on diet composition and assess conservation implications. During 2006-2014, 245 food remains and 373 pellets were collected from 63 nesting trees. Domestic pigs and sheep/goats made up 35% and 30.5% of food items respectively, estimated as frequency of occurrence. Domestic pigs’ carcasses/offal was the main food supplied at the “restaurant”, in contrast to sheep/goats which were rarely supplied (82.3% vs. 5.5% of average annual weight). These results corroborate the findings by transmitter-marked birds that Black Vultures not only exploit the food resources of the “restaurant”, but they also search for food in a broader area in Thrace. Tortoises were represented by 14.9% of food items (frequency of occurrence), a finding that might be related with kleptoparasitism or other foraging behavior. Wild ungulates were clearly under-represented in food items compared to their abundance in the region. The supplementary feeding program seems to have not significantly affected the species’ foraging behavior. Continuation of the supplementary feeding program is highly recommended as a crucial management measure for the species. Tortoise populations should be enhanced through suitable habitat management measures. Minor changes in hunters’ practices could increase availability of wild ungulates remains in nature.

Keywords: pellet analysis, “vulture restaurant”, supplementary feeding, tortoise, Dadia

Genetic and Morphological Analyses of Tub Gurnard *Chelidonichthys lucerna* Populations in Turkish Marine Waters

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In this study, genetic and morphological structure of tub gurnard *Chelidonichthys lucerna* populations in Turkish marine waters was investigated with mtDNA DNA sequencing of 16S rRNA gene and morphological characters. *C. lucerna* samples were collected from the Black Sea, Marmara Sea, Aegean and eastern Mediterranean Sea coasts of Turkey. The lowest genetic diversity (0.0005) was found in the eastern Mediterranean (Iskenderun Bay) population, while the highest genetic diversity (0.0021) was found in the Marmara population with average value of genetic diversity (0.0016) within populations. A total of 14 haplotypes was obtained from 125 individuals, and mean haplotype diversity was 0.7558. The Black Sea and Marmara populations showed the least genetic divergence (0.0012), while the highest level of genetic divergence (0.0021) was found both between the Aegean and eastern Mediterranean (Antalya Bay) populations and between eastern Mediterranean (Iskenderun Bay) and Aegean Sea populations. Neighbor joining tree analyses clustered eastern Mediterranean populations (Antalya Bay and Iskenderun Bay) close to each other. Whereas, the Aegean Sea population was found to be far away from the other populations. Discriminant function analysis of morphological characters showed that only Black Sea population is completely different from the other populations which were overlapped together in the discriminant space.

Keywords: Tub gurnard, *Chelidonichthys lucerna*, population genetics, mtDNA sequencing, morphology, Turkish marine waters

A preliminary morphology based review of the genus *Pheidole* (Hymenoptera: Formicidae) in Greece

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Pheidole Westwood, 1839 is a hyperdiverse and the most species rich genus of ants in the world. It first evolved in the New World but its distribution has been extended globally ever since. Three species have been recorded in Greece so far: *Pheidole megacephala* (Fabricius, 1793), *Pheidole pallidula* (Nylander, 1849) and *Pheidole teneriffana* Forel, 1893. *P. megacephala* is one of the most successful invasive species in the world and is considered an agricultural pest. Being native to Africa, it has today a worldwide distribution. Although the species has been recorded in the Mediterranean region, it is uncertain whether it is actually present in Greece as many of its records have been reported as misidentifications of *P. pallidula*. In this study we examined all available specimens of the genus from the myrmecological collection in the Zoological Museum of the University of Athens. Using various morphological characters – both published in the literature as well as novel morphological indexes – we regrouped the specimens in order to establish the distribution of the genus in Greece and to determine the presence of the species in the country. Results show that the invasive *P. megacephala*, although present in Greece, is confined to absolute urban environments. Interspecific competition from the well-established *P. pallidula* may be a possible reason for its ineffective dispersion.

Can wind farm collision mortality of an endangered vulture (*Aegypius monachus*) be predicted using the wind farm-colony distance?

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Harnessing wind energy is often considered as an environmentally friendly strategy able to combat climate change on one hand, but even small-scale wind farms threaten on the other hand the persistence of local raptor populations prone to collision with turbine blades. This paper attempts to explore the interrelation between predicted wind farm collision mortality and distance to the centroid of the colony (hereafter colony) of an endangered vulture aiming to facilitate wind farms sensitive siting. To do so, we used telemetry data for an endangered vulture in Thrace NE Greece (7 tagged birds), in order to predict vulture collision mortality stemming from 13 operating wind farms, by combining species spatial distribution modelling with a collision risk model. The minimum predicted annual collision mortality (0.002 deaths) was found in a wind farm 42 km far from the colony while the maximum (2.118 deaths) was found in a wind farm 20 km, under collisions risk model's avoidance rate of 98%. The average (SD) predicted collision mortality/turbine/year (Cty) for the thirteen operating wind farms was 0.08 deaths (0.09). The interrelation between the Cty and distance (D) to the colony was best described by an exponential equation ($Cty = 5.0268e^{-0.0002D}$) with $R^2 = 0.73$. The variation explained by the model was not due to chance ($p < 0.001$) [$F(1, 11) = 30.35$, $p = 0.00018$]. We suggested that, when there is lack of data, this equation can be used in combination with other tools for the evaluation of alternative wind farm proposal during the Environmental Impact Assessment process.

Keywords: spatial modeling, collision risk model, sensitive siting, telemetry, mortality/turbine/year, avoidance rate

Estimates of the spring migration flow of passerines in the Strofades Island Complex, Ionian Sea (west Greece)

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In the present study we made an effort to assess the spring flow of passerine migrants during May 2014 and 2015 in the Strofades island complex; a group of two remote islets (22m a.s.l.) in the Ionian Sea (west Greece) covering 4 km². The avifauna community was studied through mist netting and direct observations, while density estimates were generated by applying distance sampling methods at the open and wooded areas of the largest islet. Out of 33 species recorded, 28 were passerines and their mean density was calculated at 12.8 individuals/ ha (range= 10.3-16.2) in 13 transect lines (12.5 km) followed on cultivation and shrubland and 61.2 individuals/ ha (range= 37.5-99.8) in 12 (10 min) point counts conducted on Juniper forests. Taking into account the phenology of spring migration in Greece and the average stopover period for migrating passerines, and by assuming that bird counts on the islets correspond to a snapshot sample of the migration flow, the Strofades island complex constitute a significant stopover site for 294,000-440,000 passerines (min= 125,000-187,000, max= 577,000-860,000). In addition, the area proved to be a migration bottleneck for Turtle doves (*Streptopelia turtur*) as distance sampling produced an estimate of 13,000-20,000 migrating individuals that refuel on the islets during spring migration (min= 6,700-10,000, max= 26,000-39,000). Future research should include fieldwork during the entire migration period, proper census of species that are not counted by distance sampling (e.g. hirundinidae) and radio-tracking of the commonest migrants so to properly evaluate the refueling period.

Keywords: stopover site, distance sampling, Turtle dove

The Zoogeography Of Buthid Scorpions (Buthidae, Scorpiones) in Turkey

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The present study summarizes the informations in zoogeography belong to the scorpions in family Buthidae in Turkey. Because of the geographic position of Turkey, it acted as a bridge and transitional area between Asia and Europe. As a result, Turkey has different faunal elements. Also, some barriers are caused formation of the different zoogeographical regions. To understand the scorpion fauna of Turkey, the geographic and paleogeographic barriers and zoogeographic regions are important. The specimens were collected from under the stones in daytime and using UV lamp at night from all regions of Turkey. The literature records were also used. Among the known Buthid species in Turkey, *Androctonus crassicauda*, *Buthacus macrocentrus*, *Compsobuthus matthiesseni*, *Hottentotta saulcyi*, *Leiurus abdullahbayrami*, *Mesobuthus phillipsii* are distributed in Southeastern Anatolia. *Leiurus abdullahbayrami* is subendemic in Anatolia and the other species originate from Iran and Middle East. *C. schmiedeknehti* and *M. nigrocinctus* are distributed in the Eastern Mediterranean region and originate from Levant. *M. eupeus*, *M. caucasicus* and *Orthochirus zagrosensis* are distributed in Eastern Anatolia. *O. zagrosensis* and *M. eupeus* originate from Iran and *M. caucasicus* originate from Central Asia. *M. gibbosus* is distributed in Aegean and Mediterranean regions of Turkey. Although *M. gibbosus* is distributed in Balkan Peninsula, it originate from Anatolia. The present study is important to evaluate the distribution and endemism of the Buthid scorpions of Turkey.

POSTER PRESENTATIONS

Indicator Species Analysis (ISA) unveils remarkable ubiquitous and specialist centipedes (Myriapoda, Chilopoda) along the bioclimatic gradient in Tunisia

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The Mediterranean region is considered as one of the hotspots for biodiversity, with a rich fauna displaying interestingly complex biogeographical patterns. In the present work, we shed light on the distribution patterns of the centipede fauna (Arthropoda, Myriapoda, Chilopoda) in a relatively well-explored geographical region – Tunisia – along the bioclimatic gradient. Based on literature records and recent collecting data (*ca.* 200 collecting sites), a total number of 53 centipede species, belonging to 26 genera and 9 families are presently recorded for Tunisia. The species richness shows a great Northwest-South latitudinal decrease, going from the Mediterranean region dominated with the humid and subhumid bioclimatic zones to the Saharan area, the arid most sector of the country. The Indicator species analysis (ISA) is here used to identify individual species and cluster of species associated with specific bioclimatic zones and combination of bioclimatic zones. While it was hard to draw definite conclusions on species affinities, the (ISA) clearly indicated a remarkable ecological plasticity of some species e.g. *Pachymerium ferrugineum* (Geophilomorpha), *Lithobius castaneus* (Lithobiomorpha) and *Cormocephalus gervaisianus* (Scolopendromorpha), capable of dwelling in a wide range of bioclimatic zones, from humid to arid environments while others, seemingly less tolerant, are likely restricted either to the northern, more humid parts of the country, e.g. *Cryptops trisulcatus* (Scolopendromorpha), *Geophilus carpophagus*, *Gnathoribautia bonensis* (Geophilomorpha) or to the southern more arid and open habitats, e.g. *Polyporogaster tunetata* (Geophilomorpha), *Otostigmus spinicaudus*, *Scolopendra canidens* (Scolopendromorpha). The latter species collected southern Tataouine, represents the southernmost record for centipedes in Tunisia.

Three years of national pelican census in Greece

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A nationwide pelican census is carried out once a year in Greece since 2013 in collaboration with the Management Bodies of 12 wetlands and volunteers from two NGOs. The census covers the Dalmatian pelican (DP), a globally endangered species, and the great white pelican (GWP). Its aim is to estimate the number of pelicans (targeting at non-breeders and immatures) present in Greece during the breeding season. This information is expected to contribute to improved planning of conservation measures and management actions for pelicans. The census is implemented on a simultaneous survey in more than 40 wetlands on a pre-agreed date in spring. The maximum number of wetlands where DPs and GWPs were recorded was 24 and 11 respectively. The mean total number of DPs was 3866 and for GWPs it was 749. The majority of DPs occurred in the wetlands hosting the five breeding colonies. A significant number of pelicans of both species were recorded at several wetlands located in close proximity to breeding sites. The western DP population which forms a distinct meta-population accounted for 9-12% of the total number. Immature individuals accounted for an average of 15% of the total number of DPs. The number of DP non-breeders present in Greece during the breeding period ranges between 500 and 750 individuals. The current results provide new evidence on the extensive home range of both species during the breeding season and stress the need for an integrated approach regarding the protection and management of wetlands in Greece.

Diet of the Barn Owl (*Tyto alba*) in NE Peloponnese

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The diet of the Barn Owl (*Tyto alba*) was studied in Moustos wetland near Astros Arkadia in Eastern Peloponnese (Mt Parnon and Moustos Wetland Protected Area) through pellet analysis using material collected through the years 2012-2015. The analysis of owl pellets provides a non-lethal tool to record the micro-mammalian fauna of the broader Moustos Wetland, a NATURA 2000 area that has been also designated as “Strict Nature Reserve” by the Greek Law, where animal trapping and killing is strictly prohibited. The area is characterized mainly by the wetland’s hydrophilous vegetation, agroecosystems and garrique. In total, 1,461 prey items were recorded. By number mammals made up 97%, birds and insects 1% each of the total prey, while in terms of biomass the percentages were, respectively, 98, 2 and <1. The main prey species accumulatively for the four years were, in terms of biomass, *Mus macedonicus* (41%), *Apodemus sylvaticus* (30%), *Rattus rattus* (10%), *Crocidura suaveolens* (4%) and *Apodemus epimelas* (3%). Micro-mammals population fluctuations are considered for the observed annual abundance differences of the species’ consumed.

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Vulnerability of sea turtle nesting sites to climate change: Case study of Mediterranean loggerhead populations

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Calculating the ability of wildlife to adapt to climate change is fundamental for selecting which species and sites to protect. While female sea turtles come ashore to nest and climate conditions of nesting sites are of critical importance for species viability, climate change poses several threats, probably affecting the suitability of nesting areas. Here, we investigated the future climatic suitability of current sporadic and stable loggerhead (*Caretta caretta*) nesting sites (i.e. sites with < and >25 nests, respectively) throughout the Mediterranean basin, and identified areas expected to have favourable climatic conditions for nesting in the next 50 years. We examined shifts in nesting site distribution by modelling plausible range expansions based on climate suitability maps, future climate change models and movement patterns (termed forays) based on GPS-tracked females from Zakynthos (Greece, Mediterranean), to alternative nesting sites, during the breeding period, which they might test for favourable nesting conditions. The climatic suitability of the majority of current stable nesting sites considered of high conservation interest will decline by 2070, whereas that of the most of the current sporadic nesting sites will increase. Forays by females during breeding supported the observed shift in nest site suitability, and likely represent an adaptive strategy (i.e. prospective detection routes) to counter potential climatic alternation of the currently used sites. In conclusion, we suggest that the current conservation and research focus of existing nesting habitats (with stable and high density activity) should also incorporate future habitat needs to safeguard the sea turtle populations in the Mediterranean.

Keywords: ecological niche modelling, evolutionary stable strategy, bioclimate envelope, resilience, habitat quality, adaptation to climate change

The study is developed under the support of the project: "Protection and conservation of biodiversity of the National Marina Park of Zakynthos" under the 1st action of the 9th Priority Action "Protection of the Natural Environment and of the Biodiversity", of the operational Project "Environment and Sustainable Development" 2007-2013, with Contracting Authority the Management Body of the National Marine Park of Zakynthos, co-financed by European Regional Development Fund (ERDF) and national resources.

Maturity stages of gonads and stages of egg development description for the narwal shrimp *Plesionika narval* in the Dodecanese Islands, SE Aegean Sea

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Plesionika narval is a widespread species of the Pandalidae family. Shrimps were collected during six monthly experimental surveys carried out with shrimp traps in the Dodecanese area (southeastern Aegean Sea) from November 2014 to May 2015. Macroscopic examination of the first and second pairs of pleopods was used to determine the sex. Ovary maturity was macroscopically examined and four main developmental stages were defined according to their colour intensity and size; stage I: immature; II: early maturity and resting/recovery; III: late maturity and IV: full maturity. Egg-bearing females were photographed and eggs were classified into three stages of development; stage 1: eggs of recent spawning; 2: middle stage and 3: late stage. Images and descriptions of both maturity stages of gonads and stages of egg development are given in order to improve the macroscopic examination quality of the maturity data of *P. narval* for any further work. The present work was carried out in the framework of PLESIONIKA MANAGE project which is co-financed by the Greek Ministry of Rural Development and Food and the EU under the OPF 2007-2013.

Keywords: Pandalid shrimps, ovary stages, ovigerous female eggs, Eastern Mediterranean

Depicting suitable habitats for wintering Lesser White-fronted Goose (*Anser erythropus*) fennoscandian population in Greece

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Ecological niche modelling is an important tool helping the understanding of species distribution pattern in fragmented landscapes. During the LIFE program “Safeguarding the lesser white-fronted goose fennoscandian population in key wintering and staging sites within the European flyway”; effort was given to identify suitable habitats that the species wintering in Greece use for roosting and feeding. The geese arrive in Kerkini Lake, in North Greece in the beginnings of October and stay until the midst of December – early January (*Hadrinos et al, 1990, Panagiotopoulou et al., 2009*). From there they depart to Evros Delta where they stay until late February - mid March starting their migration towards the breeding grounds in northernmost parts of Nordic countries (*Aarvak et al. 2009*). It has been observed that after leaving Kerkini Lake and before arriving to Evros Delta the flock visits an unknown site in between.

We used the MaxEnt (Maximum entropy) model to predict the spatial distribution of suitable environmental conditions for LWfG through Northern Greece. The model correlates environmental conditions and locations of known species occurrence. For migrating LWfG we considered factors that influence their ability to obtain food or physiological functioning (e.g., temperature, percent slope) to determine suitable conditions for the species. The model was reclassified in two categories, based on a threshold value of 10 percentile training presence logistic threshold which revealed the suitable areas for the species occurrence. Model was evaluated by the AUC value and the proportional binomial test.

Keywords: Lesser-White fronted goose, habitat suitability, conservation, Maxent

The oniscid fauna of Cyprus and a preliminary phylogeographic analysis of *Armadillo officinalis* (Duméril, 1816)

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Cyprus is an isolated island that is considered to be a continental fragment or even a true oceanic island, since, according to many authors, it was not connected to mainland or may have been briefly connected with SW Anatolia and/or NW Near East during the Messinian Salinity Crisis, from ca. 5.6 to 5.3Ma. Either way, the fact remains that the fauna of Cyprus is a mixture of very old clades, dating back to several million years, and younger taxa that managed to disperse to the island in more recent times, many aided by humans. The terrestrial isopod fauna of Cyprus is insufficiently known, with 24 species previously reported from the island. Intensive collecting during the past few years by the authors revealed the actual occurrence of ca. 42 species, several of them new to science. Phylogeographic analyses of isopod lineages from Cyprus will provide insights concerning both the history of the islands' biota and the patterns of oniscid diversification and colonization of isolated regions. In this work we present preliminary results on the phylogeographic analysis of Cyprus' populations of the widespread Mediterranean species *Armadillo officinalis*, including also populations of the same or closely related taxa from adjacent mainland and Aegean islands. Within a phylogenetic framework we estimate the time of the clade's divergence, aiming to infer the period of *Armadillo officinalis* differentiation on Cyprus Island.

Keywords: molecular clock, genetic distance, geographic isolation

Oviposition of selected water mite (Hydrachnidia) species from Skadar Lake catchment

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The on water mites have concentrated mainly on their ecology, taxonomy and faunistics. The studies on the biology of particular species and their fecundity have been conducted much more seldom, and there are very few information concerning such matters from the Balkans. The present study attempts to partly fill the gap in the already existing knowledge. The female specimens were collected from Skadar Lake and it's catchment (Montenegro) in May and October 2014 year. Then they were placed in 40ml beakers untill eggs were laid and observed until the larvae were hatched. Female individuals representing 15 water mite species laid eggs. The numbers of egg-laying females representing a given species ranged from 1 to 124. An average number of eggs laid by a single female ranged from 1 to 60.5. The number of eggs laid in May were much higher than in October. The most egg-laying females (representing 9 species) were collected in springs, followed by Skadar Lake (7 species) and rivers (4 species). Only one species, *Hygrobates setosus*, was encountered in all types of investigated waters, two species were encountered in lake and springs (*Lebertia inaequalis*, *Piona disparilis*), and one (*Hygrobates fluviatilis*) species in springs and rivers. In general, the highest numbers of eggs were laid by females from rivers, followed by from springs and lake. An average embryological development time ranged from 9 days (*Hydrochoreutes krameri*) to 20 days (*Atractides fonticulus*, *Protzia eximia*), while the total incubation period ranged from 9 days to 30 days.

The Age Structure of *Anatololacerta danfordi* (Squamata, Lacertidae) (Günther, 1876) Population From Southern Anatolia/Turkey

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Anatololacerta danfordi is distributed in the mountains of southern Anatolia in Turkey and categorized as a Least Concern species in the IUCN Red List of Threatened Animals. Its breeding sites include rocky areas and stony parts of forests. This species can be observed at highest 2.100 m above sea level. Our aim is to determinate of the age structure and body size of a breeding population of *A. danfordi* from southern Anatolia. We used 22 male and 9 female specimens collected from Suluhan location in Kozan/Adana, Turkey at an altitude of 687 m. We measured the snouth-vent length (SVL) of individuals to obtain the body size of the population. The age was determined by skeletochronology performed counting lines of arrested growth (LAGs) of the phalanges. Ages ranged from 5 to 13 years (mean: 8.73 ± 2.12) for males and from 5 to 11 years (mean: 8.33 ± 1.80) for females. The mean SVL was 57.51 ± 6.21 mm in males and 56.20 ± 4.44 mm in females. The difference between the sexes in age and size wasn't statistically significant (Mann-Whitney U=90.000, p=0.691 for age and Mann-Whitney U=81.000, p=0.433 for SVL). The body size is strongly effected ($R=0.929$, p=0.000) by age. According to regression, $Body\ length = 34.370 + (2.642 \times age)$ ($R^2=0.864$, p=0.000).

Keywords: *Anatololacerta danfordi*, skeletochronology, age structure

Ant biogeography of Andros Island

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Andros is an island in the Greek Aegean archipelago and it is the northernmost island of the Cyclades complex. It is also, in close proximity to the Greek mainland (aprx. 50km). There is a variety of habitats in Andros, which are available to host plenty of ant species. However, little is known about the composition of Andros ant fauna. The aim of this study is to catalogue the species of Andros' myrmecofauna, discuss their spatial distribution on the island and their seasonal phenology. For this purpose, pitfall traps were set up on 18 stations, from April until November 2006. Ant species were collected, sorted, curated and identified using dichotomous identification keys and other description publications. The total number of ant species identified in Andros is 41, belonging to 15 genera and 3 subfamilies respectively. The most common species observed are *Pheidole pallidula* and *Messor ebeninus* followed by *Crematogaster sordidula* and *Camponotus lateralis*. The rarest species occurring on the island are *Cardiocondyla uljanini*, *Monomorium baal* and the invasive *Monomorium pharaonis*. Most ant species are active during early spring and late summer/early autumn. The phrygana habitats were the most taxonomically diverse ones, while the mixed phrygana-dune habitats were the ones with the fewer distinctive ant species.

Halting biodiversity loss in agro-ecosystems of central Greece: Creating a technical guide for targeted restructuring selected elements in the agricultural landscape, in order to produce agri-environmental schemes

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Biodiversity loss in intensified agro-ecosystems has been one of European Union's rural policy main aims. According to recent holistic approaches, the EU target "halt biodiversity loss" by 2010 was not finally met, at least in human induced agricultural landscapes. Although agri-environmental schemes are far more enhanced in the new CAP, still, according to recent scientific reviews the danger of not reaching the target of "halt biodiversity loss by 2020" is eminent once again. One main factor responsible for this possible new failure is a gap between European legislation, EU member's national regulations and the application of concrete in-situ measures in agro-ecosystems management.

In Greece, a first attempt is realized in order to bridge that gap through a post-doctoral research project in the Agriculture Economics & Policy Research Institute. The project is based in 3 main pillars. Firstly, in situ field work will assess avian and small mammal diversity indices in selected sites in the largest agro-ecosystem of Greece, the Thessaly plains, with standard international methodology. The diversity indices will be explored upon environmental gradients which define the major land uses in the agro-ecosystem (irrigation schemes, arable and non-arable crops, annual and multi-annual crops, set-aside fields and natural grasslands, different crop types such as cereals & industrial crops). Secondly, meta-analysis of all existing literature in the region concerning diversity indices will also be realized. Thirdly, modeling of the results in large spatial scale will take place.

The research project is not yet finalized but preliminary results indicate very low diversity indices in highly exploited agricultural areas of heavy arable and irrigation crops (e.g cotton crops). Landscape elements that support higher diversity indices are small-extension crops, road-edges high vegetation, complex mosaics of agricultural plots along with natural vegetation linear elements, and irrigation channels appear to play a major role in supporting biodiversity indices in Thessaly.

With the finalization of the project, a technical guide will be produced written in "simple language", which will aim to the main stakeholders of the area, the farmers who exploit the land. The technical guide will be a product of the Hellenic Agricultural Organization Demetra, and will try to bring the land stakeholders in a direct application of proper agro-environmental schemes through targeted, selected restructuring actions of the landscape.

Keywords: Biodiversity, agricultural ecosystems, technical guide, landscape structure

Preliminary results of the feeding behaviour of *Plesionika narval* (Crustacea, Decapoda, Pandalidae) in the S.E Aegean Sea (E. Mediterranean Sea)

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Plesionika narval (Fabricius, 1787) is of high ecological and commercial interest to fisheries in the S.E. Aegean Sea (E. Mediterranean Sea), however, no adequate information is available on its feeding habits from this area. The aim of this study was to describe the feeding behaviour of *P. narval* in the S.E. Aegean Sea (Dodecanese islands) based on information of sex, month and depth (shallow waters: 0-100, deep waters: 100-180 m).

The individuals were monthly collected with shrimp traps from four locations during the period November 2014 to March 2015 within the frame of Plesionika Manage (Operational Programme Fisheries 2007-2013) scientific project.

A total of 267 males and 708 females of *P. narval* were analysed. The diet composition (abundance, prey occurrence) and feeding activity (stomach content weight, vacuity and repletion index) of *P. narval* were examined.

Plesionika narval showed a high feeding preference on pelagic and benthic resources, considering as an active predator and an occasional scavenger. The major common preys are plant debris (27.65% of the total preys), crustaceans (20%), foraminifera (11.92%), polychaetes (2.85%), and molluscs (3%). No clear differentiation in the feeding behaviour between sexes was observed. Within females, significant differences in vacuity index were found between deep and shallow depths (t-test, $P < 0.05$). The maximum and minimum stomach fullness was recorded in November (5.33 ± 1.66) and March (2.36 ± 1.37) for males, respectively and in January (4.79 ± 0.71) and December (1.53 ± 0.88), respectively, for females. The highest percentage (F%) and (N%) for each type of prey in both sexes found in November.

Keywords: narwal shrimp, pandalids, diet, feeding activity, Dodecanese islands

Your face looks familiar: individual identification using facial markings and plumage patterns for the monitoring of the endangered Egyptian Vulture (*Neophron percnopterus*)

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Identification of individual birds in the field is necessary for various types of studies such as demographic and behavioral. Usual methods of individual identification rely on capture and marking or tagging of animals. However, such methods have limitations because capturing birds is time consuming, usually difficult and can also be costly and unsuccessful. Also, capturing a bird is an invasive method that can involve a degree of physical risk. We used phenotypic characteristics to identify individual birds in the remaining population of Egyptian Vultures in Greece. Every year from 2012 to 2015, facial markings and plumage patterns of birds were obtained from photographs of individuals or were drawn, as detailed as possible, on blank silhouettes of Egyptian Vulture when observation conditions were appropriate. Plumage patterns from photographs were analyzed using I3S contour software. The software uses a contour tracking algorithm and was initially designed for the individual recognition of whales. It was adapted to track the wing contours of birds and successfully identified all birds in the testing period. We were able to check for consistency in pairs, identify new birds in the population, track feeding movements of birds and detect changes in pairs. This method has great potential for future conservation studies as it can provide estimates on mortality and survival that can be used in population viability analyses as well as help to identify migration routes of Egyptian Vultures.

Keywords: non-invasive, phenotypic characteristics, field identification, Greece, plumage

The avifauna of Gyaros island, Greece

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The avifauna of Gyaros Island, 17.5 km², north Cyclades, Aegean, had been very poorly studied so far. Within the framework of the project LIFE12 NAT/GR/000688, CYCLADES LIFE "Integrated monk seal conservation in Northern Cyclades" four expeditions were carried out within 2014 to study the avifauna of the island. Aim of the study was to explore the composition, structure and distribution of the avifauna during the breeding and wintering periods. These data would be used to inform management proposals. So far, 30 species of birds have been recorded on the islands (Gyaros and its nearby islets Glaronisi and Fouis) while 17 almost certainly breed. The overall density of land birds in the breeding season was 28.4 inds km⁻² and in winter was 12.3 inds km⁻². The low species richness and low densities of birds are attributed partly to the low horizontal and vertical heterogeneity of vegetation (vastly dominated by the thorny burnet and thyme) and to the apparent overgrazing by feral goats, sheep and European rabbits. From the conservation point of view, the importance of Gyaros lies in the occurrence of one of the largest breeding colonies of the Mediterranean Shearwater (>1000p.), the breeding Mediterranean Shags (20p.), a large colony of Eleonora's Falcon (217p.) and several pairs of other raptors, such as Bonelli's Eagle (1p.), Long-legged Buzzard (1p.), Common Buzzard (3-4p.) and Kestrel (3-5p.). Potential threats for the avifauna of the island might include: Predation pressure by black rats and the planned establishment and operation of two wind parks.

Keywords: Aegean islands, Mediterranean Shearwater, Eleonora's falcon.

Knockdown resistance of *Anopheles sacharovi* and *Anopheles superpictus* populations in Southern Turkey

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For years, extensive use of insecticides has led to the development of insecticide resistance. Today, increase in insecticide resistance in mosquito populations is seen as a limiting factor for control of both mosquitoes and mosquito-borne diseases. Knockdown resistance (*kdr*) in mosquitos is one of the mechanisms of resistance against pyrethroids. Knockdown resistance is caused by a single mutation in the S6 transmembrane segment of domain II in the voltage-gated sodium channel (*vgsc*) gene. L1014S leads to a Leucine to Serine substitution. *An. sacharovi* and *An. superpictus* are considered to be important malaria vectors in Turkey. In the present study, we investigated *kdr* mutation of *An. sacharovi* and *An. superpictus* in Southern Turkey. Adult female *Anopheles* mosquitoes were collected using mouth aspirators from the barns and houses in eight provinces in Southern Turkey. Adult mosquitoes were identified using morphological identification keys. They were scanned to determine *kdr* mutations in voltage-gated sodium channel gene using PCR. For this purpose, we first performed genomic DNA isolation of varied populations of *An. sacharovi* and *An. superpictus*. Then, we carried out the PCR process before amplicons were sequenced to detect the *kdr* mutations. Distribution of genotypes of amino acids was detected by using Geneious Basic 5.6.7 program. As a result of genotype distribution, all populations of *An. superpictus* have Leucine amino acid on 1014th position. On the other hand, five samples of *An. sacharovi* from Aydın province are heterozygote (Leucine/Serine) and one sample is homozygote (Serine). Moreover, only one specimen of *An. sacharovi* from Burdur province is also homozygote (Serine).

Keywords: *Anopheles sacharovi*, *An. superpictus*, insecticide resistance, *kdr*, *vgsc* gene, mutation, Turkey.

This study was funded by The Scientific and Technological Research Council of Turkey (Project no: 112T479)

***Macrothele cretica* Kulczyński, 1903 (Araneae, Hexathelidae): a first approach to re-evaluate its conservation status**

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Macrothele cretica Kulczyński, 1903 (Hexathelidae) is one of the nine spider species listed in the IUCN Red data list for Europe and the single Greek spider species included in this list. It was initially categorized as “Data Deficient”. Recently it has been considered as “Vulnerable” in the Red Data Book of Greece under the criteria B1a (presence in less than ten sites) and B1biii (deterioration of habitat quality, decrease of habitat size and range), but not on population measurements. With the present project, it is aimed to obtain more information on the species ecological requirements and clarify its taxonomic status with more accurate knowledge, in order to evaluate its risks and determine its appropriate listing. A realistic conservation planning will then become possible. To delimit the ecological niche of *M. cretica* and assign the actual limits of its distribution we focus on the modeling of its possible distribution based on the current records of its occurrence. Bioclimatic data from BIOCLIM database have been used for the running of a Maximum Entropy model (MaxEnt) in order to identify new areas, suitable for the potential distribution of the species. Based on the results, new field work activities are planned for further research and confirmation of the actual occurrence of *M. cretica* on Crete.

Analyses of hard-bottom benthic communities in Crete

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Hard-bottom habitats in the Eastern Mediterranean basin are understudied compared with those from the Western or with those of soft bottom. Funding limitations in research impose the need for the testing of the taxonomic sufficiency hypothesis. This hypothesis suggests that certain taxonomic groups, perhaps the most dominant, can be used as proxies for the analysis of the entire benthic community, in order to avoid costs in expert engagement and wasting of time. The distribution and abundance of subtidal benthic communities was assessed and the effect of abiotic parameters on its spatio-temporal pattern was evaluated. The macrobenthic communities were subsequently divided into the dominant taxa (polychaetes, molluscs and crustaceans). Multivariate techniques showed that in all scales of the analyses the patterns derived from polychaetes was closer to those produced from total macrobenthic community. Additionally, algae composition and coverage percentage found as the only abiotic factors associated with the macrobenthic multivariate pattern. Based on our findings polychaetes can be used as a good indicator taxon for the whole benthic hard-bottom community analysis.

Keywords: Hard substrate, biodiversity, NaGISA, rocky habitats

The effect of ocean acidification on the calcified structures of marine gastropods using micro-computed tomography (micro-CT)

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Climate change is currently one of the major threats for the world's oceans and organisms, causing changes in subocean circulation, ocean warming, sea level rise, impacts on ice cover, freshwater run-off, salinity, oxygen levels and acidification (Nelleman et al. 2008). There is a major concern that ocean acidification will have significant consequences on marine organisms and may alter species composition, disrupt marine food webs and ecosystems and affect human activities (fishing, tourism) (Royal Society 2005). Ocean acidification is expected to reduce biocalcification of the shells, bones and skeletons that most marine organisms possess. This study aims to examine the effects of ocean acidification on the structure and density of the shell of marine gastropods. Adult gastropods of two species, *Nassarius nitidus* and *Collumbella rustica*, were treated for a total period of three months under different temperature and pH conditions. The combined effect of acidification (low pH) and ocean warming (increased temperature) was also examined. The effects of acidification on the organisms' calcified tissues were assessed through micro-computed tomography, which allows relative density measurements of the calcified tissues. All scans were performed with a Skyscan 1172 microtomograph at the Hellenic Center for Marine Research (HCMR) which is currently part of the LifewatchGreece Infrastructure. The analysis revealed significant differences between the treatments. More specifically, gastropods had a reduced shell-surface density under acidified conditions when compared to whelks from control treatments.

The experiments were conducted under a project funded by the Latsis Foundation.

Update on the herpetofauna of the islands of East Tunisia

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In 2014 and 2015 within the framework of the international program of the Mediterranean Small Islands Initiative PIM (www.initiative-pim.org), zoological investigations were carried out on several islands and islets off the eastern coast of Tunisia (Kuriat, Kerkennah, Kneiss and Djerba satellite islands).

The collected data improved both the faunistic and zoogeographical knowledge on these islands, some of which were even unexplored.

Within the results, the occurrence of *Trachylepis vittata* (Scincidae) and *Tarentola fascicularis* (Phyllodactylidae) was reported for the first time for the Tunisian islands.

Status of the unique Mediterranean monk seal colony at the island of Gyaros, Greece (2004 – 2014)

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The Mediterranean monk seal is the rarest member of the Phocidae. One of the most important monk seal populations has been identified at the island of Gyaros, Greece. We report the findings of systematic monitoring efforts (2004 – 2014) that were based on the operation of an Information Network, on regular field surveys and on the use of automatic infrared cameras. The main results obtained are summarized as following:

- Nine coastal caves and eight open beaches are used by the species for resting and pupping.
- The extensive use of open beaches -especially by mothers and their pups- is unique and has not been observed elsewhere in the Mediterranean.
- Mean annual pup production was 9.75. During the study no adult seal and only one newborn pup were found dead.
- Twenty four non-pup individuals were photo-identified, while population estimates for Gyaros range between 65 - 70 non-pup individuals.
- Regarding the behaviour of the species, fostering, nursing activity and aggressive interactions between adult females have been documented.

These data indicate that the monk seal population at Gyaros possesses the typical demographic structure of a seal colony. This is the only known monk seal population in the eastern Mediterranean with this population structure. The present findings show clearly that the island of Gyaros represents an area of outstanding importance for the survival of the critically endangered Mediterranean monk seal.

Keywords: *Monachus monachus*, conservation, management, Gyaros

This study was partially carried out within the framework of the LIFE-Nature Project LIFE12 NAT/GR/000688.

Conservation in action: clean-up of an important Mediterranean monk seal pupping site at the island of Gyaros, Greece

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Threatened with imminent extinction, the Mediterranean monk seal (*Monachus monachus*) faces a number of serious threats. Understanding the nature and magnitude of these threats and finding effective ways to mitigate them is of utmost importance for the conservation of the species. Although it has not yet been possible to establish a cause – effect relationship, pollution has often been referred to as a potential threat for the survival of the Mediterranean monk seal. Currently there is little information on the effects of marine debris on the quality of monk seal habitat. We present the results of the first clean-up of a Mediterranean monk seal pupping site that was carried out as a concrete conservation action aiming to improve habitat quality. In May 2015, the internal beach (total beach surface = $\pm 270\text{m}^2$) of one of the most important pupping sites on the island of Gyaros, Greece was cleared of all marine debris: the debris was collected and categorized according to type (i.e., paper, nylon filaments, EPS, wood, plastic, metal, glass, other) and amount (i.e., small, medium, great). The most frequently found debris were nylon ropes, broken pieces of EPS and plastic bags and bottles, followed by pieces of wood, food wrappings and glass bottles. Overall, 26 plastic bags (bag volume = 140 liters) of debris were removed. This data will serve as baseline information for evaluating the effects of marine debris on the monk seal.

Keywords: *Monachus monachus*, conservation, management, Gyaros

This study was carried out within the framework of the LIFE-Nature Project LIFE12 NAT/GR/000688

First report of *Cylicospirura* sp. in European wildcats (*Felis silvestris silvestris*) in Greece

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The European wildcat (*Felis silvestris silvestris*) is the only wild felid with confirmed reproducing populations in Greece. In this country, studies on this species are scant and information on its parasitic fauna is nonexistent. Post mortem examination of two road killed European wildcats found in the regions of Evros (Thrace) and Serres (Macedonia) in northern Greece, revealed one and two nodules, respectively, on the stomach wall, on the side of greater curvature of the stomach corpus. The nodules were 2.2-2.7 cm in diameter, purulent or non purulent and had a small, central, opening on their mucosal surface that led to a ramified burrow. At dissection, reddish parasitic nematodes were revealed. Based on morphological characteristics (vulva location in female, number of tail papillae in males and teeth morphology), the parasites were identified as *Cylicospirura felineus*. The genetic examination of these nematodes is currently ongoing. *Cylicospirura felineus* has been reported from domestic cats (*Felis silvestris catus*) and wild felids (e.g. *Puma concolor*, *Panthera tigris tigris*, *Lynx canadensis*, *Lynx rufus*, *Leopardus geoffroyi*) in India, Africa, Americas, Australia and recently Europe (Italy). This is the first report of *Cylicospirura* in Greece. The morphology of the parasites and gross and histological lesions in cyclicospirurosis are here presented. However, the clinical signs of cyclicospirurosis and its impact on health and welfare of wildcats are unknown and warrant further investigations.

Keywords: stomach, nodule, nematodes, parasites, wild Felids

The mammal collection of the Goulandris Natural History Museum, Greece

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The Goulandris Natural History Museum was founded in 1964 as a private non-profit foundation. The mammal collection of the Museum was established in 1984 with a donation of specimens of Greek and African fauna by Greeks living abroad, under the permission of the International Organisation for the Protection of Nature. The specimens have been arranged in the museum's exhibition and in the storage rooms. A determination label accompanies each specimen.

Systematic collections are valuable resources both to the scientific community, and to the society in general. Their data can be used in genetics, molecular biology, evolutionary biology, environmental toxicology, public health ecology, biogeography, systematic and taxonomy (Monk, 1997). The Museum's collection contains specimens from Greece but also from other countries, with some specimens over 100 years old.

The mammal collection of the Goulandris Natural History Museum consists of 176 specimens (97 mounted specimens, 2 in alcohol, 33 osteological, 22 heads and the rest being skins, antlers, horns and tusks). These specimens belong to 86 species of 35 families. Almost one-third (32%) of all specimens contained in the collection are representatives of the order Carnivora. Members of the orders Artiodactyla (28%), and Rodentia (16%), are fairly common in collection, while Insectivora (6%), Marsupialia (3%) and Proboscidea (3%) are less. Other orders like Monotremata, Dasypodidae, Lagomorpha, Pholidota, Perissodactyla, Cetacea, Primates, and Chiroptera, are only poorly represented.

LIFE-FORBIRDS: Improving lowland forest habitats for birds in Cyprus.

LIFE 13/NAT/CY 000176

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The project titled 'Improving lowland forest habitats for Birds in Cyprus' (LIFE13 NAT/CY/000176) is co-funded by European Union and it has three major objectives: (a) to implement conservation / management measures that will substantially improve ecological conditions for selected bird species listed in Annex I of the Birds Directive and occurring in the Natura 2000 (SPA) sites 'Kavo Gkreko' (CY3000005), 'Koshi – Pallourokampos' (CY6000009) and 'Stavrovouni – Potamos Panagias Stazousas' (CY6000007), (b) to demonstrate to the Cypriot foresters and other stakeholders the benefits of adopting a more holistic forest management approach that will address the needs of birds dwelling in or visiting the forest, and (c) to contribute towards the enhancement of public awareness on birds' conservation and combating bird crime within the broader project area. Up to now, forest management in Cyprus was concerned mainly with forest recreation, fire prevention and fire protection, conservation of flora, tree monuments and habitat types, etc. No measures were undertaken to conserve avifauna by the Department of Forests. To this end, this project will attempt to improve the ecological conditions of avifauna through a series of concrete conservation actions within forests of three SPA sites and to promote the need of bird conservation to both stakeholders and general public.

Keywords: LIFE-FORBIRDS, forest management, birdlife, SPA, Cyprus

Ecological patterns of Chironomidae assemblages in springs of Cvrcka river basin (NW Republic of Srpska, Bosnia and Herzegovina)

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Chironomid fauna of Cvrcka river springs has not been previously investigated before, apart from Vilenjska vrela spring (Filipović et al., 2009), nevertheless they determined collected chironomid larvae only to the family level giving information of their density/m² of the bottom.

The aim of this study is to recognize main environmental factors that influence Chironomidae assemblages in NW Bosnia and Herzegovina. Part of the investigated springs remain natural but the water quality and habitats of the others are substantially changed by humane impact. We verify how its environmental classification according to the pollution and ecological type (eu-hypocrenon) are followed by chironomid communities itself.

Chironomids larvae were collected from 27 springs of Cvrcka river basin. Two sites sets were analyzed: primary spring sets (PSS) grouping 26 springs and eucrenon-hypocrenon spring set (EHSS) grouping springs S 3, S 6 and S 31 representing broad springs series typical for the Cvrcka river basin. From PSS chironomids larvae were collected during September and October 2012 and 2013. From EHSS near Rastik village chironomids were taken seasonally during year, specific for source (eucrenal) and waterflow directly downstream (hypocrenal). Samples were collected with handy planktonic net (350 µm mesh apertures) from all microhabitat of investigated springs. For ecological interpretation of the data there were performed multivariate statistics.

Evaluation of the Importance of Landscape Connectivity for the distribution of *Hierophis cypriensis*

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The endemic Cyprus whip snake *Hierophis cypriensis* is a strictly protected species, but until today, the knowledge on its ecology and distribution is very limited. Given the well documented importance of habitat connectivity for biodiversity conservation, the aim of this work was to evaluate the importance of landscape connectivity for the distribution of *Hierophis cypriensis* within the region of Troodos Mountain.

The methodology used in this study employs two approaches to evaluate aspects of habitat connectivity in the landscape. First, the importance of species habitat areas and links for the maintenance or improvement of landscape connectivity was quantified using CONEFOR's Integral Index of Connectivity (IIC) and Probability of Connectivity (PC). Then Least Cost Path (LCP) analysis within ArcGIS® was used to identify potential movement routes for the species between core habitat areas following the following procedure: Habitat suitability evaluation, disturbance modelling, construction of quality surface, identification of habitat core areas, and analysis of LCP.

The analysis with CONEFOR showed that the habitat patches of the forests of Paphos, Troodos and Adelfoi, are considered the most important areas, out of seventeen evaluated, for landscape connectivity and therefore for species conservation, with Paphos forest being the most important. These three areas were also identified in LCP analysis as the core areas for the species, corroborating the results of CONEFOR. Despite the importance of these three habitat patches a large part of these areas is currently not protected under the Natura 2000 network.

Camera Trapping to Evaluate Large Carnivore Richness in Cevizli Gidengelmez Wildlife Reserve

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Being situated in a unique place in terms of biodiversity, Taurus Mountains Region includes many conservation refugees for carnivore species in Mediterranean Turkey. Among the 23 officially designated wildlife reserves in the region, Gidengelmez Mountain Wildlife Reserve is a prominent one that covers more than 160 km² of land area. Area shaped by diverse topography including steep slopes, rugged cliffs and ridges that are covered by mostly alpine meadows and sparse vegetation above the tree line. At the lower altitudes, forest cover dominantly shaped by *Cedrus libani*, *Pinus brutia*, accompanied by quercus and juniper communities. These all triggers the formation of various habitat types and the area becomes a sanctuary for many species especially for the carnivore mammals. In order to evaluate the carnivore mammal richness in the area, we performed camera trap study at 14 stations for 2591 camera-trap days in 2013-2014 and gathered 1060 records for 12 large mammal species including lynx (*Lynx lynx*), caracal (*Caracal caracal*), gray wolf (*Canis lupus*) and brown bear (*Ursus arctos*). During the study, human activities in the area were also recorded. Among them, intensive livestock grazing and illegal hunting were noted as the main issues to struggle with for the conservation efforts in the area.

Mesozooplanktonic at the Kimi region. Correlation with environmental factors, fish eggs and larvae in the area

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This study carried out in an important Greek fishing area (Kymi – island of Evia, North Aegean Sea, coordinates: N.38.4-38.8, E.24.0-24.5), presents abundances, diversity indices and correlations between the mesozooplankton, the fish eggs and larvae and the temperature, salinity, depth, coastal distance and the local sea current.. Samples collected by horizontal hauls to a maximum depth of 5m, using a sampler type Bongo net, with 250 mm mesh size, at 15 stations, on October 2011. Environmental parameters recorded using CTD. Salinity and temperature refer to surface values. The material was studied (23 taxa at the level of Genus or Species) at the Department of Zoology-Marine Biology, University of Athens, during the course of Zooplankton (Master of Oceanography). The mesozooplankton divided into 2 groups: Fish Larvae predators (10 taxa, with dominant the Cladocerans and Copepods) and Fish Larvae prey (13 taxa with dominant the Chaetognatha) according to Omori & Ikeda (1984). Multivariation analysis shows four different group of station according to the taxa distribution.

Species from transitional ecosystems: the case of talitrids inhabiting pocket beaches in Crete and mapping challenges in the LifeWatchGreece Infrastructure

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Species mapping is challenging in ephemeral environments. Sandy beaches are transitional ecosystems, assigned to the marine environment for the sake of classification, but characterised by their own physical dynamics and consequent faunal selection. Keystone species, such as talitrids, are used worldwide to model species-environment relationships. The case of Mediterranean sandy beaches provides, however, an extreme case of fluctuations in habitat availability, escaping most of the current paradigms. Nevertheless, four different species and two genera of talitrids were found with uneven distribution on a four-km coastal stretch in Crete, fragmented into pocket beaches. We used a one-year dataset to plot the occurrence of talitrids by beach width (currently indicated as main driver of species richness on beaches worldwide, but not the best descriptor in the present case) and by beach substrate (a neglected feature, but relevant in our case to depict biodiversity patterns). We consequently challenged beach biodiversity issues regarding: 1) mapping habitats with discontinuous availability (e.g. frequent storms with waves washing the whole littoral) and 2) revealing physical drivers of biodiversity, by comparing data plotted by beach width and by substrate characteristics. A traits-based approach was proposed as strategy to frame the data into a sound representation of biodiversity on beaches, independently on their small-scale characteristics. This will allow the LifeWatchGreece Research Infrastructure to integrate and link data related to the biodiversity of ecotones between land and sea, which are of high relevance to the understanding of global processes.

Keywords: sandy beaches, gravel beaches, Talitridae, Mediterranean, fragmented habitats, species traits

Spring and summer coastal fish assemblages in Zakynthos Island (Ionian Sea)

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The species composition of coastal fisheries catches provide important information on the presence and exploitation of marine fishes and are particularly useful in monitoring programs. The present work was conducted within the framework of the ichthyofauna monitoring in the National Marine Park of Zakynthos and adjacent fishing grounds, aiming to record the coastal fisheries catches and to identify fish assemblages in the coasts of Zakynthos (Zante) Island (Ionian Sea).

Samples were collected onboard a small-scale coastal fisheries vessel, using trammel nets (22/110 mm inner/outer mesh size, 4000 m in length; set for 9 hours), between April and July 2015. Catch per unit of effort (CPUE) was measured as biomass per haul given that the vessel, crew, fishing gear, soaking time and fishing area remained unchanged.

Overall, 59 species were recorded (54 fishes, of which 49 actinopterygians and 5 elasmobranchs; 2 crustaceans; 3 cephalopods) belonging to 4 classes, 16 orders and 32 families. Among them, 2 actinopterygians (parrotfish *Sparisoma cretense*, pearly razorfish *Xyrichthys novacula*) are listed as protected, while the dusky spinefoot *Siganus luridus* and blunthead puffer *Sphoeroides pachygaster* are listed among the 100 worst invasive species in the Mediterranean. Most species were caught in May (n=42). Although Sparidae was the most represented family with 13 species, the species with the highest average and total biomass and the highest abundance were the parrotfish (Scaridae) and surmullet *Mullus surmuletus* (Mullidae). CPUE ranged between 23 (April) and 30 (July) kg/haul. The research is ongoing and will be concluded by November 2015.

Keywords: fish fauna, trammel nets, coastal fisheries, CPUE, MPA

Habitat and distribution of the Pygmy Owl in Greece

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The Pygmy Owl *Glaucidium passerinum* is a rare and local breeder in Greece. It has a wide distribution in north and central Europe reaching the southernmost limit of its European range in the Balkans where it breeds in the Rodopi Mountains. Its habitat consists mainly of coniferous boreal forest being present in the south only on high mountain habitats. The first records of the Pygmy Owl in Greece date back to the 1970's and 1980's by Bauer and Böhr (1987) in the Elatia and Erimanthos Forests (Rodopi Mountains). Since then there was only one confirmed observation in 2008. Our team recorded Pygmy Owls at 13 locations in two forest divisions in October 2014 and June 2015 at altitudes ranging from 1200 to 1600 m. The core population seems to exist in Elatia Forest (central division), but the species was also recorded in Simida Forest (northwest division). The habitat of the species is dominated by Norwegian Spruce forest and there is only one observation in a mixed Scotch Pine and Norwegian Spruce forest. Forest density varied from closed forest stands, with the only opening being that of a road, to small meadows surrounded by dense forest and in one case open habitat with sparse mature trees close to a settlement. The Pygmy Owl's presence in Greece requires more research on the population status of the species, whereas additional data is needed in order to better establish the species' distribution in other possible locations such as the Frakto Forest. On the basis of the above, informed conservation measures for suitable forest management must be drawn for the preservation of this marginal population.

Keywords: Pygmy Owl, Rodopi Mountain Range, Habitat, Distribution

Biodiversity in the central Aegean archipelago: the effect of geography, geology and climate

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Here we investigate the biogeographical relationships of four groups of terrestrial organisms (i.e. birds, centipedes, plants and snails) in 19 central Aegean islands. Variation in species–area relationships (SARs) across all studied groups was summarized using Generalized Linear Mixed-effects Models (GLMMs), depending on geographical, geological and climatic factors. The best GLMMs accounted for 90.42%, 72.88%, 89.92% and 65.86% of the variation in species richness for birds, centipedes, plants and snails respectively. Compared to the simple SARs, GLMMs performed significantly better, except for plants, where results were comparable. SAR parameters varied across taxa depending on geology and island type. This can be partly explained by the differences in life strategies, such as the dispersal ability and territoriality of the four groups involved, as well as their evolutionary history.

Keywords: birds, centipedes, generalized linear mixed models, plants, snails, species–area relationship.

Establishing a citizen science initiative for the mapping and monitoring of coralligenous assemblages in the Mediterranean Sea

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Mediterranean coralligenous bioherms are built by calcifying rhodophytes on hard substrates under dim-light conditions. They are considered hotspots of biodiversity, harbouring rich benthic assemblages and valuable biological resources. Coralligenous sites are extremely popular among divers due to their complex structure, conspicuous biological wealth and high aesthetic value. Nevertheless data on their distribution, structure and conservation status is lacking for several Mediterranean areas while they are vulnerable to multiple threats.

A citizen science initiative is launched within the ongoing CIGESMED project aiming to engage enthusiast divers towards the study of coralligenous assemblages, through: (a) reporting of new data from understudied areas and (b) recurrent monitoring of predetermined sites.

For its active implementation, a citizen science protocol and a multilingual website were developed, comprising (a) an educational platform, providing information regarding the coralligenous ecosystems, and (b) a data submission platform. Georeferenced data reporting focuses on: (a) basic topographic and abiotic features, allowing a preliminary characterization of the site and the creation of data series for sites receiving multiple visits; (b) presence and relative abundance of conspicuous typical species for the ecological assessment of coralligenous assemblages, and (c) recording of pressures and imminent threats. A variety of tools is provided to facilitate end-users including more than 100 underwater images from all over the Mediterranean. Furthermore, divers have the choice to report additional information and are encouraged to upload their photographs. Our long-term goal is the development of an active community of amateur coralligenous observers providing widespread and ecologically significant data on coralligenous assemblages.

Keywords: coralline reefs, bioherms, biodiversity hotspot, SCUBA diving, data management

Calcarean sponge diversity in the Eastern Mediterranean and the Black Sea

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Sponge research in the eastern Mediterranean Sea has mainly focused on demosponges, the most speciose class of Porifera. The class Calcarea (the only whose spicules are of CaCO_3) is notably understudied. During recent sponge sampling in the Aegean Sea, a number of calcareous sponges have been collected and an updated checklist of the Calcarea of the eastern Mediterranean and the Black Sea was created. The known calcarean fauna of the eastern Mediterranean consists of 29 species (half of the Mediterranean Calcarea) belonging to 12 genera, 12 families, and 4 orders. Calcaronea is the richest subclass, with 19 species, while Calcinea has 10 species. Leucosolenida (15 species), Sycettidae (8), and *Sycon* (8) were the most diverse order, family, and genus respectively. Most species were recorded in the Levantine Basin (17), North Aegean (8), and South Aegean Sea (6), while only 2 calcarean species have been reported from the Black Sea. Recently collected calcareans yielded 6 species, of which 3 are new to science and 2 are reported for the first time after their original description and are new records for the eastern Mediterranean and the marine cave ecosystem. Our review showed that most calcarean records from the eastern Mediterranean Sea were included in old publications. The fact that a relatively moderate research effort in the Aegean Sea yielded 3 new species as well as new additions to the regional fauna indicates that further research could increase our knowledge on the calcarean diversity of the Mediterranean.

Keywords: Porifera, Calcarea, benthos, Aegean Sea, zoogeography, marine biogeographic data

The Greek Taxon Information System: Publication of the first Preliminary Checklists of Species of Greece

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The Greek Taxon Information System is an application of the LifeWatchGreece infrastructure (ESFRI) that has resumed efforts to compile a complete checklist of species reported from Greece. We present the first preliminary checklists that were validated by specialists for 6 marine taxa. Overall 65 species of Cumacea (25 genera, 6 families), 2 species of Lophogastrida (2 genera, 2 families), 47 species of Mysida (24 genera, 1 family), 10 species of Brachiopoda (9 genera, 7 families), 13 species of Chaetognatha (11 genera, 5 families) and 12 species of Cetacea (11 genera, 5 families) have been recorded in the Greek Seas. Among these taxa, only the cetaceans were recently listed in a study about the Greek cetacean fauna. Brachiopods were listed in broader studies on the Mediterranean brachiopod diversity and the marine cave fauna. Cumaceans, lophogastrids and mysids have been listed in several benthic studies, though not always at the species level. This is also the first checklist of the chaetognath fauna of Greece.

The following challenges were encountered during the compilation of the preliminary checklists: (a) existing checklists required taxonomical updates; (b) global species databases do not necessarily report species by country; (c) specialists are often lacking locally for particular taxa in a given country; (d) voluntary scientific work may be challenging. Collaboration of local scientists, even non-experts who may act as a focal point for each taxon, with international specialists could be possibly a solution to the local lack of expertise but could also stimulate future research on understudied taxa.

Keywords: Cumacea, Lophogastrida, Mysida, Brachiopoda, Chaetognatha, Cetacea

Proposing point pattern analysis to detect the determinants of nest site selection process: Case study of loggerhead sea turtles in Zakynthos, Greece

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Nest site selection represents a process of critical importance for sea turtles' reproductive phase affecting incubation success, hatchling robustness and sex ratio. Various studies have been conducted in order to improve our comprehension regarding the factors that determine nest site selection, comparing the environmental conditions in the location of nest with background characteristics. In the present study, we propose a new approach based on point pattern analysis that addresses the properties of the spatial distribution of nest locations and examines for associations with the spatial distribution of environmental variables. The outputs of such a methodological framework allow us to consider and explore potential behavioral mechanisms that drive nest site selection. In addition, the method directs towards the identification of polygons that share specific characteristics and thus, should be considered of a high priority for protection at a local scale and maintenance of their natural conditions. Here, we develop and test this methodology on georeferenced nest locations of loggerhead sea turtles breeding in Zakynthos Rookery, Greece, East Mediterranean (37°43'N 20°53'E) during the 2014 nesting period. A series of environmental and topographical variables collected at both the beach (e.g. temperature, sediment grain size) and the adjacent marine habitats (e.g. marine geomorphology) were considered as plausible drivers of the observed spatial patterns of nest distribution. The findings of the study could provide critical conservation recommendations by further improving our understanding on the potential adaptability of sea turtles to the changing conditions (natural and human-driven) of their nesting environment.

The study is developed and applied under the support of the project: "Protection and conservation of biodiversity of the National Marina Park of Zakynthos" under the 1st action of the 9th Priority Action "Protection of the Natural Environment and of the Biodiversity", of the operational Project "Environment and Sustainable Development" 2007-2013, with Contracting Authority the Management Body of the National Marine Park of Zakynthos, co-financed by European Regional Development Fund (ERDF) and national resources.

An old endemic species of freshwater shrimp in the very young Skadar Lake

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Skadar Lake system is known for its rich freshwater fauna, including numerous endemics. The lake was recognised as potentially ancient until 2014, when paleolimnological studies revealed it is geologically very young. It originated ca. 1200 years ago with overflowing of a much older marshland and karst spring area by changed course of the Drin River. Accordingly the local endemics are associated rather with the springs than with the lake itself. During our recent studies upon aquatic invertebrates of the lake system, we found a novel morphotype of *Atyaephyra* shrimp, most probably representing a species new to science. Distinctiveness of the morphotype from congeneric species was confirmed with molecular data. Phylogenetic analysis based on the COI mtDNA revealed that the new species is most closely related to the south-Balkan *A. stankoi* and *A. thymisensis*, from which it diverged probably in early Pliocene. Its present diversity dates back only to Middle Pleistocene, when apparently the population has expanded both in demographic and spatial terms. So far, our data suggest that it is the Skadar Lake system endemic and that it occurs mainly in the areas under influence of spring and riverine waters. The species may be another relic of the old marshlands occupying the basin before the present lake.

Keywords: Balkan Peninsula, Atyidae, taxonomy, phylogeography

New data on ‘*Propomacrus cypriacus* Alexis & Makris, 2002’ (Coleoptera: Euchiridae) of ecological, taxonomic and conservation significance

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The genus *Propomacrus* (Euchiridae) is represented in the western Palearctic by two saproxylic species, *P. bimucronatus* (Pallas, 1781) from the Balkans, Turkey and Near East, and *P. cypriacus* Alexis & Makris, 2002, endemic to Cyprus (two more species from China are in the genus). *P. cypriacus* is rated as Critically Endangered by IUCN, as it depends upon veteran trees, which are declining due to increasing fragmentation and exploitation of forests. Until now, its larvae were known to feed only in *Ceratonia siliqua*, *Quercus infectoria* and *Prunus dulcis*.

We aimed to a detailed documentation of the species’ distribution in Cyprus, as well as its host tree range and its levels of genetic variation, as indirect evidence of population status. We intensively searched for evidence of the species’ presence in hollows of trees of a variety of potential host species and we placed a total of 136 attracting traps in 16 localities from July to September, in order to capture live adults. We also explored genetic variation using two mtDNA and one nuclear DNA gene markers of 29 individuals, 25 *P. cypriacus* and 4 *P. bimucronatus*.

Our results indicate that the validity of *P. cypriacus* cannot be supported, but it should be considered as a subspecies of *P. bimucronatus*. We also identified more host species, such as *Platanus orientalis* and *Alnus orientalis*, further corroborating the view that it should not be considered a separate species. These findings suggest changes in the conservation status of the Cypriot taxon.

This work was partially funded by Mohamed bin Zayed Species Conservation Fund.

Genetic structure of a mediterranean spiny oyster *Spondylus gaederopus* Linnaeus, 1758 (Bivalvia) population from Aegean Sea

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The edible, large (max length 15 cm) bivalve *Spondylus gaederopus* is one of the most famous shells since the Neolithic period in Central Europe, Balkans and Greece. In the present study, the sequencing analysis of the mitochondrial 16S rRNA gene was used to characterize the genetic structure of an Aegean Sea population. Mt DNA 16S rRNA diversity was estimated via Arlequin version 3.5. In total, 548 bp at the 5' end of the mitochondrial 16S rRNA gene were sequenced. The sixteen individuals revealed six different haplotypes, which differed from each other one to nine nucleotides. DNA sequences were deposited to GenBank (accession numbers JX227728-JX227731, KR676344-KR676345). Value of haplotype diversity (h) was found $h=0.675$, whereas nucleotide diversity (π) was revealed in a value of $\pi=0.003$. The most common haplotype (1) was found in nine individuals (haplotype frequency 0.56). Haplotype 2 was found in three individuals (haplotype frequency 0.18) and haplotypes 1, 3, 4 and 6 were each represented by one oyster. The levels of intrapopulation variation for *S. gaederopus*, revealed by sequences of the mt DNA 16S rDNA region in the present study are relatively high. In the marine invertebrates the reduction of intrapopulation genetic variation can have serious consequences on the survival and reproduction of the species and it is expressed mainly with the loss of rare haplotypes, despite with the total reduction of heterozygosity in a population. Our samples are characterized both by high DNA variability and the existence of some rare haplotypes, a result which indicates the good genetic population status for the species.

Genetic identification of *Penaeus aztecus* Ives, 1891 in the Eastern Mediterranean

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The northern brown shrimp *Penaeus aztecus* Ives, 1891, is an estuarine and oceanic littoral decapod which is naturally distributed along the western Atlantic. The presence of the northern brown shrimp in the Mediterranean Sea has been recorded for the first time in Antalya Bay, Eastern Mediterranean. In the present study, a 16S rRNA sequencing analysis was used for the identity confirmation of the species in Thermaikos Gulf. Phylogenetic relationships were estimated with the MEGA6 software, using the maximum likelihood method. The final dataset included 13 sequences from different *Penaeus* individuals. Species *Palaemon elegans* was used as an outgroup. In total, 522 base pairs at the 5' end of the mtDNA 16S rDNA gene for all the individuals were sequenced. All specimens revealed an identical haplotype which was deposited at GenBank (accession number: KF983532.1). There were 404 positions in the final dataset. The maximum likelihood topology revealed three different clusters: the first one includes all the *P. duorarum* sequences, the second one includes the *P. subtilis* individuals and the third one includes the *P. aztecus* sequences. The sequence of the Thermaikos Gulf individuals was grouped with the *P. aztecus* individuals, in the third clade. The use of the 16S rDNA gene contributes to the undoubted identification of *P. aztecus* in the Aegean Sea and generally in the Eastern Mediterranean. The increase of marine non indigenous species in the Eastern Mediterranean is certainly attributed to an increase of human activities (shipping transport), but it is also a consequence of climate change.

Cranial variability of Alpine chamois (*Rupicapra rupicapra* L.) from the Balkan Peninsula

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The aim of this investigation was to assess the degree of population differentiation of the Alpine chamois (*Rupicapra rupicapra* L.) from the Balkan Peninsula and to fit the analyzed populations into the overall European framework of cranial variability.

We tested the hypothesis that the populations of Alpine chamois in Serbia and Bosnia and Herzegovina (subspecies *Rupicapra rupicapra balcanica* Bolkay 1925) differ from the populations in Romania (subspecies *Rupicapra rupicapra carpatica* Couturier 1938) in size and shape of the cranium. Variation in 25 measures was investigated in 70 crania of the Alpine chamois from five localities. Cranial variability was analyzed by standard multivariate statistical techniques with respect to the population parameters and localities.

Based on the relationships of characters measured, it was possible to describe general trend of increase in the overall size and shape of the cranium. Individuals from Romania had wider cranial capsule and larger distance between zygomatic arches, indicating the presence of massive horns and intensive mastication of Carpathian rough grasses. Individuals from Serbia and Bosnia and Herzegovina had smaller skulls, with enlarged orbits and facial region, indicating the importance of social interactions between individuals inhabiting lower altitude areas.

Since the number of Alpine chamois populations is significantly reduced, due to extensive hunting, habitat loss and competition with domestic animals, understanding differences between populations inhabiting diverse habitats can be of great importance for game management and conservation.

Keywords: population differentiation, cranium, size and shape, game management

Distribution and morphological comparison of two sibling bat species *Myotis myotis* and *Myotis blythii* (Mammalia, Chiroptera) in Greece

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The greater mouse-eared bat, *Myotis myotis*, and the lesser mouse-eared bat, *Myotis blythii*, are two sister species, with great morphological similarities, as they were separated recently at the evolutionary time (approximately 600.000 years ago) at species-level. They occur in sympatry in a zone which extends from the Iberian Peninsula to the eastern Anatolia. In addition, hybridization has been reported in some areas of co-existence. Although there are several publications reporting the presence of both species in Greece, their distribution in the country is not completely understood, due to their close genetic relationship and morphological similarities. In this study, we attempted to clarify the distribution of both species in Greece, which is part of the sympatric zone. We captured individuals on the mainland and islands from 2002 to 2015 and identified them through their external morphological characteristics (forearm length, upper tooth row length, ear length, color characters). Our results show that *M. myotis* occurs in northern and central Greece but it is absent from the south and the majority of the islands, while *M. blythii* is common on the mainland and occurs on many islands. We also indicate the presence of individuals with intermediate characteristics, mainly in northern Greece and eastern Aegean islands, suggesting evidence of hybridization, pointing out the need for molecular analysis.

Keywords: Greater mouse-eared bat, lesser mouse-eared bat, hybridization, sympatry

Evaporative water loss rates in *Podarcis* lizards

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Although certain physiological traits and processes (e.g. thermoregulation) are well documented in lizards, the ecological aspects of evaporative water loss (EWL) have received far less attention. EWL refers to the amount and rate of water losses that an individual undergoes. It is an important ecophysiological feature that represents a measure of the survival abilities of animals in a given habitat. In terrestrial reptiles water loss primarily occurs through the skin. In this study, we measured the instantaneous and accumulated EWL in four *Podarcis* lizard species (*P. erhardii*, *P. gaigeae*, *P. tauricus* and *P. peloponnesiacus*). Our aim was to explore differences in EWL patterns in relation to sex and habitat (mainland vs. insular populations). Results showed a significant differentiation in EWL rates between sexes, with females having higher instantaneous and accumulated rates than males throughout the experiment. We failed to detect a consistent pattern of EWL differentiation among the species. Island populations showed higher accumulated EWL rates than the mainland ones. Interestingly the differences in accumulated EWL rates between the insular and the mainland populations achieved their higher values during the first hours of the experiment. Instantaneous EWL between island and mainland populations did not differ in a consistent pattern and differences were not statistically significant.

Keywords: Physiology, reptiles, Lacertidae, insularity.

Discovery of an important monk seal colony at the island of Evia, Greece

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The Mediterranean monk seal (*Monachus monachus*) is the most endangered seal in the world; effectively protecting critical habitat and managing the remaining populations is one of the major conservation priorities for the species in Greece. In 2013 – 2015 we carried out systematic efforts to study the species at the island of Evia. Field surveys were carried out to identify critical monk seal habitat and infrared cameras were installed at the two most important pupping sites to identify individuals and record social behavior. Twenty one suitable marine caves were located, at least ten individual monk seals were identified and annual pup production was estimated at 7 – 8 pups. In addition, we identified the first known marine area in Greece where monk seals gather daily in small groups; the reasons for this behavior are still unknown. Based on this information we believe that the monk seal population at the island of Evia is one of the most important in Greece. The population is not isolated and should be monitored and managed together with monk seal populations frequenting the nearby shores of mainland Greece and the adjacent islands. We propose the continuation of research activities in order to improve our understanding of the status of the Mediterranean monk seal at the island of Evia and ultimately the conservation status of the species in the country.

Keywords: *Monachus monachus*, conservation, management, Evia

This study was supported by a research and conservation grant from the U.S. Marine Mammal Commission.

A comparative analysis of the apparent digestive efficiency in the rough-tail rock agama *Stellagama stellio* along a latitudinal gradient

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Digestive performance is of pivotal importance for survival, from energy acquisition to energy allocation. Apparent digestive efficiency (ADE), represents the relative percentage of ingested energy absorbed through the gut. In lizards, ADE usually increases in higher temperatures. Food availability also affects digestive performance, with lizards achieving higher ADEs in environments where food sources are spatially or temporally limited, in order to maximize each meal's energy gain. We investigated the effect of temperature and food availability on digestive efficiency in the agamid lizard *Stellagama stellio* (L., 1758). ADEs of proteins, lipids, and sugars were examined in a common-garden experiment in 69 individuals from six populations, along a latitudinal and climatic gradient: from Corfu island (Ionian Sea) and Thessaloniki at the northwestern part of the species' distribution, Naxos and Delos in the Cyclades (Aegean Sea) to Cyprus and Israel at the southeast. We predicted that differences in environmental temperatures (sketched by operative temperatures) and in food availability would induce shifts in ADE. ADE_{sugars} did not differ among populations. However, ADE_{proteins} and ADE_{lipids} were significantly lower in Corfu and Thessaloniki, which may be partly due to the relatively lower environmental temperatures that make thermoregulation more demanding and thus reduce digestive performance. Moreover, the expected higher food availability in the more humid north, alleviates the pressure for high ADEs that applies for the populations in the drier Cyclades, Cyprus and Israel, where prey is expected to be more limited.

Keywords: Digestion, proteins, lipids, sugars, Agamidae, Greece

The evolutionary history of *Euscorpius candiota* complex (Scorpiones, Euscorpiidae)

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The number of species *Euscorpius* that are distributed in Greece, has recently been increased from 6 to 17 (*E. avcii*, *E. birulai*, *E. candiota*, *E. corcyraeus*, *E. erymanthus*, *E. hadzii*, *E. italicus*, *E. koschewnikowii*, *E. kritscheri*, *E. mylonasi*, *E. naupliensis*, *E. ossae*, *E. scaber*, and *E. sicanus* *E. stahlavskyi*, *E. kinzelbachi* and *E. vignai*). According to a recent phylogenetic study, several cryptic taxa occur sympatrically with already described species. In contrast to the high number of species present in mainland and the remaining insular Greece, Crete hosts a single species. The cretan form *E. candiota* complex that appears also in Peloponnese peninsula and in a part of western Greece, is morphologically very diversified. Thus, the issue of whether it represents a single evolutionary entity arises. In this study, two mitochondrial (CO1,16S rDNA) and one nuclear marker(ITS1) are used within a phylogenetic and biogeographic framework in order to: a) reconstruct the phylogenetic relationships of the involved lineages, b) delimit the number of evolutionary lineages supported by the molecular data c) investigate the time frame of the lineages' diversification in the area, and d) assess the most likely biogeographic scenario that could account for the distributional pattern of the evolutionary lineages of Crete and beyond.

Keywords: Crete, mtDNA, nuclear-DNA, phylogeography, species-delimitation

Spatiotemporal variation in macroinvertebrate assemblages of Mediterranean Temporary Ponds of Crete Island, Greece

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Mediterranean Temporary Ponds of Greece have been neglected and only until recently their ecological value has been recognised. The seasonal and spatial patterns of macroinvertebrate assemblages and environmental parameters were assessed for the first time in Mediterranean temporary ponds of Western Crete. Macroinvertebrate fauna and environmental parameters (physicochemical, hydroperiod) were monitored for 3 years (2006-2008). A total of 63 macroinvertebrate taxa belonging to 33 families were recorded with *Plea minutissima*, *Berosus affinis*, *Pericoma sp.*, *Culex sp.*, Chironomidae and Cyprididae being the predominant taxa. Nutrient pollution was evident in ponds near agricultural areas and could be the reason for poor species richness. Inter-annual and seasonal variation of the macroinvertebrate fauna was highly significant, and macroinvertebrate community varied markedly between seasons among and within ponds (ANOSIM $R = 0.965$, $p = 0.001$). Statistical analysis showed a clear spatial and temporal distinction between lowland and upland sites. Heteroptera species were exclusively encountered on spring, while Coleoptera larvae and adults were present in all seasons, with adults being more abundant during winter. Species richness was relatively lower compared to temporary ponds from other regions due to their isolated character, unpredictable hydroperiod, man-made hydromorphological alterations and degraded water quality.

Keywords: ponds, fauna, benthic, conservation, biodiversity.

Soil nematode community modifications induced by decomposing leaves of mediterranean aromatic plants

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Essential oils from decomposing leaves of aromatic plants are biologically active compounds affecting soil function and plant growth. In order to study the effect of aromatic plants' litter on the soil food-web, we focused on soil nematodes, since the structure of their community provides insight into the functioning of the food-web and hence the state of the soil. We conducted a pot experiment in a greenhouse, where mint, spearmint and rosemary were used separately as soil amendments (at a rate of 4%). We used control pots with a commercial organic amendment and with non-amended soil. All pots were sown with tomato seeds. To further examine the effect of the crop plant on the nematode community, all five treatments were doubled, but without tomato sown. Soil nematodes were sampled 4 weeks after the beginning of the experiment. The aromatic plant amendments affected most structural characteristics of the nematode community, irrespective of the presence of tomato. They favored the growth and metabolic activity of bacterivorous, fungivorous, carnivorous and omnivorous nematodes, but did not affect herbivores. The changes in the trophic and functional structure of the nematode community, which were more pronounced in the case of spearmint and mint than in the case of rosemary, are indicative of an enriched, vigorous, pre-mature and more productive soil.

This work is part of the project "ESEPMINENT" which is implemented under the "ARISTEIA II" Action of the "OPERATIONAL PROGRAMME EDUCATION AND LIFELONG LEARNING" and is co-funded by the European Social Fund (ESF) and National Resources.

The “MetaCopepod” project: Designing an integrated DNA metabarcoding and image analysis approach to study and monitor biodiversity of zooplanktonic copepods in the Mediterranean Sea

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Timely and accurate analysis of zooplankton biodiversity poses an ongoing challenge in ecological and biomonitoring programs, since morphology-based identification of taxa is time consuming and rarely supports species-level resolution. Copepods play a major role in marine ecosystems functioning, however their study is still limited because of such methodological reasons. The recent advances in genetic and image analysis systems offer an opportunity to overcome these limitations. The 'MetaCopepod' project, based on the combination of next-generation sequencing and image analysis, aims to develop a fast, high-throughput, cost effective and accurate methodology, to assess and monitor the biodiversity of planktonic copepods in the Mediterranean, in terms of species composition, abundance, biomass and size-distribution, without the need of a taxonomy expert. To achieve this, bulk copepod samples are first analyzed using an image analysis software “trained” to automatically recognize, count and size-measure images of copepods. Subsequently, the same samples are massively sequenced for a selected DNA fragment (barcode). Through a bioinformatic pipeline, sequences are compared to a reference genetic database (which is constructed in the frame of the project) and identified at species-level. The combination of these approaches will allow to analyze copepod communities both qualitatively and quantitatively with accuracy. 'MetaCopepod' will have an immediate impact on copepod studies by unmasking hidden copepod diversity, and facilitating the identification of the numerous small-size species and early copepod life stages. In addition, it will create an efficient biomonitoring tool for detecting ecosystem changes due to global warming, bioinvasions and other human activities.

Micro-Computed Tomography (Micro-CT): A tool for interactive manipulation of 3D models

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Micro-computed tomography (micro-CT) has recently experienced a thrust of usage in biological research fields such as taxonomy, evolutionary and developmental research and functional morphology. Micro-CT is a method of non-destructive 3D x-ray microscopy, which allows the users to create 3D models of objects from a series of x-ray projection images, similar to the conventional clinical computer tomography. A micro-CT virtual lab is being developed in the framework of the LifeWatchGreece project (www.lifewatchgreece.eu). This infrastructure aims to link and integrate all data related to the biodiversity of Greece offering electronic services (e-Services) and virtual labs (vLabs) to facilitate both the data contributors and the users. The Micro-CT lab offers a collection of virtual galleries of several taxa which are displayed and disseminated through a web-based framework and a mobile application which allow the user to manipulate the 3D models through a series of online tools or to download the datasets for local manipulation. With a few clicks, accurate, three-dimensional models of organism can be studied, measured and virtually dissected without destroying the actual specimen. These cyber-specimens, therefore, contain a wealth of information for biodiversity researchers and widen our horizons for a variety of disciplines such as systematics, taxonomy, ecology or functional anatomy.

Keywords: virtual galleries, 3D volume rendering, cyber-specimen, mobile application, LifeWatchGreece

A new species and a new record of the genus *Dendarus* Dejean, 1821 (Coleoptera, Tenebrionidae, Pedinini) from western Anatolia

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Abstract. – Highly diverse Mediterranean beetle genus *Dendarus* Dejean, 1821, represented with 19 species throughout Turkey. Although most of the *Dendarus* spp. from Western Anatolia are belonging to the subgenus *Pandarinus*, *D. stygius* (Waltl, 1838) is the only representative of nominative subgenus. In this study, description of *Dendarus trichasi* **sp. n.** from the Bozdağ Mountains and the first record of *D. rhodius* Baudi, 1876 from Bodrum and Marmaris are provided new findings for nominative subgenus.

Keywords. – Coleoptera, Tenebrionidae, Pedinini, *Dendarus*, new species, new records, Turkey

Palaeoecological and taphonomical study of the microfaunal assemblage from the Palaeolithic- Mesolithic Cave 1, Klissoura, Argolis (Greece), using geometric morphometrics

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Palaeoecology is a tool extremely useful for both zoologists and palaeontologists, since it allows the scientist to “observe” the evolution of an area’s animal community through time and understand its changes due to the biotic and abiotic factors that occurred during a specific period of time. This has been the aim of the project presented herein, where microfaunal (Rodentia, Insectivora, Lagomorpha, Reptilia, Amphibia) teeth and bones from the Upper- Pleistocene Cave 1 from the Klissoura gorge (Argolis, Greece) were studied. The site’s stratigraphic sequence has been dated from 160000-10000 years BP and it bears traces of human and animal occupancy. The specimens were examined stereoscopically and were identified taxonomically and anatomically, while geometric morphometrics’ techniques were used upon 61 *Microtus* lower first molars, in order to determine if changes in their shape and centroid size were related to environmental or physiological factors. Concerning the results and their interpretation, the climate seemed to have had major influence over the microfaunal succession between the geological strata and the relationship between the studied rodent fauna, the human inhabitants of the cave and the area’s birds of prey also seemed to be important. Finally, the geometric morphometrics analysis revealed a clear relationship between the studied lower first molars’ centroid size and the climate, while their shape seemed to be determined by the morphology of the species (statistical errors due to unequal distribution of the studied teeth per geological stratum were deemed important but unavoidable).

""ΑΛΤ! ΤΙΣ ΕΙ?"- And if you were a spider, whose you would be?- a faunistic analysis of ground spiders at the NE borders of Greece"

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The Balkan Peninsula, of which Greece is a major and the most heterogeneous part, is an important share of the Mediterranean biodiversity hotspot. In a broader scale, Greece, and especially its NE area, represents a consequential connection to the neighboring Caucasian and Irano-Anatolian biodiversity hotspots, thus creating a geographical bridge between European and Asiatic elements.

The aim of the study was to create the first extensive checklist on the ground spiders of the National Park of Dadia, an important natural reserve at the NE borders of Greece (Thrace) and to conduct a first zoogeographical analysis. For this purpose pitfall traps were set in 15 sites located in and around the National Park, resulting in a large spider collection.

Of the 132 species recorded, 12 are new records for the greek territory and 7 are new species for science. European elements represent the largest share of the species inventory, followed by Widespread elements. Eastern, Mediterranean and endemic elements are less represented, but in total, they form about half of this fauna. In a more detailed analysis, the transition from the European fauna towards the Pontic, Mediterranean and Asiatic fauna becomes more evident, since the dominant chorotypes are the Eurasian, the Mediterranean, the Mediterranean-Middle Asiatic, the East Mediterranean and the Ponto-Mediterranean. The number of endemic species is low, represented mostly by local endemics of the Pontic, Balkan, Thracian or Rhodopian region and not by true Greek or Aegean endemics.

Diversity of polychaetes within the benthic boundary layer (BBL) over the continental shelf of the Cretan Sea

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The benthic boundary layer (BBL) is defined as the layer of water adjacent to the seabed which can be extended from a few centimetres to tens of metres, depending on various physical and biogeochemical both temporally and spatially. BBL supports both benthic and pelagic faunal organisms classified in different groups according to their swimming capacity and bottom dependence, and which constitute an important food source for demersal fish and epibenthic crustaceans. The present study describes the community structure of macrobenthic polychaetes living within the BBL of the continental shelf of Heraklion bay (Cretan Sea). Samples were collected at depths ranging between 50 and 200 m in two seasonal occasions (March and September 2001) by using a modified hyperbenthic sledge specifically designed to artificially resuspend the surface sediment and simultaneously to sample macrofaunal organisms (0.5 mm mesh size). The analysis of the macrobenthic polychaetes, revealed 142 different taxa with densities ranging from 12 to 646 individuals per 100 m². The results indicate the presence of a zonation of the polychaetes' communities along a depth gradient as well as seasonal adaptations to the prevailing environmental conditions. The polychaete diversity derived from the samples collected by using this modified sledge in comparison with the polychaetes collected by traditional sampling gears in different benthic surveys in the study area provide complementary information on the benthic assemblages of the continental shelf of the Cretan Sea.

Keywords: marine benthic polychaetes, benthic boundary layer, continental shelf, Cretan Sea, eastern Mediterranean

Molluscan diversity within the benthic boundary layer (BBL) over the continental shelf of the Cretan Sea

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The benthic boundary layer (BBL) supports epibenthic, hyperbenthic and zooplanktonic, mostly macrofaunal, organisms with different degrees of mobility and bottom dependence. BBL macrofauna is considered to be an important link in marine food webs as prey for demersal fish and epibenthic crustaceans, many of which are commercially important. The present study describes the macrobenthic molluscan community structure living within the BBL of the continental shelf of Heraklion bay (Cretan Sea). Samples were collected at depths ranging between 50 and 200 m in two seasonal occasions (March and September 2001) by using a modified hyperbenthic sledge specifically designed to artificially resuspend the surface sediment and simultaneously to sample macrofaunal organisms (0.5 mm mesh size of the nets). The analysis of the macrobenthic molluscan fauna, revealed 77 different taxa with densities ranging from 3 to 2690 individuals per 100 m². Results of this study indicate the presence of a zonation of the molluscan communities along a depth gradient and seasonal adaptations due to the prevailing environmental conditions. The molluscan diversity derived from the samples collected by using this modified sledge in comparison with the molluscan species collected by traditional sampling gears in different benthic surveys in the study area give complementary information on the benthic assemblages of the continental shelf of the Cretan Sea.

Keywords: marine benthic molluscs, benthic boundary layer, continental shelf, Cretan Sea, eastern Mediterranean

Late Pleistocene and Holocene extinctions on Eastern Mediterranean and Philippine islands

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The mammalian biodiversity on the islands of Eastern Mediterranean and the Philippines has been dramatically re-shaped since the end of the Pleistocene. Although in both island groups a significant part of the Pleistocene biodiversity has been lost, the extinction patterns were not the same between the two groups. On Eastern Mediterranean islands, nearly all endemic mammals became extinct at the end of Pleistocene or during the Holocene. Today, the only survivors from the Pleistocene are a shrew (*Crocidura zimmermanni*) from Crete, a mouse (*Mus cypriacus*) from Cyprus, and perhaps a rock-mouse (*Apodemus* cf. *mystacinus*) and a shrew (*Crocidura* sp.) from Naxos. On the contrary, the extinction on the Philippines, affected mainly the large-sized herbivores, such as elephants and rhinos, leaving the small- and medium-sized mammals practically unaffected. Today, there are numerous Pleistocene survivors on the Philippines, but the vast majority of them are rodents. The difference in extinction patterns between the Philippines and Eastern Mediterranean has to do with (1) latitude (biodiversity increases with decreasing latitude, the latitudinal diversity gradient), (2) the size of the islands (most Eastern Mediterranean islands are small and thus prompt to habitat loss due to environment change or/and human over-exploitation) and (3) the distance to continental land masses (the close proximity of Mediterranean islands to the mainland enabled easier introduction of alien species).

Keywords: biogeography, biodiversity, mammals

Sand dune biodiversity on Crete: the darkling beetle (Coleoptera: Tenebrionidae) assemblages of the coastal sand dunes of Crete

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Coastal sand dunes are aeolian landforms, found along the majority of the world's coasts, at the spatial transition between terrestrial and marine environments. During the last thirty years, almost 75% of Mediterranean coastal dunes have been damaged or destroyed, principally by activities related to tourism. Dune wildlife, both natural vegetation and animal activities, plays an important role to these systems' stability, while there are very few data concerning animal assemblages of these habitats on Greek coasts. We sampled by pitfall trapping 7 coastal sand dune sites on Crete and, in combination with NHMC collections of similar habitats on satellite islands of Crete, we investigated the tenebrionid communities of these areas. Dunes were chosen on coasts of east, west, north & south Crete in order to elucidate aspects of possible geographic determinants in the species distribution. Samplings took place bimonthly (in 2014 & 2015) and 32 taxa (± 11.000 individuals) of tenebrionids were collected. First results revealed well-defined darkling beetle communities across Cretan coasts, with 7 to 12 taxa per site and different species dominances in accordance to geography: among the larger beetles, *Erodius* spp. are distributed to the north & east coasts, while *Tentyria* spp. dominate the south & west coasts. *Tentyria grossa*, a west Mediterranean element is strictly distributed on west coasts, while the rest of *Tentyria* taxa (of central and east Aegean origin) are dominating the east and south coasts, as well as the southern islets of Crete. Finally, the status of rare and/or doubtful tenebrionid taxa was also elucidated through the present investigation (*Pachychila frioli*, *Pseudoseriscius* cf. *normandi*, *Calyptopsis* cf. *caraboides*, etc.).

Does size matter? : The species - area relationship for Trichoptera in the Aegean Islands (Greece)

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For more than eighty years, researchers have been attempted to study one of the most prevalent law in ecology, the species – area relationship (SAR). Many of these efforts have been focused in the Aegean Islands (Sfenthourakis, 1996; Dennis, 2000; Fatorini, 2002), and have shown that the number of species increases continuously as the area increases.

The present study aims to investigate the SAR in the Aegean Islands using Caddisflies fauna (Trichoptera) and to explore if other eco-geographical variables [elevation, isolation (both distance to the mainland and distance to the nearest island), endemism] may have important effect on this relationship. SAR was studied using the power relation between species and area of each island and different models were used to know the effect of each eco-geographical variable to explain island biodiversity.

A total of twenty-seven Aegean Islands, with well distribution throughout the whole Aegean area, were included in this study. The islands vary in area, ranging from 8260 km² (Crete) to 130.6 km² (Kea). Several Trichoptera species are represented by different species endemic to individual islands (e.g. 12 in Crete) or groups of islands (endemism of Kyklades). In North Euboea and Kos were found the highest (50) and the lowest (2) number of species, respectively.

The results concerning the spatial diversity patterns could assist efforts to understand these patterns and to contribute to our knowledge of community structure, in order to promote nature conservation initiatives. This is especially important in Greek islands where many Trichoptera species are endemics or currently endangered.

Keywords: island biogeography, Mediterranean, SAR, isolation, community ecology, biodiversity

Insular lineages of freshwater molluscs of Greece, are they limited, under-sampled or newly emerged? A quest using molecular phylogenies

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In Europe, the distribution of hydrobioids is centred in the Mediterranean. Greece is considered a “biodiversity hotspot” with high levels of endemism and species richness. Hydrobioids demonstrate a variety of morphological/anatomical attributes and high degree of genetic diversity. In Greek freshwater systems, 79 species and subspecies belonging to 29 genera have been recognised. Nevertheless, the taxonomy and classification of the taxa distributed in Greece, is far from being resolved. In recent years, several studies have used molecular data aiming to clarify the taxonomic status and assess the phylogenetic relationships of several of these taxa. A total of 25 species belonging to 11 genera have been studied within a phylogenetic/phylogeographic framework. Insular lineages are significantly under-represented in these endeavours. This is in contrast to phylogenetic studies involving other invertebrate and vertebrate taxa, in which the insular taxa are the focal ones. More specifically, only 8 insular species belonging to 7 genera have been included so far in phylogenetic studies. Is the under-representation of insular lineages due to their lower species diversity, are they under-sampled or less divergent? Aiming to provide some insights into these puzzling questions, we review the phylogenetic literature involving insular and mainland lineages of hydrobioids and present our major findings. Furthermore, using sequence data retrieved from GenBank, phylogenetic and time-estimate methods, we provide the temporal frame of differentiation of the insular lineages compared to the mainland ones. Future research guidelines are also discussed.

Keywords: diversity, hydrobioids, islands, phylogeny

Differences in activity of soil decomposers during the circadian cycle in an olive orchard

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The differences of activity during the circadian cycle were studied in an olive orchard in the campus of TEI Crete, at the western end of Herakleion city during a period lasting one month.

For this study were used ten pitfall traps, with propylene glycol as liquid. The collection of specimens and the replacement of the liquid were conducted twice per day; about an hour after dawn the morning and one hour before sunset the evening. The soil fauna was studied mainly at the level of orders. The total number of captured taxa was 26. This work is mainly focused on seven taxa of decomposers as Acari, Microcoryphia (Thysanura), Isopoda, Psocoptera and Collembola. This last order, which represented the majority of specimens, was divided in three suborders the Entomobryomorpha (most known families Tomoceridae, and Isotomidae), the Poduromorpha (Poduridae and allies) and the Symphypleona (Sminthuridae, Sminthurididae and other lesser known families).

The captures of Poduromorpha and Symphypleona were practically equal during day and night samplings, while the captures of Entomobryomorpha were twice during the day, but without to present a statistical difference.

Studying the biodiversity, by using the total of 26 taxa, the values of Shannon index were higher during the night at the time space 17 November – 3 December 2014 and the difference was statistically significant (ANOVA 99%). This difference remained statistically significant and when we examined all the duration of this experiment's phase (ANOVA 99%).

Keywords: soil decomposers, day – night activity.

The first ecological data for *Podarcis levendis*, one of the most rare lizards in Europe

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The ecological and conservation importance of insular endemics grows higher as the island size decreases. Species that are endemic to small islets are in the front line of conservation efforts and thus the good knowledge of their biology is required. *Podarcis levendis* is a medium sized lacertid lizard, endemic to the small rocky islets Pori and Lagouvardos (close to Antikythira Island, south of Peloponnese and north of Crete, Greece). Because of its extremely restricted distribution the species has been categorized as “vulnerable” by IUCN. *P. levendis* was elevated in specific level in 2008 and since then no data on its biology are available. Here we present the first ecological information on the species, focusing on thermal biology (the most significant parameter in reptilian biology) and antipredatory tactics. To evaluate the thermoregulatory effectiveness of *P. levendis* we measured operative and body temperatures in the field and the selected body temperatures in the lab. We also recorded regenerated and damaged tails in the field as a measure of antipredatory performance. Thermal data demonstrated that *P. levendis* is an active thermoregulator, achieving very high thermoregulation values ($E = 0.84$). The high thermoregulatory effectiveness comes to compensate living in an inhospitable habitat as the operative temperatures denote ($d_e = 8.54$). Regenerated tails were common and reached a considerable 72.7%. Further research is required to assert if the high percentages of regenerated tails are due to intraspecific competition or to predation pressure as the two islets are on an important avian migratory route.

National Wildlife Observation Network

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The National Wildlife Observation Network (www.paratiro.gr) collects data on incidents of sick and injured wild animals in the whole Greek territory. The network contributes to the recording of the wild animal's injuries, deaths and their causes (e.g. road accidents, poaching, electrocution, etc.), while the processing of the collected data will highlight priority areas that need special interventions in order to reduce risks for wildlife. It is currently the only organized nation-wide effort to implement Citizen Science i.e. the research based mainly on the collection and analysis of data by citizens, scientists or not, in terrestrial biodiversity issues. It is based on the use of modern technology which enables the use of new generation mobile phones that most citizens have at their disposal as devices for taking photos of the incidents, recording geographic data and commentary. The network exists since April 2015, and is operated by ANIMA - Hellenic Wildlife Care Association. Almost 100 citizens have registered around 300 incidents of dead or injured animals. Most of these incidents involve mammal roadkills (mainly hedgehogs, but also badgers, foxes and martens)

Keywords: citizen science, biodiversity, roadkills, animal death causes

The breeding population of the White stork in the National Park of Nestos Delta – Vistonida and Ismarida Lakes

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The area of East Macedonia and Thrace holds the majority (77%) of White stork breeding pairs in Greece and thus it is very important for the conservation of the species in the country. Between 2012-2014, we monitored on average 290 ± 22.72 nests annually, in the National Park of Nestos Delta, Vistonida and Ismarida Lakes, covering an expanse of 1.510 km². Earlier studies in the area are available for the period 1970-1991 and were used for assessing changes in demography and distribution of the population. Mean number of occupied nests (HPa) is 221 ± 30.64 and the mean number of nests with fledged young (HPm) is 198.33 ± 22.81 . Compared to the first study period, average breeding success (JZa) has increased from $1,54 \pm 0,51$ to $2,78 \pm 0,36$ FY/pair and average brood size (JZm) from $2,25 \pm 0,49$ to $3,09 \pm 0,44$ FY/nest. Currently average nest density is 11.52 breeding pairs/100klm² and the highest breeding density reached 45 pairs/100klm² locally in two areas of Xanthi prefecture. There are 5 villages which hold the largest concentrations (8-20 active nests), but the number of nests in these villages is reduced by 27-67% since 1970, with the exception of Genissea that still maintains a stable population of 20 active pairs. The most pronounced reduction of active nests is in the Chrysoupoli province, ranging from -25.7 to -89.6% locally. This dramatic decline is caused by agricultural intensification. Since 1970 there is a marked drop of nests located on buildings (50.5% in 1970, 3.8% at present) and on trees (25.8% to 0.38% respectively), with most nests (54.7%) currently located on electric poles with platforms.

Keywords: White Stork, East Macedonia & Thrace, Distribution, Breeding population

A status assessment of the mesocarnivores (Mammalia: Carnivora) in Chelmos-Vouraikos National Park and Geopark

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The fauna of medium-sized mammals in Chelmos-Vouraikos National Park and Geopark was surveyed during the summer period of 2015. The survey focused on the priority species of the Habitats Directive, particularly the Eurasian otter (*Lutra lutra*), the golden jackal (*Canis aureus*) and the European wildcat (*Felis silvestris silvestris*). Regarding the wildcat, the Park region is considered to be its southernmost area of expansion within the Greek mainland, however its status in Greece is rather unknown. Both the Eurasian otter and the golden jackal are classified as 'Endangered' in the Red Data Book for Greek Vertebrates, however the otter's distribution in Peloponnese hasn't been studied since the 1980s. Our goal was to collect baseline information, regarding the distribution and, where possible, assess the conservation status of the three species populations. Sampling comprised camera trappings, Bio Acoustic monitoring for the golden jackal and the implementation of the Standard Method for otter surveys. Results revealed that the otter is widely distributed in the National Park, since spraints were found in nearly 70% of the surveyed sites. Territorial golden jackal groups were detected mainly along Vouraikos gorge, where at least 14 individuals were counted. Jackals seem to have expanded their distribution since the last survey of 2009, when established groups were confined around Vouraikos river springs. Camera traps showed no clear evidence of wildcat, suggesting that species presence is rather scarce in the area. As expected, foxes, badgers and beech martens proved to be the most prevalent mesocarnivores.

Keywords: Otter, Jackal, Wildcat, Monitoring, Habitats Directive

The study is funded by the Management Body of Chelmos-Vouraikos within the framework of the project "Monitoring of the fauna species of the European Directives 92/43 and 79/409" under the action of the Operational Programme Environment and Sustainable Development 2007-2013 "Protection and Conservation of the Biodiversity of Chelmos-Vouraikos National Park".

Soil nematode community structure in differently-aged forests of Epirus, Greece

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The diversity and abundance of soil nematodes makes them important indicators of soil functioning in forest ecosystems. In this project, the soil nematode community structure was studied in sixteen forested areas at the mountainous region of Epirus, belonging two by two to four forest types and two ages. Forest types included black pines (*Pinus nigra*), mixed broadleaves (*Ostrya carpinifolia* - *Acer obtusatum* - *Quercus* spp), broadleaved oaks (*Q. cerris* - *Q. frainetto*) and prickly oaks (*Quercus coccifera*). Regarding the age of the forests, we studied a) old-growth forests belonging to the network of Sacred Natural Sites (SNS), i.e. forests protected and conserved for religious reasons for centuries, and b) younger forests that have developed on abandoned meadows that were used for livestock grazing until WWII. Forests of the same type and different age shared common habitat characteristics, such as orientation and parent rock substrate. The forest type affected almost all parameters of the soil nematode community. Total nematode abundance as well as the abundance of almost all trophic groups were highest in prickly oaks and mixed broadleaves, and lowest in broadleaved oaks and black pines. The age of the forest affected the trophic structure of the nematode community. The old-growth forests were characterized by higher abundances of bacterial feeders and the *k*-selected omnivores.

This research is co-financed by the European Social Fund (ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" under the project THALIS-«Conservation through religion. The sacred groves of Epirus».

Feeding niche overlap and food selection between two morphs of the smooth newt *Lissotriton vulgaris* living in sympatry

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The existence of alternative ontogenetic pathways in Amphibians (i.e. facultative paedomorphosis) has been proposed as an evolutionary “vehicle” towards the minimization of intra-population competition. We examined the feeding ecology of paedomorphic and metamorphic smooth newts living in sympatry in a breeding pond in Ioannina (NW Greece), in order to examine the existence of possible competition between them over their resources. To determine whether food partitioning occurred between the two co-existing morphs, as well as between sexes in paedomorphs, we performed seasonal samplings and the captured individuals were stomach- flushed in order to investigate their stomach content and compare it with food resource availability. Food niche breadths found to be higher in metamorphic newts in autumn, winter and spring. However, in the summer and in the absence of the potentially antagonistic metamorphosed newts, food niche breadth of the paedomorphs increases highly. Similarly, food niche breadth was found to be higher in male vs female paedomorphs in three out of four seasons. Numerical analyses of stomach content showed that, both morphs, as well as both sexes, displayed high food selection since different prey categories were consumed disproportional to their availability. High food niche overlap was observed between morphs and between sexes, suggesting that both morphs and both sexes display diet convergence rather than partitioning their food resources. This is in contrast with the expectation that resource partitioning actually favors the maintenance of facultative paedomorphosis in natural populations. However, such situations that imply increased inter-morph and intra-sex competition may also indicate that food resources are not a limiting factor in the study pond.

Keywords: paedomorphosis, diet, feeding ecology, stomach flushing

Mediterranean node of Ocean Biogeographic Information System

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MedOBIS is the Mediterranean node of the Ocean Biogeographic Information System (OBIS). It is integrated as a virtual laboratory in the LifeWatchGreece Research Infrastructure (ESFRI) that aims to integrate and link data related to the biodiversity of the Mediterranean, and offer applications to facilitate both data gathering and data analysis. Specifically, MedOBIS will: (a) search for existing datasets in electronic and paper format; (b) digitise them, if necessary; (c) reformat them so to be Darwin Core standard format compliant; (d) provide them to OBIS, and ultimately to the Global Biodiversity Information Facility (GBIF). The virtual laboratory will provide a reliable repository for standardized data, tools for quality control, and visualization tools. MedOBIS reliably manages and stores data with PostgreSQL database and publishes data in a variety of formats using Geoserver. The structure has been adapted from the OBIS and EurOBIS databases. Weekly satellite Mediterranean data will be freely available. The data follow the Open Geospatial Consortium standards. Using OpenLayers and GeoExt, a flexible user interface is being built. It is connected to Geoserver in order to query species occurrences, the corresponding satellite values, other spatial information. Users can visualize, map, publish and download the results in different formats (CSV, Geojson, WMS, WFS, KML). Six datasets are currently in the database. There are 144 datasets located in the Mediterranean, available from the EurOBIS node. MedOBIS will repatriate these datasets. In addition, a MedOBIS mobile application is experimentally applied to run on smartphones and tablet computers.

Keywords: obis, gbif, geoserver, openlayers, postgresql

Is the eastern Mediterranean basin a data-poor spot for biodiversity? Digging for historical biodiversity datasets (pre-1945) from Egypt

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The aquatic biodiversity of the southeastern Mediterranean is considerably understudied compared to most northern Mediterranean regions. Monitoring biodiversity in this area is crucial as this region is particularly susceptible to biological invasions and temperature alteration. Historical biodiversity data could provide a useful basis for monitoring potential alterations although it is often fragmented and found only in hard copy and grey literature. In this study, performed under the LifeWatchGreece infrastructure, we present preliminary results from the digitization of biodiversity data from various sampling expeditions carried out from 1904 to 1933 in Egyptian waters. Biodiversity records were georeferenced to more than 180 stations, mostly located in the marine area off Alexandria, in the Suez Canal, alongside the river Nile and in a number of lakes. All records were digitized and species names were cross-checked and taxonomically updated using the World Register of Marine Species. Overall 2,256 records of marine and freshwater biota were digitized, belonging to 15 phyla of the kingdoms Chromista, Plantae and Animalia. Despite the many challenges encountered during the digitization process (e.g. taxonomic updates, exact georeferencing, misspellings of taxa and places, compiling overlapping information from different publications), the outcome clearly shows that such initiatives can reveal an unexpected amount of highly valuable biodiversity information for “data-poor” regions. Future steps include the ongoing digitization of additional publications from Egypt and other areas of the Eastern Mediterranean Sea, the publication of the data in global biogeographic databases and the exploration of tools assisting with the automatic extraction of data.

Keywords: aquatic biodiversity, LifeWatchGreece Research Infrastructure, World Register of Marine Species, Alexandria, Suez Canal, Nile

Island wetlands as a stopover, wintering and breeding areas for birds. Bird ringing in Potamos wetland, Malia, North Crete, Greece

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Mediterranean island wetlands are biodiversity hot spots with international interest due to bird migration. The successful management of these areas can be based on bird monitoring, by using bird species as an indicator. During 2011 to 2015, bird ringing was carried out in the Potamos wetland, Malia, North Crete. The aim of this paper is to contribute to the protection and management of the study area by the presentation of the ringing data of the most important species, biometrics and recoveries. Potamos wetland is a stopover place for migratory birds, invaluable wintering and breeding area for various bird species. A total of 8950 birds belonging to 74 different species were ringed. 58% of the species were passerines migrating from or to wintering areas. Several species, connected to marshes like *Acrocephalus* sp., *Locustella* sp. and *Porzana* sp. and also *Anthus trivialis* and *Phylloscopus trochilus*, use the wetland as a stopover place. Moreover, the reedbed can provide a safe roost for *Hirundo* sp., *Riparia riparia* and *Motacilla flava*. Potamos wetland seems also to be an important wintering area for *Rallus aquaticus*, *Acrocephalus melanopogon*, *Phylloscopus collybita*, *Emberiza schoeniculus* and occasionally, *Remiz pendulinus*. Rare species such as *Luscinia svecica* and *Phylloscopus fuscatus* were ringed. In general, the presence of all of the above mentioned species in good numbers depends on the water level in the wetland. Conservation actions aiming to prolong the presence of the water in the reedbed, mainly during migration, would be beneficial for the wetland's biodiversity.

Keywords: Island wetlands, bird migration, wintering, bird ringing, Crete

Determination of Glutathione S-Transferase and Acetylcholine Esterase Enzymes Activities of *Anopheles sacharovi* Populations in Turkey

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Anopheles sacharovi is an important vector of malaria in Turkey and has widespread distribution in many parts of Turkey. As malaria vector control becomes increasingly reliant on successfully managing insecticide resistance, the characterisation of resistance mechanisms becomes increasingly important.

The objective of this study was to evaluate enzyme activity levels responsible for the insecticide resistance in the *An. sacharovi* populations from Southeastern Anatolia and Mediterranean parts of Turkey.

Larvae and adult samples of *An. sacharovi* were collected from eight different localities in the Mediterranean and Southeastern Anatolia regions. *Anopheles* were identified using morphological identification reference keys. Two enzymes were tested; Acetylcholine Esterase (AChE), which is the target site in organophosphate and carbamate insecticide resistance and Glutathione S-Transferases (GSTs), which have a significant role in the detoxification of organochlorine and pyrethroid insecticides. Samples taken from laboratory colonies of *An. sacharovi* were also tested for comparison with the field-collected populations. GSTs and AChE levels were measured individually in the adult females as described by the WHO for possible biochemical insecticide resistance mechanisms. Statistical significance of differences in enzyme activity values of field-collected populations compared with laboratory colonies was examined using Mann-Whitney U test (SPSS 20).

The level of AChE enzyme activities in all localities were found at higher levels in the resistant groups than in the susceptible groups ($p < 0.05$). It was also found that, the level of GST activity in these localities were significantly different from laboratory colonies ($p < 0.05$) except two localities (Kahramanmaraş/Türkoğlu and Muğla/Fethiye, $p > 0.05$).

The detected differences in GSTs and AChE levels between resistant and susceptible mosquitoes have important implications for our understanding of insecticide resistant populations of malaria vectors in Turkey.

Keywords: *Anopheles sacharovi*, GSTs, AChE, Enzyme Activity, Turkey.

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Herpetofauna surveys in protected areas: a case study from Zakynthos

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Anthropogenic activities degrade natural habitats with deleterious effects for the herpetofauna. Protected areas function as conservation pockets, providing the required undisturbed habitat for the survival of many threatened species. The condition of amphibian and reptilian populations, which are important bioindicators, is of pivotal importance for the assessment of the conservation status. The network of the 27 protected areas under the scheme of Management Bodies represents the most useful conservation tool in the country. In 2014 and 2015 we surveyed the herpetofauna of the National Marine Park of Zakynthos. We employed three different, complementary methods: line transects, time constrained surveys and road cruising. Line transects were chosen randomly to maximize the representativeness of the sample. During time budget method we turned rocks and logs, disturbed the leaf litter and searched for inactive individuals. We also drove a car at a low speed to encounter snakes or dead individuals. Our findings strongly enhanced the NATURA 2000 standard data forms in both Zakynthos (GR2210002) and Strofades (GR2210003) with eight and two new species respectively. In the case of Zakynthos two species (*Emys orbicularis* and *Elaphe quatorlineata*) are of top conservation priority and belong to Annex II of Directive 92/43/EEC. Furthermore in Strofades Islands we did thorough population density estimates for all five reptiles inhabiting this insular cluster. Species distribution and habitat condition were plotted in detailed GIS maps. Our findings further expand the available information considering herpetofauna occurrence and distribution while they contribute toward the effective conservation and management of wildlife.

A tale of tails: Phylogeographic analysis of *Podarcis erhardii* and *Podarcis muralis* suggests additional refugia in Southeastern Europe

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We studied the phylogeography of two wall lizards (*Podarcis erhardii* and *P. muralis*) across the entire species' distribution, in order to reevaluate the existing knowledge by adding several new samples from mainland Greece. More specifically, the current study aimed to infer levels of genetic diversity and detect putative glacial refugia in the southern Balkans. For this purpose, we used a fragment of 243bp of the mitochondrial cyt b gene from 447 specimens (59 *P. erhardii* and 388 *P. muralis*). The phylogenetic relationships of haplotypes were determined using Maximum Likelihood and Bayesian Inference. A total of 30 *P. erhardii* haplotypes were found, forming two distinct clades that comprised samples from mainland and Cyclades respectively, with an average p-distance between them of 12.1%. Concerning *P. muralis*, a total of 124 recognized haplotypes were grouped in 11 distinct clades, with a p-distance among them ranging from 0.4 to 7.9%. Four of them (clades C, D, E and M) were located exclusively in Greece, expressing among-clade p-distances from 4.1 to 5.4%. Another clade (L) seems to be confined in SE Europe, comprising samples from the Greek island of Samothraki and western Turkey, and exhibits a relatively high p-distance of 4.2-7.9% from all the remaining clades. The existence of numerous and well-differentiated evolutionary lineages within a small geographic area, implies greater isolation in multiple southern refugia than previously assumed, and conforms to the "refugia-within-refugia" hypothesis.

Keywords: Lizards, Greece, southern Balkans, cyt b, Bayesian Inference

Preliminary results on the small mammal fauna (Chiroptera – Rodentia) of Chelmos-Vouraikos National Park and Geopark

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We present the first results (May-June 2015) of the ongoing systematic survey on the small mammal fauna (Chiroptera-Rodentia) within Chelmos-Vouraikos National Park and Geopark. Our primary goal was to collect baseline information on local bat and rodent diversity, since available data were scarce. With regard to bats, roost searches and captures, mist netting at foraging sites, and acoustic surveys were applied. Nineteen species have been recorded to date through the current ongoing project and from older data (totaling 56% of Greek species). The most important findings include the only known large colony of *Plecotus kolombatovici* in Greece, and the presence of 8 Annex II species in 'Spilaio Kastrion' (GR2320009), many of which form maternity colonies, despite it being in part a show cave. With regard to the rodent diversity, live-trapping was conducted using Sherman traps on the ground and on trees of two sites, aiming at ground- and tree-dwelling species. In the 'Aisthitiko Dasos Kalavryton' (GR2320004), the yellow-necked field mouse *Apodemus flavicollis* was either found alone or sharing rocky substrates with the western broad-toothed field mouse *A. epimelas*. In a hazelnut mixed forest next to Lake Doxa, *A. flavicollis* was the only ground-dwelling species caught. The long-tailed field mouse *A. sylvaticus* was absent from both sites. In all cases, recapture rate became high, as field mice became rapidly accustomed to the traps in their areas. Important results include the finding of the dormice *Myoxus glis* and (the rarely encountered) *Dryomys nitedula*, which constitute first reports for the National Park of Chelmos-Vouraikos.

Keywords: National Park, Geopark, Conservation, Monitoring, Habitats Directive, Natura 2000

The study is funded by the Management Body of Chelmos-Vouraikos within the framework of the project "Monitoring of the fauna species of the European Directives 92/43 and 79/409" under the action of the Operational Programme Environment and Sustainable Development 2007-2013 "Protection and Conservation of the Biodiversity of Chelmos-Vouraikos National Park".

Bats (Mammalia: Chiroptera) of Cephalonia Island, Greece

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Bats of the National Park of Mt. Ainos and Cephalonia Island were systematically surveyed for the first time within the framework of the project “Protection and Conservation of Biodiversity in the National Park of Mt. Ainos” under the demands of Art. 17 of the Habitats Directive. Available data were scarce, therefore, we aimed to collect baseline information and, where possible, assess the conservation status of local bat populations. Fieldwork was conducted in November 2012, June and October 2013, and August 2015. Sampling comprised roost searches (primarily caves) and captures, mist netting at foraging sites, and acoustic surveys. In total, 18 species (53% of all species in Greece) were recorded in 23 days of fieldwork. The most common bats were *Pipistrellus pygmaeus* and *Nyctalus leisleri*. The latter species showed seasonal change in sex composition with predominantly males present in summer and more females appearing in autumn. We explored 12 known caves including sea caves and potholes. Five caves contained important mixed species colonies of several hundred individuals, including eight Annex II species, and showed seasonal fluctuations in species composition and abundance. Only one of these caves, however, is located within the borders of a Natura 2000 site and the National Park of Mt. Ainos. We propose that the existing Natura 2000 sites of the island be expanded to incorporate all of these caves to ensure their conservation, particularly as access to the caves for leisure activities is not controlled.

Keywords: National Park, Conservation, Monitoring, Habitats Directive, Natura 2000

[The study was conducted under the umbrella of the Management Body of the National Park of Mt. Ainos, the Universities of Thessalia and Patras, and the Aristotle University of Thessaloniki, Greece. The project was funded by the Operational Programme “Environment and Sustainable Development 2007-2013”.]

The effect of urbanization on the body length of *Scolopendra cretica* (Chilopoda, Scolopendridae)

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The effect of global urbanization has been a major force that may potentially alternate or eliminate natural habitats. Human influence on urban ecosystems increases as we move from natural habitats to the city. In environmental studies, an urban-rural gradient approach has been introduced in order to study ecological alternations along this continuum. Body length of *Scolopendra cretica* was studied as an expression of age class, along an urbanization gradient (urban-suburban-rural zones), with the use of pitfall traps in and near the city of Irakleio (Crete, Greece) from November 2010 until November 2011. Our results show that there is statistically significant difference between the body length of *S. cretica* in the suburban and rural zone, where the body length in the later zone is higher. Also, the highest number of individuals was found in the suburban zone, while inside the city, the number of individuals is remarkably low. In short, although *S. cretica* is found in a wide altitudinal range and in numerous natural habitats in Crete, it shows narrower tolerance limits to urban environments and human disturbance.

Keywords: urbanization gradient, age class, abundance, Iraklion

DNA barcoding and male genital morphology reveal six cryptic species in the West Palearctic bee complex *Seladonia smaragdula* (Vachal, 1895) (Hymenoptera: Apoidea: Halictidae)

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The species complex *Seladonia smaragdula* (Vachal, 1895) is a group within the sweat bee family Halictidae, which are one of the main and ubiquitous pollinators in Mediterranean ecosystems. Using DNA barcoding as well as morphological features, primarily of the male genitalia, we recognized six species within this complex. The first author recognized the existence of 5 forms since many years referring to them as form A to E. A lectotype is designated for *Seladonia smaragdula* (Vachal), which agrees with the form A. The other five species, new to science, will be referred to as species B to F.

Species E and *S. smaragdula* showed a strongly supported sister relationship in our phylogenetic analysis, while the relationship between species B, species C and species D remains unclear. Species F seems to represent a relict species endemic to Crete and Karpathos with a highly divergent COI sequence.

The three species with a core distribution in the Eastern Mediterranean are: species D, species E and species F. Species E is restricted to the Eastern Mediterranean and has an allopatric distribution with its Western Mediterranean sister species *S. smaragdula*.

Species D occurs on the Italian Peninsula and the Eastern Mediterranean region and has a sympatric distribution with species E in the Eastern Mediterranean. Preliminary results from the Aegean Islands indicate a difference in their habitat requirements. The endemic species F needs further study and is of conservation significance. The overlapping geographic distributions suggest a complex biogeographic history of the Eastern Mediterranean species.

Keywords: new species, bees, endemic, Greece, Eastern Mediterranean

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Natural History Museums are fascinating to visit. Their Zoological collections range from huge whales to microscopic organisms. They are the most important source of information on earths' biodiversity (Chalmers, 2000) and in the same time contribute to our understanding of what we have already lost" (Lincoln & Rainbow, 2003). In Greece 53 Natural History Museums are open to the public. 20 of them are in Attiki, 10 in North Greece, 1 in Central Greece, 3 in Peloponnese, 3 in Crete, 3 in Thessalia/Magnisia, 3 in Evia, 4 in Aegean, 1 in Ionio, 2 in Cyclades and 2 in Cyprus. Twenty-five of them are presenting zoological collections also of endemic species and only 5 Museums preserve specimens for scientific purposes. It is important for these specimens to can easily be used by all researchers as reference source. Specimens require special care. They were donated to the museum or collected by the museums' scientists during field works. Some have been preserved with the method of taxidermy where others in bottles of alcohol that has proved to be not only fully effective but also relative cheap and non toxic. Specific storage conditions are required for the collections and most importantly right labelling. A specimen without data is useless. What is the future of these collections? As technology develops new possibilities and benefits will come along.

Habitat affects the feeding ecology of the Balkan Water frog

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The Balkan Water frog (*Pelophylax kurtmuelleri*) is the most widespread frog in Greece while it also occurs in Albania, Montenegro and Serbia and has been introduced in Italy and Denmark. However its biology remains surprisingly understudied. Here we assess for the first time the feeding ecology of the species. We worked with two populations from Attica (central Greece), one from a natural habitat (Erasinos River in Vravra) and another from an artificial landscape (Diomidous Botanical Garden). We aimed to compare the impact of the habitat on the feeding preferences of the Balkan Water frog, and also to examine how food availability affects food composition and selectivity. For the purposes of the study a total of 75 individuals (41 from the Botanical Garden and 34 from Erasinos River) were captured and stomach content was removed following the flushing method. Prey availability was evaluated with the quadrat counts method. The food preferences of *P. kurtmuelleri* conform to the general feeding patterns of other ranid species in the Balkans with insects dominating in stomach content whereas spiders, isopods and gastropods comprised an important part of the diet. The habitat had a clear effect on the diet of the species: the two populations differed in all partial prey parameters examined, that is, composition, frequency, size and volume. Furthermore, the two populations showed a different degree of selectivity in regard to the available food resources in each habitat.

Detecting changes on the spatial distribution of seagrass meadows through Earth Observation – A case study from the Samaria National Park

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Posidonia oceanica is seagrass species endemic to the Mediterranean Sea and a key species in the coastal zone. It is widely employed as the ideal biological indicator for assessing the quality of water under the Water Framework Directive (WFD) as well as for assessing the health status of coastal ecosystems. To achieve both, it is crucial to develop a network of monitoring stations and an update mapping of the spatial extend within the area of interest, in our case Samaria National Park. It is one of the biggest National Parks in Greece, including the well-known gorge of Samaria, part of the NATURA 2000 network (SCI: GR4340008) and has an extended coastline of 32 km. The information about the spatial extent of the seagrass meadows from the area is poor and is dated back to 2000. QuickBird and WorldView II pansharpened very high resolutions (VHR) satellite images from two periods (2003 and 2014) have been used in order to map the spatial extend as well as to identify changes in the shapes due to loss of extend. No changes have been found after the analysis of the two images and a comparison with the old data show several mistakes in the initial dataset. Earth observation can support a continuous monitoring of the changes and thus should be a mandatory tool in the arsenal of the environmental scientists that couple with conservation actions.

Keywords: Seagrass monitoring, Earth Observation, VHR imagery, Cretan Sea, Eastern Mediterranean

A spatio-temporal dynamic protection network for brown bears (*Ursus arctos*) habitat in Greece

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In Europe, most bear populations are strictly protected under the Habitats Directive (Annex II, priority species), with all populations being listed in Annex IV. However, habitat loss due to infrastructure development, disturbance and accidental human-caused mortality are among the major threats to the European brown bears. A number of studies have indicated that brown bears respond to traffic and show a selection of road and roadside habitats. Primary roads with heavy traffic are avoided, while secondary, forestry roads and trails seem to serve as an attractive habitat feature to brown bears, due to food resource opportunities and low energy cost movements. Thus, management policies for the conservation of bears should focus on integrated approaches taking into account this complicated, multivariate and human-induced pattern of brown bears' spatial behavior. We investigated the potential complementarity of Roadless Areas (RAs) in the European Natura 2000 (N2K) network with view to ensuring brown bears' population conservation. The dynamic features of the proposed network refer to the expansion of N2K sites through the integration of RAs that contain low traffic roads (i.e. forest roads or trails) and are not strictly roadless as the brown bear, shows a positive selection for these habitat types. At a temporal dimension, restrictions in the use of the road network could be enforced for the spring-summer period when bears are more active. This integrated network in combination with other effective mitigation measures could decrease the conflicts between bears and humans, while protecting high-quality bear habitats in a time-and-cost-effective way.

Mount Parnon: a micro-hotspot of freshwater-dependent biodiversity in Greece

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Even though the terrestrial mollusc fauna of Mt Parnon (Eastern Peloponnissos, Greece) has been already thoroughly investigated and the ecological and biogeographical insularity of its peaks has been illustrated, the hydrobiid fauna (Caenogastropoda, Truncatelloidea) of this mountain remains almost unknown. An exhaustive survey of hydrobiids in 38 localities (springs, fountains, cisterns, streams and rivers) was done in this area, during 2014 and 2015 within the framework of the National Natura 2000 Monitoring Survey supervised by the Management Body of Mount Parnon and Moustos Wetland. Fresh material was collected by hand from stones, gravel, mosses and dead leaves and preserved in 99% ethanol for genetic analysis and 70% ethanol for anatomical study. Hydrobiids were found in 32 localities. Three hydrobiid genera were recorded in one locality. In all the other cases one or two taxa were found. The most frequent genus was *Bythinella* Moquin-Tandon, 1856. The presence of the local endemic species *Bythinella beckmanni* A. Reischütz, P.L. Reischütz & W. Fischer 2008 was confirmed. Several other hydrobiid taxa were recorded in the studied area. Our findings reveal that Mt Parnon hosts an unusual plethora of locally endemic hydrobiid species and identify this mountain as a micro-hotspot of freshwater-dependent biodiversity in Greece.

The study was conducted under the umbrella of NCC Ltd. The project was funded by the Operational Programme "Environment and Sustainable Development" and co-funded by European Regional Development Fund.

The role of mtDNA diversity in adaptations of hybrid water frog (*Pelophylax* spp.) populations from Southeast Europe

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The Balkan Peninsula and eastern Mediterranean are home for a variety of *Pelophylax* genetic lineages. We examined mitochondrial DNA (mtDNA) variation in hybrid *Pelophylax* populations from southern parts of the Pannonian Basin and a north-south transect of the Balkan Peninsula. Geographically restricted *P. epeiroticus* in central and southern Balkans and the widespread *P. lessonae* in European populations hybridize with *P. ridibundus* and form numerous hybrids that carry genomes from the both parental species. We found an exceptional intraspecific variation and geographic divergence in both the *lessonae* and the *epeiroticus* mtDNA phylogenetic lineages. Within the *lessonae* lineage, the divergent *lessonae* haplotype was found in the Ulcinj (Montenegro) locality, with the genetic distances between this type and the other *lessonae* from northern Serbia comparable to those between the *ridibundus* and *epeiroticus* types. The divergence of smaller scale occurred within the *epeiroticus* clade for the Ioannina population in Epirus and the Lysimachia population in Western Greece, which were shown to carry different *epeiroticus* mtDNA haplotypes. This suggests that these three populations have been isolated for a considerable time by physical barriers of the Dinaric Alps and Pindus Mountains, which dominate the western and southern regions of the Balkan Peninsula. The *lessonae* mitochondria were found to be more effective under hypoxic conditions compare to the *ridibundus* ones and the mitochondrial types that have diverged in isolated environments in this area most likely have the same function. Genomic diversity of combined parental genomes that gives higher fitness to hybrid animals and the type of mitochondria less sensitive to oxygen deficiency, they carry on could both offer an adaptive advantage through their better survival rates in various and challenging environments.

Keywords: Balkans, water frogs, hybrids, mtDNA, mitochondria, geographic isolation

Recovery times in Brown Bears in Greece using zolazepam-tiletamine/medetomidine and atipamezole

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During brown bears (*Ursus arctos*) handling operations for telemetry purposes in NW Greece, necessary adjustments on anaesthetics dosage addressed both crew safety and bears welfare issues. In early operations, using zolazepam-tiletamine/medetomidine and atipamezole as reversal, we faced problems of prolonged bear recovery time in human populated areas. During the following years our intention was to minimize the quantity of drugs but also to optimize immobilization process, with precise estimation of bear weight and reduction of total bear handling time to a maximum of 1h. In 2003-04 the dose of zolazepam-tiletamine (ZT) / medetomidine (MT) ranged from a minimum of 4,7mg/26µg/kg of bodyweight to a maximum of 11,4mg/64µg/kg (average 7,45mg ZT/58µg MT/kg). With this combination the atipamezole initial effects started within 36 min average, whereas complete bear recovery averaged 5h and 19min. In the 2007 sample (n=10) the combination of ZT / MT ranged from a minimum of 1mg/3µg/kg to a maximum of 2.3mg/6µg/kg (average of 1.48 mg ZT/ 4.5µg MT). The antipamezol dosage ranged from 15µg to 37µg/kg (average 24µg/kg). Total recovery time decreased to 4-90 min (average 22.5 minutes). In the 2008 sample (n=8) ZT/MT was delivered with a min of 0.5mg/3µg/kg to a max of 1.31mg/6µg/kg (average 1.0mg/3.7µg). The antipamezol ranged from 13µg to 26µg/kg (average 19µg/kg). Total bear recovery time dropped to 3-9min (avg 5.5 minutes). In the 2011 sample (n=6) ZT/MT was 1.1mg/1µg/kg min to 1.4mg/3µg/kg max (average 1.2mg/2µg). The antipamezol dosage ranged from 2µg to 15µg/kg (average 7µg/kg). Total bear recovery time dropped to 2-8min (4min 12 sec). In the 2012 sample (n=7) ZT/MT was 0.8mg/1µg/kg min to 1.5mg/5µg/kg max (average 1.1mg/2µg). The antipamezol dosage ranged from 4µg to 13µg/kg (average 10µg/kg). Total bear recovery time dropped to 1-6min (4.5min).

Keywords: brown bears, anesthesia, drugs, dosage.

Valuation of drifting longlines fishing operations in the fleet of Kalymnos (Dodecanese, NE Aegean)

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Fishing effort valuation is an important for a sustainable fisheries management. The present study took place in the island of Kalymnos (Dodecanese, NE Aegean Sea) the recording of fishing operations of the fishing logbooks for fishing vessels with the main gear drifting longline for the year 2013-2014 and the simple random sampling technique. Data from a total of 331 fishing operations were registered, with the drifting longline (97,0 % the fishing operations) being the most used fishing tool and pot (3,0 % the fishing operations). Four target species were recorded as catch (*Xiphias gladius*, *Thunnus thynnus*, *Thunnus alalunga*, *Palinurus elephas*), with a total catch of 213630 tones for 2013 and 237548 tones for 2014. Per fishing operations caught by 0-2 target species (1,0, $\pm 0,23$). The size of hooks were used from 150-2800 hooks (849,91, $\pm 378,00$) and hook numbers 2,3,6. Identified 29 landing ports in the region of Greece. One-way ANOVA detected significant differences between season and selling price (€/Kg)(ANOVA, $F=8,999$, $\alpha=0,05$, $P=0,0001$). The Hierarchical Cluster Analysis combined with K-Means Cluster identified 3 *métier*, with the drifting longline being the most used fishing tool. When there was persistent targeting of the same species of a specific gear type, these fishing operations were formed a distinct *métier*. This was the case for pots with the target species *Palinurus elephas*. A total of 4 *métiers* was defined in terms of fishing gear, target species and season. The analysis of the results shows that fishing operations intensity during the reproductive period of specie *Xiphias gladius*.

***Aphanius almiriensis*: an established and breeding population in Moustos wetland**

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Aphanius almiriensis (Almiri Toothcarp) is an endemic species of the E. Peloponnese and is considered as Critically Endangered in The Red Data Book of Threatened Animals of Greece. Its type locality refers to two springs: Kato Almiri (Saronikos Gulf) and Meligou (Astros Kinourias). The species is considered very rare or even extinct at K. Almiri while at Meligou is considered to survive in the adjacent lagoons of Moustos wetland without any further knowledge available. The aim of the present study was to investigate the presence, the status and biology of the species population in Moustos wetland. Samples were collected on a seasonal basis from June 2014 to April 2015 using a beach seine and a hand net. Due to its conservation status, samplings were based solely on non-lethal methods and individuals were returned to their ecosystems. Species abundance and individuals' total length (0.1 mm) were recorded. Sex was determined macroscopically. Almiri Toothcarp was found in high abundances (387 individuals) and the population composed of individuals from 18 (YOY) mm to 52.3 mm (female). Sexually matured males and females were both sampled. These results indicate the existence of an established and breeding population in Moustos wetland. This is of great importance for the species survival given that ecosystem management efforts should be implemented to protect its vulnerable remaining population.

The study was conducted under the umbrella of the University of Ioannina. The project was funded by the Operational Program "Environment and Sustainable Development" and co-funded by European Regional Development Fund.

Genetic uniformity in the Dalmatian *Algyroides* (*Algyroides nigropunctatus*) from the Greek mainland

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The Dalmatian *Algyroides*, *Algyroides nigropunctatus*, ranges along the eastern Adriatic coastal region to western Greece and the Ionian islands. Based on a limited number of samples, the current phylogeny of the species suggests the existence of three clades with low divergence among them. In this study we aim to expand the existing knowledge on the phylogeography of the species by adding several new samples from the Greek mainland, sequenced for a 526bp fragment of the mitochondrial 16S rRNA gene. Both Bayesian Inference (BI) and Maximum Likelihood (ML) analyses produced highly supported trees with identical topologies. Our results are in accordance to previous studies in respect to the number of clades. However, the phylogenetic relationships of the three clades found to differ considerably. A basal clade (A) includes individuals from the island of Corfu and Parga (Ionian coast), while Clade B refers to the islands of Kefalinia and Lefkada (ssp. *kefalithiacus*) with an average p-distance between them of 1.3%. The third clade (clade C) comprised the remaining samples from mainland Greece and Croatia (Adria-Pindos clade) expressing an average within-clade p-distance of 0.1%. In order to further investigate for possible sub-structuring within the Adria-Pindos clade, we used sequences from a faster evolving mitochondrial segment: a 732bp fragment of ND4 and the accompanying tRNAs. We found similarly low sequence divergence and no further substructuring (within-clade p-distance: 0.1%). Additionally, the Mismatch distributions revealed highly significant signs of sudden expansion, further supporting the hypothesis of a recent expansion of the Adria-Pindos clade from a single refugium possibly located in NW Greece.

Keywords: 16S rRNA, ND4, Bayesian Inference, Maximum Likelihood, Mismatch Distributions

Record elements of the terrestrial environment of Gyaros island: flora, habitats, arthropods, mollusks, reptiles and mammals

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Gyaros is a small island in the northern Cyclades with a total area of 17.76 km², surrounded by the islands of Andros, Tinos, Syros, Kythnos and Kea. In 2014, within the framework of the project LIFE12 NAT/GR/000688 CYCLADES LIFE, two field surveys from the Natural History Museum of Crete (NHMC) were carried out. The aim of the project was to record elements of the terrestrial environment with emphasis on habitat types, flora and epigeal fauna. Besides the monotonous phryganic vegetation, other important habitat types were observed, although spatially restricted (e.g. temporary ponds, intermittently flowing rivers, maquis with *Juniperus* spp., and scrublands with *Euphorbia dendroides*). Up to date, more than 240 plant taxa occur on the island, among others the vulnerable (VU) species *Fritillaria obliqua* subsp. *tuntasia* and the invasive species *Ailanthus altissima*. As concerns the fauna of Gyaros, 20 species of molluscs, 23 species of beetles, 8 species of spiders, 5 species of centipedes, 5 species of reptiles, and 3 species of mammals are reported. Most noteworthy species are the snake *Hierophis viridiflavus*, probably introduced several centuries ago on the island, the two Cycladic endemic land snails *Chilostoma arcadica* and *Monacha rothii*, the two spiders *Dysdera* sp. and *Zelotes* sp., most likely new species for science, and the east Mediterranean beetle *Protaetia afflicta*, presenting a distinct chromatic variation. Future management planning for Gyaros, should take in account the degradation of the environment, as a result of overgrazing by goats, sheep, and rabbits, in order to protect small and sensitive habitats.

Bleaching of the scleractinian coral *Madracis pharensis* (Anthozoa, Cnidaria) in Rodopos peninsula, NW Crete

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Coral bleaching refers to the loss of endosymbiotic zooxanthellae from the host coral. It is a widespread phenomenon with an increasing trend worldwide, correlated with climate change; temperature, in particular. In the Mediterranean, most incidences refer to the endemic coral *Cladocora caespitosa*; however, such events have recently impacted also the scleractinian *Madracis pharensis*. *M. pharensis* is widely distributed in the Mediterranean, typically forming sparse populations in the coralligenous community. The present work aims to assess population and 'health' status of *M. pharensis* along Rodopos peninsula (NW Crete). Sampling took place in October 2014 at 13 coastal, rocky-bottom stations spread over Rodopos by diving up to 40 m depth and applying non-destructive techniques. Species' abundance was estimated through coverage data using strip transect sampling. Two random replicate transects (2 x 5 m), divided in 125 squares, were photographed, and each photo was analyzed with PhotoQuad software to estimate *M. pharensis* coverage. The number of impacted, bleached, colonies was also recorded. Sea surface temperature was 22.8 °C; water column was homogenous up to 40 m along the western Rodopos coastline, whereas a thermocline occurred at 30 m along eastern coast (2°C reduction, CTD records). *M. pharensis* was found in seven out of the 13 stations, usually deeper than 30 m with a mean coverage ranged from 0.01 to 3.85 cm²/m². In total, about 36% of *M. pharensis* colonies were affected by bleaching. These results highlight the need to establish monitor programs on vulnerable coral populations along the Aegean.

Novel discoveries, concerning the Robertsonian (Rb) chromosomal variability of the house mouse *Mus musculus domesticus* (Rodentia: Muridae) in Peloponnese, Greece

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Robertsonian (Rb) fusions between acrocentric autosomes is the most prominent feature of the karyotype of *Mus musculus domesticus*, leading to the formation of bivalent chromosomes and the reduction of the diploid chromosome number ($2n=22-40$). The formation of different Rb fusions creates Rb chromosomal races and complex Rb systems. In Greece there are 3 Rb systems, i.e. in Peloponnese, Ipeiros and E Sterea Ellada. Even though the Rb system of Peloponnese with least 4 Rb races is the most well-known, there is still a lot to be discovered about its fine structure and complex dynamics. As a contribution to this effort, 55 individuals from 13 localities were karyologically studied, using the G-banding staining technique. Results showed that: A) the core of the GRP1 Rb race ($2n=30$) seems to extend further to the E-SE of Patras (ca. 13 km from the center of the city) than previously thought. B) Similarly, the known dimensions of the GROL Rb race ($2n=24$), the largest, already, of the Rb system, have been significantly extended to the NE, approaching Kalavryta. C) Studied individuals with $2n=29$ indicate that the GRKA Rb race ($2n=28$) comes closer to Patras than assumed before. D) At least two different types of individuals with $2n=31$ exist in the vicinity of Patras, probably occupying different areas. E) Unexpected findings include the discovery of 8 individuals with $2n=37-39$ from 2 localities of Sterea Ellada opposite of Patras that, based on Rb constitution and area of distribution, may be related to the Rb system of Peloponnese.

Keywords: Rb fusion, Rb chromosome, Rb race, Heterozygote

Preliminary results on the dietary habits of the European otter *Lutra lutra* (Carnivora: Mustelidae) in Lake Stymfalia, Peloponnese

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The European otter, *Lutra lutra*, presents semi-aquatic habits and thus is a top predator in freshwater ecosystems. It is widely distributed mainly in Europe and Asia and has been evaluated in the Greek Red Data Book as Endangered (EN). The otter demonstrates a large home range that reaches ca. 39 km² for males. Recent research for Greece has revealed new information on the otter distribution, however there has been very little work done on the dietary habits of the species, whereas significant progress on this field has been made on a European level. Therefore, our research constitutes the beginning of an effort to cover this gap of knowledge. For this reason, Lake Stymfalia was repeatedly visited during Spring-Summer 2015 and at least three suitable linear routes around the lake were systematically surveyed for the presence of otter fecal matter, i.e. spraints. These were collected, dried at air temperature, soaked in a solution of a detergent-saturated aqueous solution and filtered through a 1mm mesh. The undigested food remains were examined under the stereomicroscope and separated, based on animal group. Preliminary results show that the most abundant prey are frogs (possibly *Pelophylax kurtmuelleri*), followed by fish of the family Cyprinidae, which, based on the morphology of the pharyngeal teeth in our sample, exclude *Cyprinus carpius*, the largest cyprinid resident of the lake. A significant part of the diet also consisted of small birds, snakes of the genus *Natrix* and Coleoptera mostly of the aquatic order Dytiscidae and of the family Carabidae.

Keywords: Spraint, *Natrix*, *Pelophylax*, Cyprinidae, Dytiscidae

Environmental responses on soil arthropod diversity in organic and conventional agroecosystem of Greece

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Biodiversity is the key factor of the structure and function of ecosystems. Study on the relation between the vineyard agroecosystem diversity and factors of environment has been rather poor, despite its importance over an extensive area. The aim of the present study was to optimize the efficiency of soil arthropod diversity in vineyards under different management systems, considering as well other specific variables. Thus soil arthropod diversity was monitored by using pitfall traps, monthly (April, May and June 2015) in organic and conventional vineyard, in Corinthia Prefecture of Greece. Canonical Correspondence Analysis (CCA) applied on the data ordinated the sites in relation to the response of soil arthropod diversity to management practices, soil factors [soil organic matter, pH, nitrogen (N), phosphor (P), potassium (K)] and weather conditions as explanatory variables. The results showed that Coleoptera, Formicidae and Araneae were the most abundant taxa in the study area. Significant differences were observed in the arthropod taxa activity density (individuals/100 trap-days) and diversity. In pair-wise comparisons, the “activity density” and diversity were highest in organic vineyard. Among factors used as explanatory variables, soil organic matter, temperature, humidity and pesticide application appeared to be most important. More specifically, soil arthropod diversity was positively correlated with soil organic matter, temperature and humidity in organic vineyards while it was negatively correlated with pesticide application in conventional vineyards. We can possibly to conclude that arthropod diversity is a bioindicator of the environmental change in vineyards and could be employed for conservation monitoring and for planning purposes in vineyards in all the Mediterranean basin.

Species richness and composition assessment of carabid beetle (Coleoptera, Carabidae) in an agricultural landscape of Thessaly Plain, Greece

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Agricultural farming practices have strong influence not only on the crop yield but also on the biodiversity of agricultural ecosystems. Low-input farming systems provide habitats for wildlife on farmland. Soil invertebrates as bioindicators (Coleoptera: Carabidae) have proved to be a useful tool for monitoring and detecting changes in the environment. Hence, the aims of the present study were: a) to assess the effects of low input farming system on carabids species richness and composition and b) to correlate carabid species richness with soil factors (soil pH, soil organic matter, N, P and K) in low input cultivation of *Cynara cardunculus*. The study was conducted in the rural area of Thessaly plain during the period of autumn-winter of 2013 in central Greece. In total, in low input cultivation of *Cynara cardunculus* studied six carabid species were recorded. The most frequently occurring carabid species were: *Zabrus femoratus* and *Carabus coriaceus* (75%). According to the Principal Component Analysis (PCA), the carabid species richness was found to be positively correlated with the soil organic matter and N. On the contrary, carabid species richness was negatively influenced by soil pH in the research area. Thus, it can be concluded that low input cultivation of *Cynara cardunculus* has an important influence on shaping the epigeal fauna of carabids.

Endangered benthic invertebrates in bottom trawl catches in the South Aegean Sea

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It is well known that bottom trawl fishery has negative effects on the benthic organisms and their habitats. The aim of this study was to investigate the occurrence of endangered or threatened invertebrate species in bottom trawl catches. Experimental fishing was carried out in three fishing grounds of the South Aegean Sea (Cyclades Isl., South Evoikos Gulf and Saronikos Gulf) at depths between 50 and 350 m. A total of 129 hauls were performed, 65 in September-October 2014 (most all of them before the trawl fishing period) and 64 in May- June 2015 (after trawl fishing period). Four of the invertebrate species caught, are included in the Annex II - List of endangered or threatened species of UNEP; *Aplysina aerophoba* (Porifera), *Centrostephanus longispinus* (Echinodermata), *Tonna galea* and *Pinna rudis* (Mollusca). The occurrence of these species varied between the two sampling periods with higher values occurring during the second one (*A. aerophoba*: 4.6-22%, *C. longispinus*: 21,5-38%, *T. galea*: 3-17% and *P. rudis*: 0-3%). *P. rudis* was present in very low occurrence (only two hauls of the Saronikos Gulf) as expected because the unique habitat of the species is beyond the trawl fishing grounds. It is important to mention that empty shells of *T. galea* occurred in high abundances in both periods (59% of the hauls of the second survey). The depth range and the species abundance have been also examined.

Keywords: *Aplysina aerophoba*, *Centrostephanus longispinus*, *Pinna rudis*, *Tonna galea*, fishing impacts, Eastern Mediterranean.

Spatial variability of polychaetes inhabiting the photophilic algae community in the North Aegean Sea

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Sublittoral rocky bottoms are prominent habitats along the Mediterranean coastline. They are occupied by algal or animal dominated communities depending on local environmental conditions, depth in particular. These communities are of special interest mainly due to their high structural complexity, productivity and species richness. Polychaetes have a prominent ecological role in algal-covered rocky bottoms, often constituting over one third of both species richness and abundance. Therefore, the present work aims to assess spatial patterns of polychaete biodiversity in shallow-water (3-5 m depth), gently-sloping rocky reefs covered by the photophilic algae community in the north Aegean Sea. Sampling was carried out during the warm period of the year at six coastal stations, three in Kavala Gulf (2012) and another three in Thermaikos Gulf (2014), using a quadrat sampler (400 cm², 3 replicates per station). All polychaetes were sorted out (0.5 mm sieve) and the errantia were identified to species level. Overall 5,292 individuals were collected, identified to 54 species (33 and 35 in Kavala and Thermaikos, respectively). Two facies of the photophilic algae community were detected: (i) beds of *Anemonia viridis* interspersed with various macroalgae and (2) *Cystoseira barbata* beds, in Thermaikos and Kavala, respectively, which were spatially separated by multivariate analyses. *Platynereis dumerilii* and *Exogone dispar* were the dominant polychaete species in the former facies, whereas *E. dispar*, *Nereis zonata*, *Syllis prolifera* and *P. dumerilii* in the latter. Many of the recorded species have been related with organic pollution, especially considering Thermaikos stations, indicating degraded environmental conditions.

First record of *Cydalima perspectalis* (Walker, 1859) (Lepidoptera: Crambidae) in Greece

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The box tree moth *Cydalima perspectalis* (Lepidoptera: Crambidae) is native to subtropical regions of eastern Asia. The main host plants of *C. perspectalis* are *Buxus* species. The moth was introduced in Germany in 2006 *via* plant importations and since then it spread rapidly across Europe. The box tree moth could be a serious threat for natural habitats of wild *Buxus* in Europe and a major pest of ornamental *Buxus* in urban landscape, historical and decorative gardens and parks where they are highly used as design plants, as well as in nurseries.. Heavy infestation leads to dry plants and defoliation, which combined with the subsequent attack of the bark results in the death of the plants. The present study concerns the first records of the box tree moth in Greece and subsequent infestations on ornamental box trees in urban environment. Adults of the pest were first spotted in six locations around the country from October 2013 until April 2015, when infestation was also detected. The pest was found infesting plants of *Buxus sempervirens* in several private and public gardens and parks in the urban environment of Kifissia, Attica (mid April 2015) and in a private garden in Thessaloniki (August 2015). Introduction seems more likely to have taken place *via* plant importations; however, active dispersal or a combination of both ways cannot be excluded. Stakeholders should be alerted to the new pest in order to prevent spreading and reduce its impact. Chemical control seems to be the most effective method for the control of the pest so far.

Keywords: box tree moth, alien species, invasive, *Buxus*

Molecular Phylogeny of the two *Algyroides* species (Sauria; Lacertidae) in the Balkan Peninsula

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The lizards of the genus *Algyroides* belong to the family of Lacertidae and currently comprise four morphological species. Two of them (*Algyroides nigropunctatus* and *A. moreoticus*) are distributed in Greece, whereas the second one is a Greek endemic. *Algyroides nigropunctatus* interestingly presents two different location-specific color phenotypes. Hitherto, there hasn't been any assiduous molecular study on the phylogenetic relationships between the different insular and continental populations of the two species, which is the aim of the present work. Fresh tissue samples, as well as voucher samples from the Natural History Museums of Crete and Bonn, were obtained in order to represent the two species' range sufficiently. Both mitochondrial and nuclear genes were sequenced in order to reveal the intra- and inter-specific genetic differentiation. Mitochondrial data reveal the presence of several clades of *A. nigropunctatus* with distinct geographic distribution in southwestern Greece. Combining molecular data and field observations it seems that there is reproductive isolation between the two color morphotypes, which are genetically distinct, despite the absence of any geographic barrier in western mainland Greece. No significant divergence was revealed within *A. moreoticus*. Current data indicate a possible need for a thorough morphological survey that may contribute to a re-evaluation of *A. nigropunctatus* taxonomy.

Keywords: *nigropunctatus*, *moreoticus*, Maximum Likelihood, mitochondrial DNA, nuclear DNA, Taxonomy

Deep phylogeographic splits and post-glacial expansions shaped the current distribution of the Balkan Wall Lizard *Podarcis tauricus*

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Studying the history of genes in space and time, contributes highly to the understanding of species' current distributions and population structure. We aimed to expand the existing knowledge on the phylogeography of the Balkan Wall Lizard by adding several key samples from the Greek mainland. 280bp of the mitochondrial cytochrome b gene, amplified in 47 newly collected samples, along with 24 homologous sequences retrieved from the GenBank, were used in order to infer the phylogenetic relationships of the studied individuals. Both Bayesian Inference (BI) and Maximum Likelihood (ML) analyses produced trees with identical and highly supported topologies, which conform to the geographic origin of the samples. Sixteen haplotypes were detected, forming two distinct lineages (Clades A, B) with an average p-distance ranging from 10.6 to 11.8%. Adopting a universal mtDNA molecular clock of ~2% sequence divergence per million years, the splitting of these two major lineages dates back to late Miocene-early Pliocene (5-5.5 Mya). The eastern lineage (Clade A) consists of two subclades: A1, including individuals from Thassopoula Island, and A2 comprising individuals from north Greece (Macedonia and Thrace) and Ukraine. The western lineage (Clade B) consists of individuals from continental Greece, Ionian Islands and Peloponnisos. Considerable further subdivision was detected within the western lineage: six subclades (B1-B6) displaying pairwise p-distances between 1.1-7.9%. Contrary to previous hypotheses, the eastern lineage expands further to the west (W. Macedonia). Analysis of mismatch distributions in clades with adequate number of individuals (A2, B6) supports the sudden expansion of the corresponding clades from different refugia, which might have resulted in the current distribution of *P. tauricus* in the Balkans.

Keywords: Greece, cyt b, Bayesian Inference, Maximum Likelihood, mismatch distributions

Cataloguing the species of Crete in the NHMC: New and/or rare findings among Coleopteran taxa of Crete

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The Natural History Museum of Crete, is actively exploring the Greek biodiversity for more than 30 years, enriching its collections throughout several expeditions per year. Besides major national or international projects serving environmental and biodiversity research all over the country, smaller scale collections, often in the frames of students' dissertations are producing considerable amounts of data on mainland or insular Greek species. The island of Crete is on a first priority of such collections with a multiple sampling intensity for obvious reasons. The arthropod collection, one of the largest in NHMC (over half a million specimens) is intensively following the above activities, mainly on arachnids, myriapods as well as several insect orders, with emphasis in ground active coleopteran families. Having in mind the progress of coleopterology in the Eastern Mediterranean and the faunistic/taxonomic problems or doubts that often arise in this admittedly less explored area, we summarize herein several cases of Coleoptera taxa that are/were doubtful or unknown to the area. The majority of them concern Carabidae and Tenebrionidae species, new for Crete or in doubt for the island, as it is expressed through the latest catalogues and similar scientific publications. Taxa like the giant carabid *Scarites procerus eurytus* or the tiny *Masoreus* spp., the otherwise common in Greek mainland *Calosoma inquisitor* and several more smaller ground beetles belong to the taxa discussed here. In tenebrionid research, cases like the doubtful presences of *Pachychila frioli*, *Cephalostenus elegans*, *Eutagenia* & *Calyptopsis* spp., as well as the establishment of a new genus for the island (*Pseudoseriscius* sp.) are also elucidated during recent investigations on Cretan material.

Bats (Chiroptera) of Mount Parnon and Moustos Wetland

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Bats of the protected area of Mount Parnon and Moustos Wetland were systematically recorded for the first time within the framework of the project “Survey and monitoring of Chiroptera species” under the demands of Art. 17 of the Habitats Directive. We aimed to collect baseline information and, where possible, assess the conservation status of local bat populations. Fieldwork was conducted in June 2014, and in October and April 2015. Sampling comprised roost searches (caves, rock cavities, chapels, bridges, etc.), roost captures, mistnetting at foraging sites and acoustic surveys at a variety of sites, covering a large proportion of the study area. In total, we recorded 22 species (65% of all species present in Greece) in 20 days of fieldwork, including two of the rarest bats in the country, *Barbastella barbastellus* and *Nyctalus lasiopterus*. The most common bat was *Pipistrellus pygmaeus*. Bat foraging habitat in the study area appears to be highly variable and well preserved. Only three of the several known caves in the wider area were found to host important mixed species colonies of several hundred individuals, including seven Annex II species. All three caves showed seasonal changes in species composition and abundance, and all are located just outside of the borders of the protected area, while only one is located within a Natura 2000 site. Within the framework of the project, we propose that these caves be included in the protected zones to ensure their conservation. Further fieldwork will be conducted in September 2015.

The study was conducted under the umbrella of GEOANALYSIS S.A. The project was funded by the Operational Programme “Environment and Sustainable Development” and co-funded by European Regional Development Fund.

Population genetic analysis of wild and domesticated pikeperch (*Sander lucioperca*, Linnaeus, 1758) populations in Europe

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The pikeperch (or zander *Sander lucioperca*, Linnaeus, 1758) is a Eurasian freshwater fish species with wild populations showing signs of decline in many areas of its natural range of distribution due to human activities whilst it presents growing interest for the European aquaculture. Pikeperch is considered still a wild species for the aquaculture industry and in principle each pikeperch farm uses its own stock, captured either from the wild or supplied by another farmer. The species has been recently introduced in southern European and northern African countries and many other regions. We developed and used two highly informative and efficient microsatellite multiplex panels (in total 10 loci) in order to assess the genetic variability in approximately 1,000 fish from twenty-one populations of the species: thirteen domesticated (from commercial farms) and eight wild populations. Partial Cytochrome *b* gene sequences were also used to infer phylogeographic relationships between populations. Results indicate that the majority of the populations show medium to low levels of genetic diversity and some of them may suffer from inbreeding. Differentiation between domesticated broodstocks was high in most cases, while lowest values were estimated for pairs of populations with already known common origin or geographic proximity. Finally, we provide evidence that pikeperch populations in Europe belong to at least two genetically differentiated groups: the first is found in northern Europe from Netherlands/Denmark to the West and Poland to the East to the North of Finland and the second one comprises all remaining populations in Central and Southern Europe.

Keywords: microsatellites, Cytochrome *b*, differentiation, freshwater fish

Natural and invasive distribution of Catfish *Clarias gariepinus* Burchell, 1822 in Turkey

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Family Clariidae at present consists of 14 genera which comprise 92 species distributed in Africa and South-East Asia (Teugels 1986). *C. gariepinus* Burchell, 1822 (C. lazera; Cuv. and Val., 1840) is a widespread freshwater species found in the Middle East, and throughout Central and South Africa (Teugels 1982). *C. gariepinus* inhabits natural lakes, fishponds, streams, and natural ponds in both deep and shallow waters. *C. gariepinus* is naturally found in the Asi River in the northeastern Mediterranean region and invaded to Seyhan, Ceyhan, Goksu and Aksu rivers, stretching from Hatay to Antalya in Turkey (Geldiay & Balik 1996). *C. gariepinus* has increasing commercial importance in fisheries and aquaculture in Turkey (Turan and Guragac, 2014). A recently introduced population of *C. gariepinus* is established in the Sakarya River (Eskisehir) due to aquaculture purposes in the North part of the Turkey (Emiroglu, 2011; Turan et al. 2005). Catfish introduction has negative effects on macroinvertebrate community that was reflected by decrease in diversity, richness and biomass (Kadye and Booth, 2012). There is also community-level impact of introduction that results variation in macroinvertebrate composition in the rivers (Kadye and Booth, 2012). Yalcin (2001) analysed stomach contents of *Clarias gariepinus* and reported that the catfish feed basically on Pisces, arthropod, mollusca, larvae and plant materials to a considerable extent. Therefore, introduction of *C. gariepinus* in Dams, rivers and lakes can cause food competitions with native fish and give irreversible changes in the fish community and cause losses of native fish.

Keywords: Catfish, *Clarias gariepinus*, distribution, invasion, negative effects

Intraspecific aggression in the locally widespread ant species *Lepisiota frauenfeldi* (Mayr, 1855)

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Intraspecific aggression is an important interaction that can determine the dominance of a species in a specific area. The evolutionary loss of intraspecific aggression has been a matter of extensive research as it is the key to the success of invasive ants, as in the case of the Argentine ant *Linepithema humile* (Mayr, 1868). In this study we tested the levels of intraspecific aggression in the ant species *Lepisiota frauenfeldi* (Mayr, 1855) at the campus of the University of Athens. This species is largely abundant in the surrounding area with nest densities reaching about 30 per 100m². In order to determine its' intraspecific aggression, we conducted behavioral bioassays between different colonies of the species, mainly through the use of arena testing between workers of different colonies utilizing a single food source we provided to them. We also tested whether distance between colonies plays a role in the levels of aggression. Results showed that there is a loss of intraspecific aggression within the area of study, with distance being a statistically insignificant factor (maximum distance examined: 2km). Workers showed minimal antagonism over the food provided and in several cases trophalaxis between workers of different colonies was observed after significant time was left for them in the arena. This is possibly one of the reasons of the large population density of the species in the area.

Keywords: competition, invasive, arena experiment, population density

Cultural landscapes in protected areas in Greece: Preliminary biodiversity conservation insights

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Cultural landscape analyses are rarely utilized in biodiversity conservation research in Greece. Cultural landscapes are defined as land areas that have been sculpted by the influence of traditional human land-uses; these long-term human interactions with the land have created unique species assemblages and characteristic ecological patterns and processes. During the last decades widespread land-use changes are taking place that affect cultural landscape features, influencing biodiversity, ecological conditions and resources. Widespread land abandonment and changes in traditional agriculture and livestock grazing have negatively affected biodiversity and important steps should be taken to understand and appropriately manage cultural landscape features, especially in protected areas. This study aims to provide a literature review and cartographic analysis of cultural landscapes in Greece's Natura 2000 protected area network. Prominent cultural landscape features in Greece's protected areas were mapped using the CORINE land cover resources. These include generic habitat units involving: a) settlements, b) agricultural land, c) low scrub formations (phrygana etc.), d) high scrub formations (macchia and other scrublands), and e) grasslands. This initial cartographic analysis shows that these features are outstanding constituents of protected areas, covering almost 70% (69,78%) of the protected terrestrial land area of Greece's Natura 2000 network. References to managing and/or restoring cultural landscape features for biodiversity are scant and poorly applied in management planning. This study presents preliminary insights that should to be addressed for continuing this line of conservation-relevant research in order to introduce special management approaches that benefit biodiversity within cultural landscape features in protected areas.

Keywords: cultural landscapes, protected areas, Natura 2000 network

Preliminary observations on the African chameleon *Chamaeleo africanus* in semi-captive conditions in Greece

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The African chameleon can be found in Europe only at the southwestern Peloponnese (Greece). The population is small, the estimation of the population density, for the last five years, is between 200-300 individuals (Dimaki *et al*, in press). The maintenance of a chameleon population in controlled environment is probably the only chance for survival of this species in Europe. The project for captive breeding started in March 2014 (No of permit: 104174/315/29-1-2014) and is a cooperation between the NGO Pelargos and Hellenic Herpetological Society and takes place on the premises of Attica Zoological Park.

Two couples of chameleons from Peloponnese were located in special off-exhibit area that has been design to simulate their natural environment. After one week of adaptation, the mating started on the 4th of September. Males mated with both females until 29 of September. During the mating season animals were observed using higher branches in the middle of the day, compare to the ones they used during the evening and night time ($p < 0.05$). Chameleons observed to be more active during warmer temperatures. When cold temperatures came, in mid October, we observed them to move less and to rest more. One of the individuals died in November, so we put the rest indoors and warmed them with UV lamp. After few days one of the females laid 3 eggs and after died.

Incongruence between molecular phylogeny and morphological classification in the endemic *Gammarus* species flock from the ancient Lake Ohrid

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The Balkan Lake Ohrid of tentatively dated Plio-/Pleistocene origin is the oldest ancient lake in Europe, characterized by very high endemism rate, especially among amphipods. Here, we focused on genus *Gammarus*, with ten species described from the Lake Ohrid valley, of which eight are endemic. Our previous studies have shown that endemic *Gammarus* species comprise an ancient species flock that evolved *in situ*. Now we scanned molecular diversity within this species flock, using a portion of mtDNA genome (*COI* barcodes), and compared the results to morphological assignments. To verify the taxonomy based on morphology we applied two approaches to species delimitation: the molecular distance-based Automatic Barcode Gap Discovery (ABGD) approach and the phylogenetic tree-based approach using general mixed Yule coalescent (GMYC) method and the Bayesian implementation of the Poisson Tree Processor (bPTP) method. The *COI* data set was partitioned into 11 to 14 OTUs (Operational Taxonomic Units), of which most (eight) were consistent among all methods. Our results indicated a substantial decoupling between morphological and genetic data. Only three species described so far are morphologically and molecularly well defined. Moreover, based on our results at least two new endemic, still undescribed species of *Gammarus* were discovered. The remaining representatives could not be unambiguously assigned. Thus, we assume identifying novel morphological characters to distinguish these species. Our results illustrate that molecular methods aiming at delimitation of putative species may be useful in verifying already established taxonomy based exclusively on morphology.

Keywords: *Gammarus*, ancient lakes, Lake Ohrid, species delimitation, molecular taxonomy

Mercury contamination in *Posidonia oceanica* of coastal Crete

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Seagrasses are of prime ecological importance, as they are the primary producers in the marine food web. Furthermore, they represent an important pathway of trace metals incorporation into the ecosystem. Among the Mediterranean seagrasses, the endemic *Posidonia oceanica* is an accurate bioindicator of past and present metal contamination. Through the lepidochronology method, it is possible to have information on its life history traits, particularly the mercury contamination which is the most dangerous contaminants in marine environment. In the framework of MAPMED Project, we investigate the temporal trend contamination by mercury on dead sheaths of *P. oceanica* collected in two sites around Heraklion (Crete coast). Our results showed a low mercury concentration level in the two sampled populations during the period 2002 - 2011). The comparison of the contamination levels by mercury in seagrass of Heraklion area with other Mediterranean ones highlight the good quality of seagrass meadow in the Crete coast.

Keywords: *Posidonia oceanica*, lepidochronology, mercury, Heraklion

The way towards more effective conservation practices: Understanding *Lullula arborea* and *Lanius collurio* occurrence patterns in the National Park of Lakes Koronia-Volvi and the Macedonian Tempe

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The need to preserve biodiversity in constantly changing landscapes in Europe has led to the designation of the Natura 2000 network and the need for a closer examination of species distributions and requirements within each site for the implementation of effective conservation measures. In this study we examine two passerine species, *L. arborea* and *L. collurio*, listed in Annex I of Dir.2009/147, in the National Park of Lakes Koronia-Volvi and the Macedonian Tempe (SPA GR1220009). We sampled 477 points from 2013 to 2015 and recorded 217 and 30 individuals of each species, respectively. After mapping the landscape features and extracting a set of metrics using Fragstats, we estimated each species distribution with Maxent and pinpointed the factors that are most important for their occurrence patterns. For *L. arborea* both forests and open landscapes were important, while the presence of 10-20% open-forests as small sized patches at the landscape level increased the probability of occurrence (PO). Woody plantations were also significant, while PO peaked at 250-300m altitude, and increased with semi-open forest interdispersion. For *L. collurio*, cultivations and loose forests were the most important features, while the presence of 5-10% high maqui or low altitude forest was significant. The species also requires maqui or open-forest edges, while PO peaked at northern slopes. Our results may prove useful for landscape management targeting to the conservation of these species. However, in an effort to better serve the needs of as many species as possible, other species-specific needs should also be evaluated.

Wingless predators VS Winged herbivores: Ground beetles (Coleoptera: Carabidae) in a battle for dominance across a gradually changing landscape after land abandonment in Pindos Mts

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Land use change, including agricultural land abandonment, is nowadays identified as a major threat for biodiversity. Contrary to some well-known vertebrate groups, the response of invertebrates to land abandonment is poorly studied. We investigate the importance of forest encroachment, following land abandonment, on Carabid beetle diversity and community structure vis-à-vis a set of environmental factors. We sampled 20 randomly selected sites of 1km² representing a gradient of abandonment, using 300 pitfall traps which remained active from May to July 2011. A total of 3330 individuals of 66 carabid species were captured. Thirty eight per cent of the trapped individuals were predators and 32% were herbivores, while 27% were short-winged or wingless and 54% were winged. The only factor significantly affecting carabid beetle species richness was longitude, with eastern sites being richer than the western, while overall abundance was not affected by any of the parameters considered. Predators' abundance increased with woody cover and decreased with altitude, which was also the case for wingless species, while winged species abundance increased with longitude. Woody vegetation cover in combination with locality significantly affected community composition and two distinct species groups were revealed, the first comprising mainly of species with high dispersal ability and the second including many species with low dispersal ability. In conclusion, overall carabid beetle diversity remained unaffected by land abandonment, while species with different habitat requirements and dispersal abilities respond differently, altering community composition. In order to preserve diverse communities it is important to maintain landscape heterogeneity, preserving open landscape patches.

Standardizing electrofishing methods for monitoring and conservation in inland waters of Greece and Cyprus

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Standardized methods to collect freshwater fish assemblage data were until recently rarely applied in Greece and Cyprus. Since 2002, HCMR has developed a protocol in order to streamline fish assemblage data collection primarily from electrofishing surveys in rivers, especially since fishes are considered biological quality elements (BQEs) for bioassessment within the EU WFD 2000/60. Here we describe the field protocol and present selected results. The protocol utilizes a rapid-assessment approach to gather basic habitat parameters and fish data along a representative stretch of a river, other lotic or lentic water body. This provides a rapid and consistent description of the assemblage of fishes (i.e. percentage composition, relative abundance and size-class structure). The sampling effort is assessed and particulars are given for specific sampling approaches (although electrofishing is promoted, other sampling methods are also suitable documenting through the protocol). The data gathered are usually adequate for using fish as BQEs since they include species abundance and size structure data and relate to specific area and habitat conditions. This method is very useful for site-specific species and community conservation purposes as well since it entails a replicable survey of water body sections. So far, the HCMR database holds 1240 samples from 800 sites from Greece (from 129 basins) and 186 sites and samples from Cyprus (31 basins). Policy-relevant inventory and monitoring based on this approach has helped compile species inventories, conservation status assessments and to define fish-based aquatic ecosystem typologies in these countries for the first time. This method and the database are indispensable for ongoing ichthyological monitoring in these countries.

Investigating the effect of different agricultural practices on fauna diversity in High Nature Value Farmlands in Cyprus

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The importance of HNVfs for the conservation of lizards, snakes, as well as butterflies and other insects has been well established in Europe. In Cyprus HNVfs are threatened by intensification, abandonment or lack of awareness about their contribution to biodiversity conservation. The current work aims to implement sustainable agriculture practices along with conservation actions in small scale traditional fields that will evaluate and demonstrate the role of HNVfs in biodiversity conservation.

Two types of traditional crops, carob groves and vineyards are included in the project. In each crop type we selected i) four fields where sustainable agricultural practices and biodiversity conservation measures are applied ii) four fields managed with conventional methods and iii) four abandoned fields.

Sustainable practices include pheromone mating disruption for controlling European grapevine moth and placement of metal sheets around carob trunks together with installation of owl nests to protect groves from black rats. Restoration actions aiming at enhancing biodiversity focus on diversification of fields and their margins through re-planting of indigenous trees and shrubs, stonewall restoration and construction of brush piles, rock piles and snake hibernacula.

The impact of conservation measures on biodiversity is assessed through monitoring of birds, lizards, snakes, butterflies and other insects. Measurements before and shortly after project actions were implemented showing similar levels of biodiversity in diversified, conventional and abandoned fields. The work is still in progress and we anticipate that the generated knowledge will provide important guidelines for the conservation and sustainable management of vine and carob HNVfs in Mediterranean agro-ecosystems.

Keywords: High Nature Value Farmlands, HNVfs, sustainable management, enhance biodiversity, vineyards, carob groves

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