Coimbra Master in Ecology
&
International Master in Applied Ecology

Research topics & Supervisors
2023

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FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE D COIMBRA

dcv.uc
DEPARTMENT OF LIFE SCIENCES
FACULTY OF SCIENCES AND TECHNOLOGY
UNIVERSITY OF COIMBRA

This document has been assembled to help prospective students to get in touch with potential supervisors that match their interests. You can use this list to approach several potential supervisors and discuss these or other research ideas you want to develop during your dissertation.

This document is updated yearly. For any correction, please contact the course coordinator: rheleno@uc.pt

Índex

31. Assessing **effects of low risk pesticides** in non-target terrestrial organisms

32. Land use and land management effects on **soil fauna** soil functions and associated ecosystem services

33. Plant-**parasitic nematodes** - a threat to Mediterranean agriculture

34. Biological control of plant pathogens

35. Bioaccumulation of **mercury** by *Gracilaria gracilis*. Risk for human use?

36. Searching for **pinewood nematode** pathogenic determinants

37. Pelagic **seabirds** as sentinels of Ocean health

38. AquaCSI - **AquaCulture** using Stable Isotopes

39. Growth dynamics of **hyperaccumulator plants** associated with **rhizobacteria** and arbuscular **mycorrhizal** fungi

40. Biological control of the invasive invasive plants

41. Heartworm disease in Coimbra: a case study

42. How does **(micro)plastic pollution** affect coastal and marine ecosystems?

43. Toxicity bioassays of **nanoplastics** to model stream biota

44. Unravelling functional associations between **soil fauna** and **carbon** dynamics in Portuguese forest ecosystems

45. Antarctic food webs research: Assessing the role of Antarctic organisms in a climate change context

46. Linking pine **cell wall** composition and structure to **pinewood nematode** resistance under climate change

47. Sustainable **pharmaceuticals** degradation in **wastewaters**: the way forward

48. Small-scale fisheries: implications of gear used, and fish species caught on local economy, environment and society

49. (Less)PlasticBrain – Bio replacing plasticizers – impact in the human brain development

50. Assessing **pharmaceuticals accumulation** in non-target organisms

51. Seabirds as bioindicators of chemical contaminants and environmental health in the North Atlantic

52. Marine fish ecology under a changing climate

53. Plant diversification and sympatric speciation through polyploidization processes

54. Are you singing to me? **Birdsong communication** and development

55. Assessment of **ecosystem services** of agriculture and forests

56. New **tools** against **phytoparasitic** nematodes

57. Sexual segregation and grouping behaviour in **ungulates**

58. Communication and acclimation strategies in **microalgae**

59. Using baited remote underwater video (BRUV) to assess **marine megafauna** traits

60. Spatial and **foraging ecology of waterbirds** in relation to human stressors

61. Wastewater reuse as a potential source of Giardia and Cryptosporidium

62. Acute contact **toxicity** of pesticides to the invasive **Vespa velutina**: Lab & field validation of ecotoxicological endpoints

1. On the search of a better (stream) water

Contact:

Cristina Canhoto (ccanhoto@ci.uc.pt)

Research group: **FreE** - Freshwater Ecology Lab
http://cfe.uc.pt/profile/members/1544

WATCH IT ON YouTube https://youtu.be/NqJDkms2S2Q

Description:

Freshwaters are among the most threaten ecosystems in the planet. In the face of global changes, understanding and predicting the effects of single and multiple stressors on streams and rivers constitute a main step for their conservation and maintenance of the services (e.g. drinking water) provided to man.

Streams and rivers are exposed to a growing number of stressors such as:

- ***Riparian forest management*** (our studies deal with the effects of *Eucalyptus* afforestations and native riparian forests composition on streams ecological integrity);
- ***Increased water temperature*** (we perform our studies using controlled conditions, mesocosms and a manipulated warmed stream);
- ***Intermittency*** (we use Lousã's intermittent streams and their riparian areas as "playground");
- ***Salinization*** (worldwide, still underexplored, threat to freshwaters; we assess the problem using several aquatic groups, levels of organization and approaches … "from genes to the ecosystem");
- ***Man!*** The team is also engaged in citizen science activities (international project - LivingRiver) using a key ecosystem process in streams - litter decomposition - for the assessment of stream water ecological integrity.

Some of our studies are developed in collaboration with other groups, National (e.g. "Fish themes" - ISA, Lisbon) or International Universities. We are mainly focused on a key-ecosystem-level process - leaf decomposition - to understand stressor impacts in streams whose food chains are *brown* (i.e. aquatic webs rely on leaves from the terrestrial systems).

The results of each investigation project are expected to originate a master thesis and one scientific paper to be published in an international peer reviewed journal.

If you are interested in any of these topics or any other topic in stream ecology… contact us!

2. Conservation threats affecting the Kentish plover in central Portugal

Contact:

Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Ana Cláudia Norte (aclaudia.norte@gmail.com) http://www.mare-centre.pt/pt/user/45

Vitor Paiva (vitorpaiva@uc.pt) http://www.mare-centre.pt/pt/user/137

Research group: **EcoTop** - Ecology and Conservation of Top Predators

Description:

Este projeto pretende estudar as principais ameaças (presença humana, stress térmico, predação) para a reprodução do borrelho-de-coleira interrompida na zona centro de Portugal. Esta espécie reproduz-se em praias arenosas, longe da perturbação humana, e em salinas do estuário do Mondego. A população desta espécie tem vindo a diminuir em toda a Europa, sendo necessário uma gestão sustentável das zonas costeiras para evitar o seu declínio.

Este projeto pretende estudar as ameaças à reprodução desta espécie utilizando metodologias modernas (data-loggers para avaliar o stress térmico e mapear os movimentos locais das aves) e experiências in situ (vedação de ninhos para reduzir a perturbação humana) de modo a propor medidas para a conservação desta espécie.

Este projeto será financiado através de um programa Interreg, e decorrerá em praias da zona centro (entre a Figueira da Foz e Mira) e em salinas do estuário do Mondego. O candidato interessado poderá concorrer a uma bolsa de iniciação à investigação, que cobrirá o decorrer do mestrado a partir de Abril de 2024, e deverá participar também em atividades de Educação Ambiental. Possuir viatura própria e autonomia de deslocação serão fatores preferenciais, sendo que as deslocações serão cobertas pelo projeto.

3. Conservation of biodiversity in the genomics era

Contact:

Luís Cunha (luis.cunha@uc.pt) http://cfe.uc.pt/profile/members/1809 http://eworm.xyz/

José Paulo Sousa (jps@zoo.uc.pt) http://cfe.uc.pt/profile/members/1621

Research group: **SEEL** - Soil Ecology and Ecotoxicology Laboratory
https://www.facebook.com/labsolos/

Description:

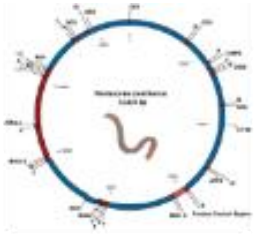
Several projects available

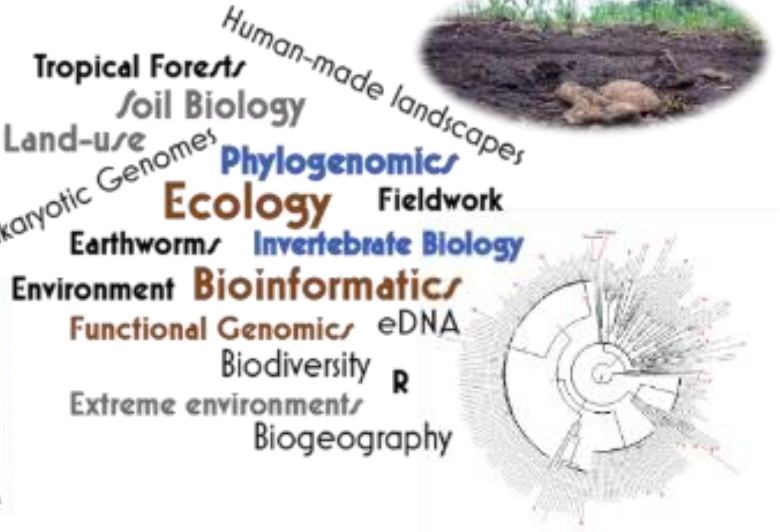
"Conservation genomics" englobes the assumption that genome-scale data allow us to protect any given species with an inherent conservation value. Genetic approaches have long been used in conservation biology, however, with the recent advances in sequencing technologies, genome-wide data become available allowing an unprecedented scale of useful information. We have several projects available, mostly involving genome-scale data (big data) to inform ecological and evolutionary questions for a chosen species / population . This kind of project is well-fitted for someone with a profound interest in contributing to the conservation across scales, from individual species to the ecosystem level but also keen on learning wet-lab techniques and data analysis (bioinformatics). A full range of topics can be found by following the link below. Additionally, we have also opportunities to use previously generated genomic data for a pure *in-silico* approach (desk-based options).

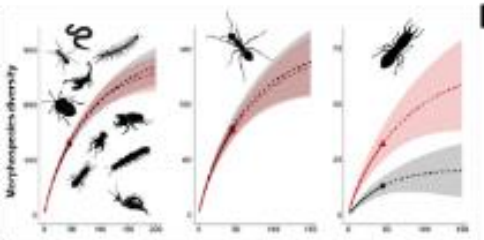
I will be happy to discuss a range of project possibilities.

Some Possible Research Topics: https://eworm.xyz/research-topics/

Discord Channel: https://discord.gg/enzpbg







4. Valuing wild pollinators for sustainable pollination services in agroecosystems

Contact:

Sílvia Castro (scastro@bot.uc.pt)

João Loureiro (jloureiro@bot.uc.pt)

Helena Castro (hecastro@ci.uc.pt)

Research group: **FLOWer Lab**
https://www.facebook.com/cfeFLOWerLab/

Description:

Pollination is a biodiversity-dependent ecosystem service of vital importance for nature, agriculture and human well-being. Currently, pollinator's decline resulting from globally prevalent drivers constitutes a major threat to sustainable crop production. However, there is limited quantitative evaluation on the abundance, diversity and function of wild pollinators across regions, time and crops. The applied research line of FLOWer Lab focuses on pollination as key regulation ecosystem services to understand current biodiversity levels in nature towards conservation and sustainable use of wild resources. Our goals include, the establishment of baselines and monitoring programs to assess status and trends of wild pollinators and crop pollination deficits, incorporating citizen science, quantify economic and environmental consequences of pollinator deficit and map pollination ecosystem services. This will be achieved through funded projects (CULTIVAR; i9Kiwi; Polimax).

5. Exploring the diversity of Serra da Estrela forests: endogenous resources for ecosystem restoration

Contact:

Susana Rodríguez Echeverría (susanare@ci.uc.pt)

Marta Correia (correio.marta@gmail.com)

Description:

The recovery of forests in the Serra da Estrela NP devastated by the 2022 fires and the conversion to ecosystems of greater ecological value and greater resilience in the face of global changes requires better knowledge of their diversity and response to climatic factors. Within a research project devoted to enlarge this knowledge, we are looking for passionate students who want to develop research on:

- Diversity inventories of fungal and plant species in Serra da Estrela forests in order to identify a) species of significant importance for the functioning of theses forest, b) the sustainable use of endogenous resources to boost local economy, and c) the development of nature-based sustainable tourist activities.
- Study of post-fire regeneration, focusing on the recruitment, biotic interactions and effect of microclimatic conditions on forest recovery.
- Monitoring and controlling invasive plant species during post-fire recovery.
- Effectiveness of the activities of local citizens' associations and conservation movements for the restoration of burned areas, which include techniques to prevent erosion such as the formation of barriers with burned wood or the sowing of herbaceous species, and the sowing and planting of native trees.
- Greenhouse inoculation experiments to understand the role of different soils and soil microbiota on the recruitment of native and invasive species after wildfires.

@ecolab_estrela @ecolabestrela

6. Heavy metals and essential mineral concentration of Macroalgae along the portuguese coast

Contact:

Miguel Pardal (mpardal@uc.pt) https://cfe.uc.pt/profile/members/1658

Research group: **Marine Research Lab**
https://mobile.twitter.com/marineresearchl
https://www.facebook.com/marineresearchlab/

Description:

Macroalgae are increasingly being used as a food item by humans in recent years. They can be an alternative to some extent of the animal protein. It is known that a diet rich in marine products can be highly beneficial to human health. Furthermore, the concentration of heavy metals can be high in some areas of the Portuguese coast, in parallel to industrial development, posing potential risk to human health.

With this in mind, the main goal of this work is to screen marine macroalgae consumed in the southern European countries, for the content of heavy metals and 10 essential elements (Ca, K, Mg, Na, P, Cu, Fe, Mn, Se, and Zn) along the Portuguese coast.

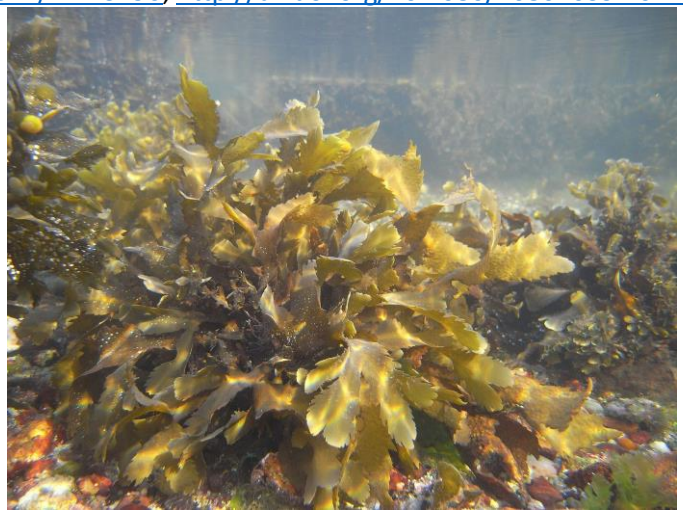
Differences in the heavy metals and mineral content (two different dissertation opportunities) along the vertical distribution on the rocky shore or along the north and south coast of the country will be assessed and discussed bearing in mind the human health and safety consumption of marine products.

The work intends to assess the most common macroalgae of the Portuguese coast as well as different locations where this collection can be made easily by the general population or by commercial companies that later sell these products in supermarkets.

At the present time there is a lack of knowledge concerning these species and locations along the Portuguese coast.

Further Reading:

http://dx.doi.org/10.1016/j.jfca.2021.104118, http://dx.doi.org/10.1007/s10811-016-0867-7, http://dx.doi.org/10.1071/MF13190, http://dx.doi.org/10.1080/10807039.2014.890480



7. Breeding ecology of **hole-nesting birds** in a changing world

Contact:

Ana Cláudia Norte (aclaudia.norte@gmail.com) http://www.mare-centre.pt/pt/user/45

Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube https://youtu.be/uxRRyji1n2U

Description:

Hole-nesting birds are one of the most used model species in several ecological studies. This is in part due to the easiness to accept nest-boxes to breed in by some species, but also their abundance and wide geographical distribution, their territoriality and the fact that they are top predators, reflecting constraints at lowers levels of the food chain. In our research group we are monitoring the breeding populations of hole nesting birds at Mata Nacional do Choupal, Coimbra, since 2020, to study the effects of changing environmental conditions on their fitness - breeding success and physiological health. We will be mainly focusing on meteorological conditions, food availability and parasitic constraints on breeding success and their relationship with physiological health indicators, but also how the incorporation of anthropogenic materials such as plastics in birds' nests affect their breeding performance.

Fieldwork will take place during the breeding season of 2024 and laboratory work will be carried out at MARE - UC. Within this topic the candidate will contribute to at least one international peer-reviewed publication.

8. Trophic and ecological characterisation of key aquatic species present in estuarine communities

Contact:

João M. Neto (jneto@ci.uc.pt) http://www.mare-centre.pt/joaoneto

Ana Marta Gonçalves (amgoncalves@uc.pt) http://www.mare-centre.pt/pt/anamartagoncalves

http://www.mare-centre.pt/en

Research group**: MAREFOZ | Marine Ecosystems Lab**

Description:

Aquatic ecosystems are known as a principal dietary resource of some essential components, both for aquatic and terrestrial animals. Indeed, some of these components are only produced by bacteria, plants and algae, as the expression of the water properties through metabolic and cellular processes. They cannot be synthesised de novo by primary consumers, being the feeding behaviour the basic process in the food web. They constitute useful trophic markers because they are assimilated, accumulated and transferred by animals to higher trophic levels. In comparison to terrestrial ecosystems, marine and freshwater ecosystems are characterised by relatively high levels of "essential components" and, indeed, fish and seafood are the most important sources of these vital nutrients in the human food basket. The balanced presence of these "essential nutrients" in tissues of terrestrial predators is essential on physiological functions and on the metabolism of all animals and on the prevention of diseases, and it's known to increase directly with the consumption of aquatic preys. For that reason, the detection of the presence of these trophic markers constitutes a useful tool on the study of environmental health. Thus, it becomes vital to study biochemical changes in aquatic species and the repercussions in aquatic trophic food webs caused by differences in the habitat (presence/absence of vegetation).

The main objective of this study is to assess the biochemical profiles of key species inhabiting different estuarine habitats (e.g., fish, macroinvertebrates) and link it to environmental stress sources. Biological samples will be seasonally collected in the field and prepared in the laboratory for subsequent biomarkers' analyses and compared to parameters affecting environmental conditions.

Photos Ana Marta Gonçalves and students

9. The expansion of **eucalyptus plantations**: is this an elephant in the room?

Contact:

Raquel Juan-Ovejero (raquel.juan.ovejero@gmail.com)

José Paulo Sousa (jps@zoo.uc.pt)

Environmental Ecology and Ecotoxicology Group (Centre for Functional Ecology)

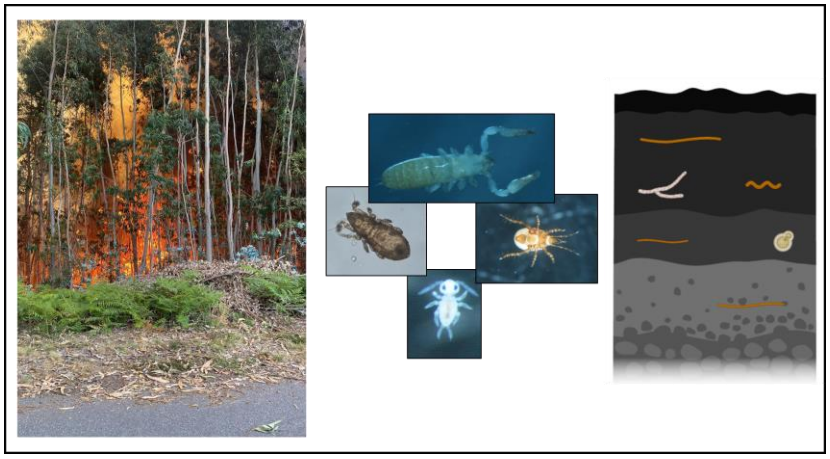
https://www.facebook.com/grupoE3G/

Description:

The controversy surrounding some negative impacts about the expansion of eucalyptus trees remains unresolved because it depends on the context in which plantations are or have been developed. In particular, little attention has been paid to the positive and negative impacts of eucalyptus plantations on soil-based ecosystem services that are of vital importance for the conservation of the planet, such as regulation of water supply, nutrient cycling and carbon sequestration. Thus, it is especially necessary to investigate how the below-ground part of these ecosystems is being affected by the expansion of this forest species. Moreover, soils are a critical ecological habitat for invertebrate, fungal and bacterial communities, and the edaphic communities of eucalyptus plantations remain largely unexplored.

In this framework, we seek to study the magnitude and direction of the effect of the expansion of eucalyptus plantations on several key ecosystem functions. Hence, this will allow us to identify essential aspects that can help to develop forest management plans to control further expansion of these plantations and thereby reduce their high pressure on native forests. To do this, a combination of information from National Forest Inventories, MODIS and LANDSAT satellite imagery, and soil global databases will be used.

Students interested in forest and soil ecology are more than welcome to contact us. You will be able to improve your statistical skills by using R with cutting-edge methodologies such as meta-analysis and structural equation modelling. Apart from this, you may participate in some fieldwork campaigns with the purpose of collecting soil fauna samples in eucalyptus plantations and native forests in Portugal. Additionally, the obtained results could be part of a scientific paper expected to be published in a peer-reviewed journal.



10. Effects of **forest** changes on **stream** ecosystems

Contact:

Verónica Ferreira (veronica@ci.uc.pt) http://www.mare-centre.pt/en/user/136

Research group: **Freshwater Ecology (MARE)**

WATCH IT ON YouTube https://youtu.be/-2rqiFe7xiQ

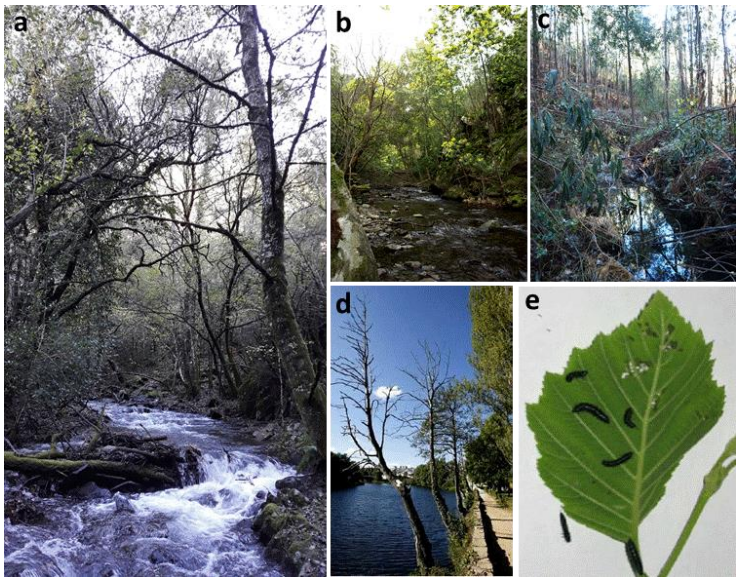
Description:

Small forest streams are strongly dependent on the riparian forests, which provide shade and organic matter, control the inputs of nutrients, sediments and pollutants, among other important roles on which aquatic communities depend[a]. Changes to riparian forests may thus have impacts on aquatic communities and processes.

In the Freshwater Ecology Research Group of MARE, we address the effects of changes in riparian forests on stream communities (microbial decomposers and benthic macroinvertebrates) and processes (e.g., decomposition of plant organic matter) by performing laboratory and field experiments, and systematic reviews/meta-analysis. Forest changes in which we are most interested include:

- Invasion of native deciduous forest by exotic *Acacia* species[b]
- Replacement of native deciduous forests by monocultures of *Eucalyptus globulus*[c]
- Infection of native tree species by invasive pathogens[d]
- Formations of galls on leaves of native tree species
- Herbivory of native tree species by insect larvae[e]
- Inter and intraspecific variation in litter characteristics – with possibility for a small fellowship

We seek for enthusiastic students to join our team and help us pursue new ecological questions. Expected scientific outputs of each research project include papers in (inter)national journals. There will also be opportunities for communication (oral/poster) at scientific meetings and to non-scientific audiences.



a) Stream flowing through a native deciduous forest, Central Portugal, b) Stream flowing through a forest invaded by exotic Acacia dealbata, central Portugal, c) Stream flowing through a Eucalyptus globulus plantation, central Portugal, d) Riparian alder trees infected with the pathogenic oomycete Phytophthora xalni, central Portugal, e) Herbivory on Alnus incana leaves by larvae of Agelastica alni bettles. Photos: a–d, VFerreira; e, LHuttunen.

11. Sustainable alternatives to synthetic agrochemicals for growing crops

Contact:

Maria Celeste Dias (celeste.dias@uc.pt) http://cfe.uc.pt/profile/members/1635

Paula Lorenzo (paulalorenzo@uc.pt) http://cfe.uc.pt/profile/members/1672

Cristina Galhano (cicgalhano@esac.pt)

Description:

The continued and excessive use of inorganic agrochemicals in agriculture to maximize yield and to feed increasing population has led to soil and water resources pollution. Therefore, there is an increasing demand for organic sustainable and safe alternatives. Organic waste with phytotoxic properties can be used as potential bioherbicides. Additionally, organic amendments can be a source of nutrients for crops and also improve soil fertility and water retention. The application of both phytotoxic waste and organic amendments help to reduce the use synthetic agrochemicals. The use of organic waste contributes to recover and maintain soil quality and health that is essential in sustainable agriculture. Valorizing organic waste by finding new potential uses for them while reducing the application of synthetic agrochemicals in agriculture is a combined sustainable alternative that prevents environmental contamination, provides new raw materials, and favours zero waste, which efficiently implements the Circular Economy strategy and the Waste Directive approved by the Council of the European Union. For instance, the increased consumption of coffee beverages has been leading to the generation of high amounts of spent coffee grounds waste, which is usually mixed with common garbage causing major environmental issues. However, the richness of this waste in phenolic compounds, nitrogen, phosphorus and potassium highlights its potential to be used on agriculture as bioherbicide, fertilizer or as soil improver. This proposal relies on the Circular Economy strategy to reduce the use of synthetic agrochemicals to conduct more sustainable crops.

The main objective of this work is to assess the effects of spent coffee grounds on weed emergence and plant physiological performance. Weed and crops will be growth in pots with a mixture of soil + spent coffee grounds (in a proportion of 0.9 and 1.8 Kg m-2) under two water regimes (100 % and 50 % water retention capacity). After a growth period the effect of these organic waste in the performance of the plants will be evaluated by measuring weed biomass, crop growth, photosynthesis, water content, antioxidant responses (e.g. antioxidant enzymes activities, and metabolites), cell membrane damages, sugars and proline contents. The levels of leaf nitrogen, carbon and protein will be also measured. Additionally, soil available carbon, nitrogen, total organic and total inorganic carbon fractions will be determined.

12. Long-term effects of climate change and heatwaves on the intertidal seagrass meadows of the Mondego estuary

Contact:

Elsa Rodrigues (etrodrig@uc.pt) https://cfe.uc.pt/profile/members/16

Miguel Pardal (mpardal@uc.pt) https://cfe.uc.pt/profile/members/1658

Research group: **Marine Research Lab**

Description:

Two related topics available:

1) **Historical records and new data to monitor intertidal meadows of the Mondego estuary**

The marine plant *Zostera noltii* is one of the key habitat-forming species of intertidal seagrass meadows in Portugal. These aquatic systems support a host of marine invertebrates and fish, some of which of great commercial interest. Seagrass meadows also demonstrate an incredible facility for capturing carbon, play a key role in cycling nutrients and protect islands from sea-level rise. To study long-term changes on a seagrass meadow, the present project aims to develop a field experimental setup in the Mondego estuary, where *Z. noltii* forms an important intertidal meadow. Seagrass abundance and distribution (coverage) will be seasonally determined in three sampling sites at low tide, and further compared with historical records. Several water parameters will also be assessed to confirm possible changes in water quality over time, as well as climate data to relate possible alterations to climate events. This project will also validate a passive remote sensing approach which uses satellite data to estimate the coverage of this seagrass habitat and contribute to develop new methods to monitor these key ecosystems and improve their management.

2) **How do Portuguese intertidal seagrass meadows deal with heatwaves?**

There is growing evidence that extreme climatic events such as heatwaves, floods, droughts and cyclones are increasing in frequency and intensity, and that this is caused by climate change. *Z. noltii* meadows support a vast biodiversity and play other key ecosystem services. To measure the losses and damages caused by the known negative impacts of heatwaves on these important ecosystems, as well as promote ecological awareness of seagrass meadows, the present project aims to develop an experimental setup to simulate a heatwave in laboratory. For that, two temperatures will be simultaneity tested: a control temperature and a test temperature representing a heatwave. With this experimental approach we intend to understand the behaviour of seagrass meadows facing new environmental challenges.

13. Drivers of ectoparasitism by ticks in breeding gulls nesting in sandy beaches of Ilhas Barreira, Algarve

Contact:

Ana Cláudia Norte (aclaudia.norte@gmail.com) http://www.mare-centre.pt/pt/user/45

Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Vitor Paiva (vitorpaiva@uc.pt) http://www.mare-centre.pt/pt/user/137

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

Description:

Nest-site selection by colonial breeding birds entails several trade-offs between predation risk, intra- and inter-specific interactions, heat stress and parasitism. For open nesting birds in coastal habitats, vegetation surrounding the nest may provide shelter from sunlight preventing heat stress and dehydration, but it may come with the cost of increased tick parasitic pressure. Soft ticks find shelter in the vegetation and take frequent blood meals from the incubating birds or chicks and may affect the development of chicks and overall breeding success of a host population. The re-use of nest sites and colonies may also increase ectoparasitic risk.

In this study we aim to evaluate tick parasitism in chicks of yellow-legged (*Larus michaellis*) and Audouinn's (*Ichthyaetus audouinii*) gulls nesting in Ilhas Barreira in Algarve. We will also assess if vegetation characteristics influence tick infestation intensity in colonies with different years of establishment.

Fieldwork will be performed during spring 2024 in Algarve and results of this study will contribute to an international journal peer-reviewed publication.

14. Habitat selection of lesser horseshoe bat in Aljezur, Algarve

Contact:

Joana Alves (jalves@uc.pt | joanasilvaalves@gmail.com) http://cfe.uc.pt/profile/members/13

Research group: **BEWild** – Behavioural Ecology and Wildlife Conservation Research group

Description:

The largest maternity colony of lesser horseshoe bats in Portugal, and one of the biggest in the EU, was recently found in an abandoned building in Vale da Telha. The maternity colony and Vale da Telha are situated in Natura 2000 site Costa Sudoeste.

This project will be based on field work and first of all will be aimed to identify foraging areas and commuting corridors of the bats by use of radio tracking. During the planned studies emergency counts, assessment of reproduction success and measurements of microclimatic condition inside the bat roost by use of temperature and humidity loggers as well as observations of bat activity in different habitats by use of ultrasound bat detectors will also be involved.

This project counts with the international collaboration with Wrocław University of Environmental and Life Sciences, Institute of Environmental Biology (Wrocław, Poland). Dr. Tomasz Kokurewicz (tomasz.kokurewicz@upwr.edu.pl).

Female of lesser horseshoe bat (*Rh. hipposideros*) with juvenile

15. Genetically inherited tolerance to acid mine drainange by an impacted zooplankton population: a recessive trait?

Contact:

Rui Ribeiro (rui.ribeiro@zoo.uc.pt) https://publons.com/researcher/2743232/rui-ribeiro/

Matilde Moreira-Santos (matilde.santos@zoo.uc.pt) https://www.cienciavitae.pt/7913-7FCE-0AEA

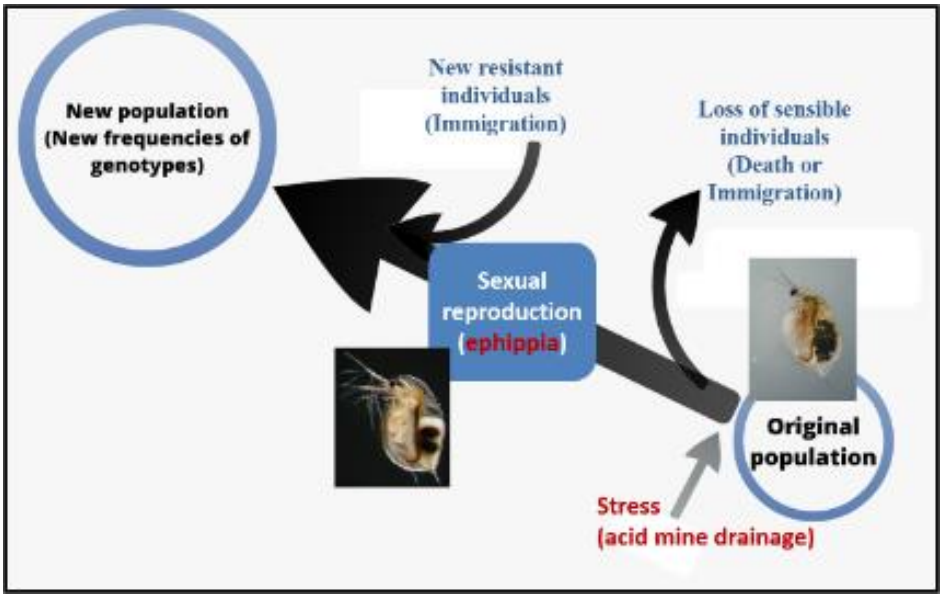
Research group: **Soil and Freshwater Stress Ecology**
http://cfe.uc.pt/profile/lines/4

WATCH IT ON YouTube https://youtu.be/8fqh4EsjXHk

Description:

Understanding the tolerance of natural populations to stressors is key for biodiversity conservation. Yet, it has been largely neglected in ecotoxicological studies. Acting as a directional selective pressure, chemical contamination may cause genetic erosion by wiping out the most sensitive genotypes. Of upmost concern is that, if tolerance is a recessive or incompletely dominant trait – the recessive tolerance inheritance (working-) hypothesis, the loss of genetic variability will be irreversible due to contaminant-driven elimination of alleles. Accordingly, the present study project aims to investigate the tolerance inheritance to lethal levels of a metal-rich acid mine drainage (AMD) in a population of *Daphnia longispina* inhabiting the impacted water basin. This species can be easily cultured in the lab. Under optimal conditions it reproduces asexually through cyclical parthenogenesis with each female originating broods of females genetically identical to it. It is thus possible to characterize the AMD tolerance of various clones by estimating their 48-hours median lethal concentration (LC50). Yet, under unfavourable conditions sexual reproduction takes place and genetic recombination occurs (males fertilize eggs enclosed in a shell called ephippium). To study inheritance, ephippia will be produced from clones with different AMD tolerance and toxicity tests will be performed with the new hatched clones to determine their 48-hours LC50 to AMD.

The work conducted within this research project is to be published as a scientific manuscript in a peer reviewed international scientific indexed periodical.



16. Do **nanoplastics** pose a risk to **freshwater** ecosystems?

Contact:

Seena Sahadevan (seena.sahadevan@gmail.com) http://www.mare-centre.pt/pt/user/552

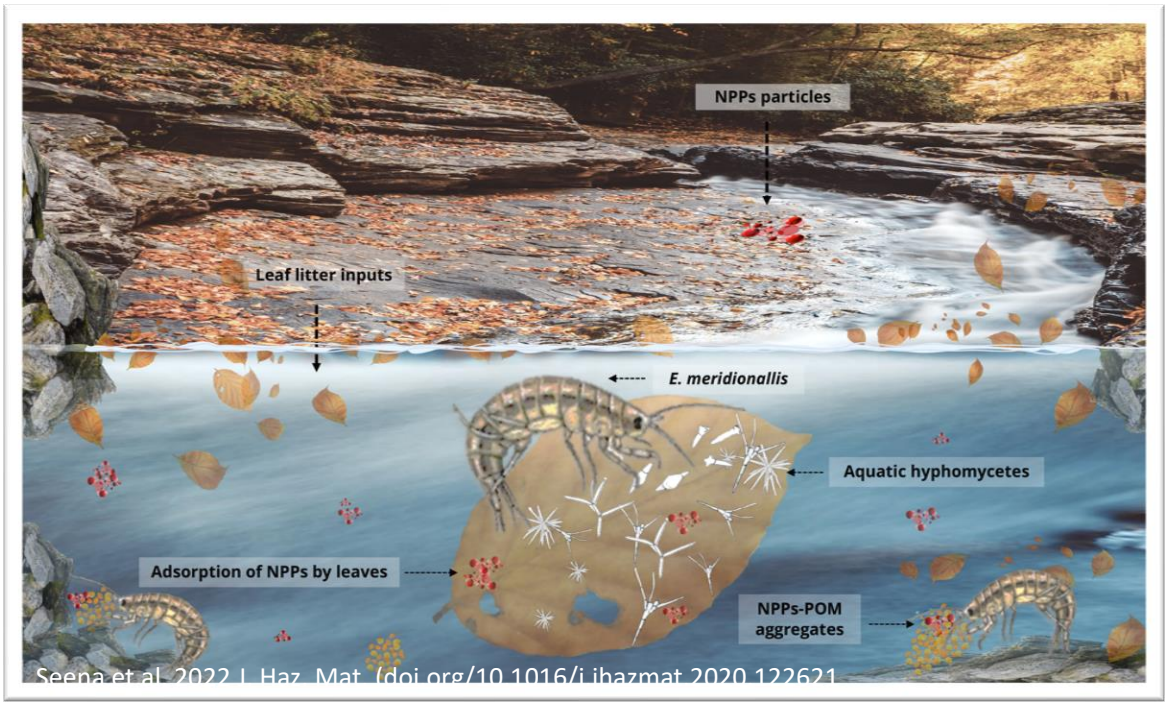
Research group: **Freshwater Ecology (MARE)**

Description:

Presently, plastic pollution is recognised as a critical issue within the aquatic environment. The production and demand for plastic have experienced rapid growth over recent decades. While plastic concentrations in freshwater systems are comparable to those found in marine environments, freshwaters often receive insufficient attention. It is estimated that between 1.15 and 2.41 million metric tonnes of plastic find their way into the ocean via global river systems each year. Presently, research primarily focuses on the environmental impacts of microplastics, leaving a substantial gap in our understanding of the environmental effects of nanoplastics.

Within freshwater ecosystems, the decomposition of plant litter serves as a vital process connecting riparian vegetation with microbial and invertebrate activities. Fungi, particularly aquatic hyphomycetes, are recognized as the primary microbial decomposers, followed by bacteria. Leaf litter decomposition is highly sensitive to water chemistry and serves as a crucial indicator for assessing the functionality and overall health of freshwater ecosystems.

This study aims to conduct research on leaf litter decomposition to evaluate the influence of nanoplastics on the functioning of stream ecosystems. This investigation will encompass factors such as decomposition rates, reproductive outputs of aquatic fungi and invertebrate feeding rates, under nanoplastic exposure. We anticipate that the outcomes of one master's thesis will culminate in a publication within an international, peer-reviewed journal.



Plant litter decomposition process in streams

17. Surf zone zooplanktonic communities along the Portuguese coast

Contact:

Ana Lígia Primo (ana.primo@uc.pt) https://cfe.uc.pt/profile/members/1490

Miguel Pardal (mpardal@uc.pt) https://cfe.uc.pt/profile/members/1658

Research group: **Marine Research Lab**
For videos of our animal research go to the WEBSITE

Description:

Surf zones are productive ecosystems that support a large diversity of marine species. The coastal proximity to nutrient sources, intense light exposure, and the concentration of suspended materials toward the shore collectively foster substantial primary production. Moreover, the shallow depth, turbidity, and abundant accumulation of detached macrophyte wracks contribute to the availability of ample food resources and offer protection to numerous organisms.

Studies describing zooplankton surf zone assemblages and their trophic importance have been carried out worldwide. Zooplankton in surf zones comprise a diverse assemblage of microscopic organisms, including copepods, krill, larvae, and other invertebrates. They are subject to the intricate interplay of physical, chemical, and biological factors unique to this turbulent environment. Hydrodynamic forces, wave action, and varying sediment dynamics influence the distribution and abundance of surf zone zooplankton, shaping their community structure and diversity.

Despite their proven ecological significance, surf zone zooplanktonic communities remain relatively understudied due to the challenges posed by the dynamic nature of their habitat.

In this project we will assess the surf zone zooplankton community's assemblages along the Portuguese coast, on rocky shore and soft bottom, and evaluate the environmental forcing in the communities.

Student will be able to participate in zooplankton sampling campaigns, analysis to chlorophyll and nutrients on water, zooplankton identification and data analysis.

18. Microzooplankton–ichthyoplankton link in the Northeast Atlantic

Contact:

Ana Lígia Primo (ana.primo@uc.pt) https://cfe.uc.pt/profile/members/1490

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Research group: **Marine Research Lab**

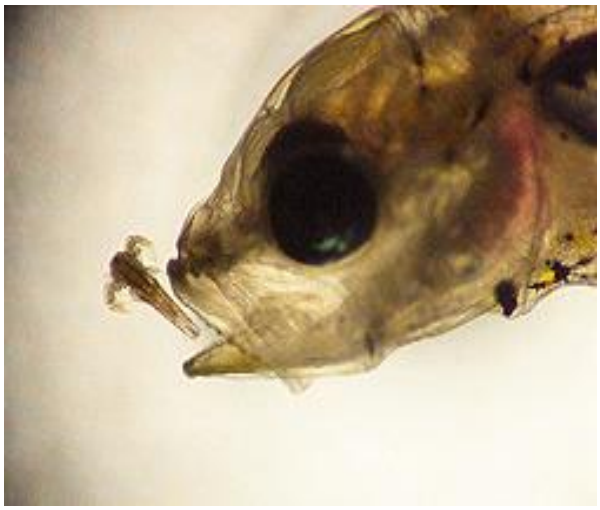
For videos of our animal research go to the WEBSITE

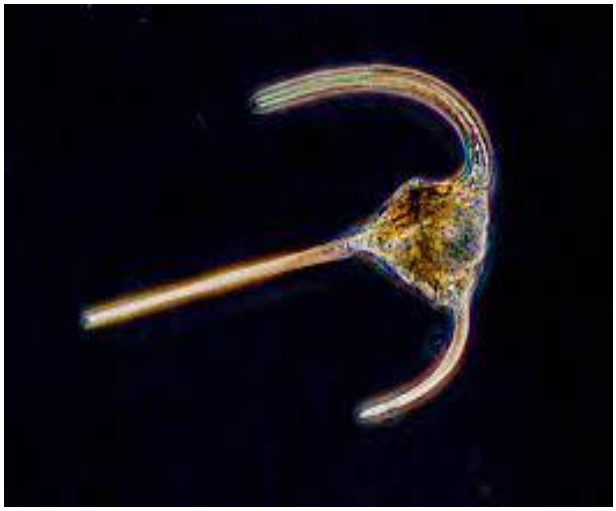
Description:

Microzooplankton represents a group of planktonic predators of small size (20-200µm). It can include flagellates, dinoflagellates, ciliates, acantharids, radiolarians, foraminiferans, copepod nauplii, rotiferans and meroplanktonic larvae.

Worldwide, the importance of microzooplankton to the trophodynamic structure and function of aquatic ecosystems has become more and more evident. They play an important role as grazers and as prey for higher trophic levels (e.g. copepods, larval fish). These organisms serve as a primary food source for larval and juvenile fish, providing the essential nutrients and energy needed for the growth and survival of young fish, facilitating their transition from planktonic to juvenile stages. This relationship between microzooplankton and ichthyoplankton is critical for the recruitment of fish populations, influencing the abundance and diversity of commercially and ecologically important fish species in marine ecosystems.

Despite that, little is known about the relationship of microzooplankton-ichthyoplankton in the field. In this project we will assess the seasonal distribution of the microzooplankton community's assemblages in the Northeast Atlantic area. Students will be able to participate in zooplankton sampling campaigns, analysis to chlorophyll and nutrients on water, microzooplankton identification and data analysis.





19. Assessing effects of pesticide use on non-target arthropods and bats at landscapes scale

Contact:

José Paulo Sousa (jps@zoo.uc.pt)

Luís Cunha (luis.cunha@uc.pt)

António Alves da Silva (antonioalvesdasilva@gmail.com)

Research group: **E3G –** Environmental Ecology and Ecotoxicology Group
https://www.facebook.com/grupoE3G/

Description:

Biodiversity is key to modern society, sustaining natural resources and providing essential ecosystem services. Pollution is one of the main drivers of biodiversity loss. Environmental Risk Assessment of Plant Protection Products (aka PPPs or Pesticides), despite being strongly regulated at the EU level, does not include effects at the landscape scale, although it is known that protection of biodiversity and associated ecosystem services must be done at the landscape scale.

In this project, we propose to link Pesticide use to biodiversity of Non-Target Arthropods and Bats and natural pest control along a gradient of landscape complexity. Funded by the EU-funded project SYBERAC, this project can encompass 3 different (but interlinked) MSc theses.

The work will be carried out in the wine region of Bairrada and will include: (1) landscape characterization (structure, composition and management) using GIS techniques, (2) field campaigns to sample soil organisms and soil functions, (3) field campaigns to evaluate non-target arthropod diversity (mainly pest control agents) and (4) on-site monitoring of bat populations and assess their potential exposure to pesticides by assessing consumed preys. Next Generation Sequencing will be used to assess biodiversity of the different groups (including prey consumed by bats) and bat community will be done via acoustic methods.

With the collected results we expect to prove the hypotheses that (1) more complex landscapes will host a better biodiversity status due to PPP use in comparison to simplified landscapes (fully dominated by vineyards), since existing patches of less intervened habitats and of natural/semi natural habitats will act as refugia for many species and that (2) communities from vineyards in complex landscapes will be more resilient to PPPs due to the larger capacity for recovery after PPP use.

20. Galápagos ecosystem recovery: integrating species interactions in ecological restoration

Contact:

Isabel Donoso (isa.donoso@imedea.uib-csic.es) www.researchgate.net/profile/Isabel-Donoso-3

Ruben Heleno (rheleno@uc.pt) http://cfe.uc.pt/profile/members/14

+ Anna Traveset, Alejandro Mieles (www.travesetlab.com/copia-de-people-1)

Research group: **Community Ecology Lab (CFE)**

Description:

Our research presents a unique opportunity for master's students to dive into the fascinating world of ecosystem dynamics. Recent research has improved our understanding of global change effects on ecosystems, but we're still uncertain about post-disturbance recovery. Traditional methods often focus on basic attributes, such as species richness, neglecting the complex web of biotic interactions crucial to ecosystem functioning.

Located in Santa Cruz, Galápagos Islands, an ongoing experiment since 2014 offers us an enticing prospect. We study the captivating tropical *Scalesia* forest, currently grappling with invasive blackberry (*Rubus niveus*). This distinctive case study allows us to explore ecological complexity in real time. Our goal is to decode the forest's intricate interactions, including pollination, herbivory, predation, and seed dispersal, across varying levels of invasion and in areas where blackberry has been removed. By doing so, we aim to uncover the secrets of forest recovery.

If this research aligns with your interests, together we will tailor the specific research questions spanning various taxonomic groups and potential fieldwork opportunities, with the goal of leading to a scientific paper. Additionally, you will have the chance to collaborate with international researchers, including scientists from the Charles Darwin Foundation and the Mediterranean Institute for Advanced Studies.

21. Exploring coastal solar saltworks

Contact:

Zara Teixeira (zara.teixeira@uc.pt) http://www.mare-centre.pt/pt/user/138

Research group: **MAREFOZ | Marine Ecosystems Lab**
http://www.mare-centre.pt/pt

Description:

Coastal solar saltworks provide a larger diversity of Ecosystem Services than expected for an anthropogenic biome, but with the abandonment of salt production, relevant cultural, economic and environmental values may be lost. To counteract this trend, the project Quinta Ciência Viva do Sal intends to explore the value of the Ecosystem Services concept for sustainable development generating opportunities for people living in, and depending on, coastal areas.

Students enrolled in this project may contribute to monitoring assessments, evaluation of provisioning, regulating and/or cultural ecosystem services, or collaborate with local communities in stakeholder and societal engagement, including science communication.

If you're interested in field monitoring and analysis, geographic information systems' and/or science communication, this theme is for you. I am totally available to discuss the most suitable MSc theme for you. The work will be carried out at the MAREFOZ laboratory in Figueira da Foz, but students may partially work remotely.

22. Botanical inventories of historical gardens in the centre of Portugal

Contact:

António Xavier Coutinho (cafe@bot.uc.pt)

https://youtu.be/qBk8PTTPaZM

Description:

In Portugal, and, more specifically in the centre of the country, there are many gardens and particular parks whose botanical inventory, in an environmental and historical education perspective, has not yet been carried out. The work will involve monthly field trips. All the trees and shrubs will be identified and herbarium specimens will be prepared and deposited in the Herbarium of the University of Coimbra. A carpological collection and photographs of all the notable specimens will be made. The tree and shrub height will be taken with a clinometer. Historical records belonging to the owners' families will be consulted. Ethnobotanical information on the uses of each botanical species encountered, such as cooking, making utensils, perfumery, toxicity, and mythological associations, will be compiled and treated.

23. Fruits and frugivorous animals: from the field to Big Data

Contact:

Ruben Heleno (rheleno@uc.pt) http://cfe.uc.pt/profile/members/14

Sérgio Timóteo (sergio.timoteo@uc.pt) http://cfe.uc.pt/profile/members/1700

+ Sara Mendes or José Miguel Costa (depending on the topic)

Research group: **Community Ecology Lab (CFE)**

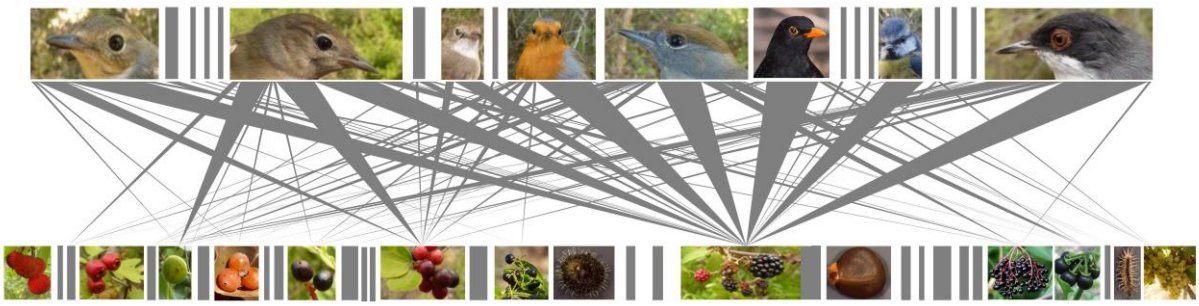
Description:

We have different projects available for students interested in Fruit-Frugivore interaction networks:

A) Characterizing the birds of the Botanic Garden of the University of Coimbra and the seeds they disperse (field work including mist netting birds in the Garden every other week. Collecting the droppings and identifying the seeds to build a seed dispersal network).
B) Exploring and combining 3 very large datasets we recently assembled in the group:
   1) Historical records of fruit production for 4462 species in Portugal between 1926 and 2013
   2) A review of fruit-frugivore interactions in Europe (441 animals; 2634 plants; 28 countries)
   3) A characterization of plant seed-dispersal syndromes for 9876 plant species

The specific questions will be discussed with the prospective students according to his/her interests and with the goal of leading to a scientific paper. Potential questions include:

- Are animal dispersed plants more likely to be threatened than abiotically dispersed ones?
- What are the birds of the Coimbra Botanic Garden, and which seeds they disperse?
- Do native and non-native plant species differ in fruit timing?
- How much information is lost on English-only literature reviews?
- What are the most important dispersers for post-fire reforestation?



24. Age-related differences in the lethal sensitivity of Daphnia sp. neonates to contaminants

Contact:

Matilde Moreira-Santos (matilde.santos@zoo.uc.pt) https://www.cienciavitae.pt/7913-7FCE-0AEA

Joana Pereira (jpereira@ua.pt) http://orcid.org/0000-0001-7573-618

Description:

Ecological risk assessment (ERA) is transversal to major pieces of environmental legislation in Europe and USA, to quantify the probability of occurrence of adverse effects on ecosystems due to contaminants. Among the various toxicity tests available, those using *Daphnia sp.* (freshwater fleas; Cladocera) are among the most widely used in regulatory aquatic ERA. To determine safe (accurate and precise) levels of contaminants in waters, such tests, either lethal or sublethal, require standardized methodologies. Although available standards recommend organism age at the start of the tests to be less than or equal to 24 h old, the occurrence of age-related differences in the lethal sensitivity to metals within this narrow age range has been reported. The present study project will further investigate potential differences in the lethal sensitivity of *Daphnia sp.* (clonal lineages of *D. magna* and *D. longispina*) to main contaminants (metals, pesticides, pharmaceuticals) in function of the neonates age at test start (using age classes up to a maximum of 24 h old). It is also intended to unravel whether sensitive indicators of condition and growth, particularly molecular/biochemical biomarkers reporting on RNA:DNA ratios, DNA damage and lipid allocation, respond differentially in function of the age factor. These endpoints can provide a view on age-dependent variation in adverse outcome pathways and, as daphnids are models in ecotoxicogenomics, inform on whether the responsivity to stress of their genomes, transcriptomes and corresponding phenotypic consequences is dependent on the organism's developmental stage and body condition. This project is anticipated to contribute to increase the level of standardization in toxicity tests with cladocerans, to decrease uncertainties when extrapolating from such responses to effects on real contamination scenarios.

The work conducted within this research project is designed to be published as a scientific manuscript in a peer reviewed international scientific indexed periodical.

25. Seed coating with plant beneficial microbes in agroecology

Contact:

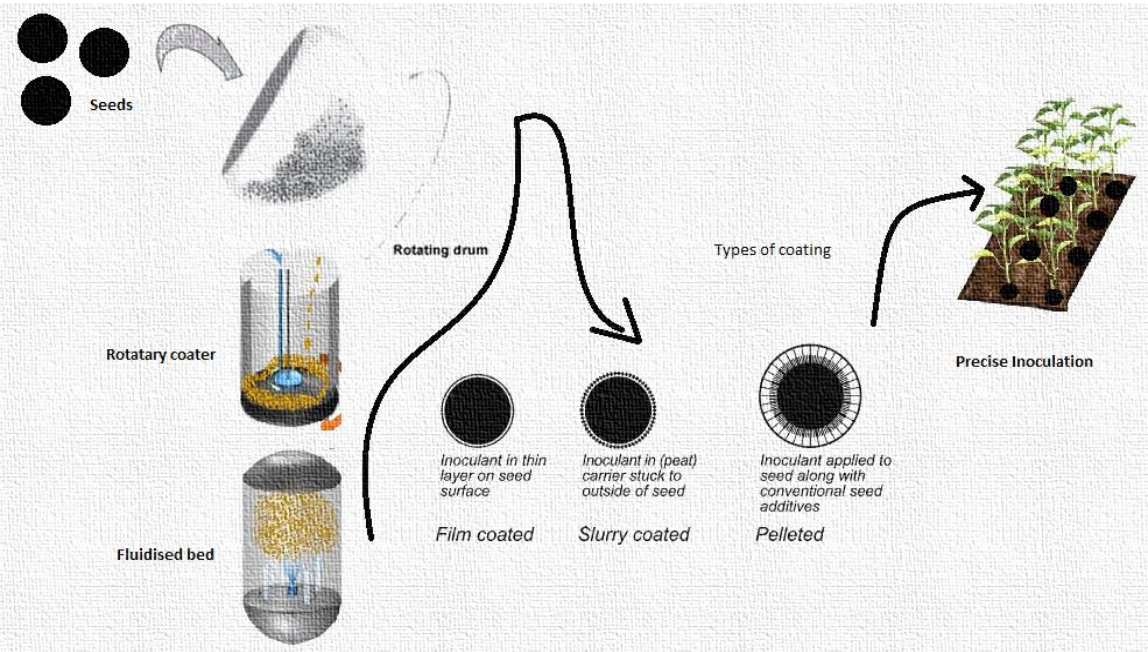
Rui Oliveira (rsoliveira@uc.pt) http://cfe.uc.pt/profile/members/1688

Ying Ma (cathymaying@gmail.com) http://cfe.uc.pt/profile/members/1716

Helena Freitas (hfreitas@uc.pt) http://cfe.uc.pt/profile/members/1581

Description:

Plant beneficial microbes (PBM), such as arbuscular mycorrhizal fungi and plant growth-promoting bacteria, can reduce the use of agrochemicals and increase plant yield, nutrition, and tolerance to biotic–abiotic stresses. Yet, large scale applications of PBM have been hampered by the high amounts of inoculum per plant or per cultivation area needed for successful colonization. Seed coating, a process that consists in covering seeds with low amounts of exogenous materials, is gaining attention as an efficient delivery system for PBM. Microbial seed coating comprises the use of a binder, in some cases a filler, mixed with inocula of PBM, and can be done using simple mixing equipment (e.g., cement mixer) or more specialized/sophisticated apparatus (e.g., fluidized bed). Binders/fillers can be used to extend microbial survival. Notwithstanding the promising results of seed coating, there are still challenges mainly related with the scaling up from the laboratory to the field and proper formulation, including efficient microbial combinations and coating materials that can result in extended shelf-life of both seeds and coated PBM. These limitations need to be addressed and overcome in order to allow a wider use of seed coating as a sustainable delivery method for PBM in agroecology. The aim of this project is to study seed coating with PBM to assist crops in improving seedling establishment and germination and achieving high yields and food quality, under reduced chemical fertilization and abiotic stresses.



26. Valorisation of "Sargaço" as a fertiliser

Contact:

Leonel Pereira (leonel.pereira@uc.pt) https://www.mare-centre.pt/pt/user/88

Ana Cristina Rocha (acsrocha@uc.pt) http://www.mare-centre.pt/pt/user/7934

http://www.mare-centre.pt/pt

Description:

"Sargaço" is a mixture of diverse algae that grows on the continental platform of Portuguese north coast, being mainly composed by *Saccorhiza*, *Laminaria*, *Fucus*, *Codium*, *Palmaria*, *Gelidium* e *Chondrus*. The harvesting and use in agriculture of *"sargaço"* date back to the Middle Ages, having been a considerable economic and social activity on the North coast. However, it is currently an almost extinct practice.

As an organic-rich mixture, *"sargaço"* was frequently used, in the past, as a fertilizer, increasing agricultural productivity of coastal lands. Additionally, macroalgae are composed by several minerals and biochemical compounds, such as fatty acids, steroids, terpenes, carotenoids, phenols, amino acids, vitamins, etc, presenting a wide range potential of application.

Students enrolling in this project will be involved in the taxonomical, chemical and biochemical characterisation of *"sargaço"* collected at Vila do Conde, also participating in field campaigns. The student will then participate in the preparation of algae extracts and compost with macroalgae and perform germination bioassays, using algae extracts as biostimulants and the produced compost as fertiliser, with seeds of cultures with local interest.

The work will be carried out at MARE-UC, specifically, at the MAREFOZ laboratory, at Figueira da Foz, and the Marine Macroalgae Laboratory, in University of Coimbra. The most important characteristics is that the students are genuinely interested in the topic and available to work in Figueira da Foz and Coimbra. This work will be performed under the scope of the project ***ValSar – Valorização do Sargaço da Costa Litoral Norte***.

27. The physiological basis of powered flight

Contact:

Miguel Araújo (pmaraujo.ecotopt@gmail.com) https://www.mare-centre.pt/pt/user/116

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

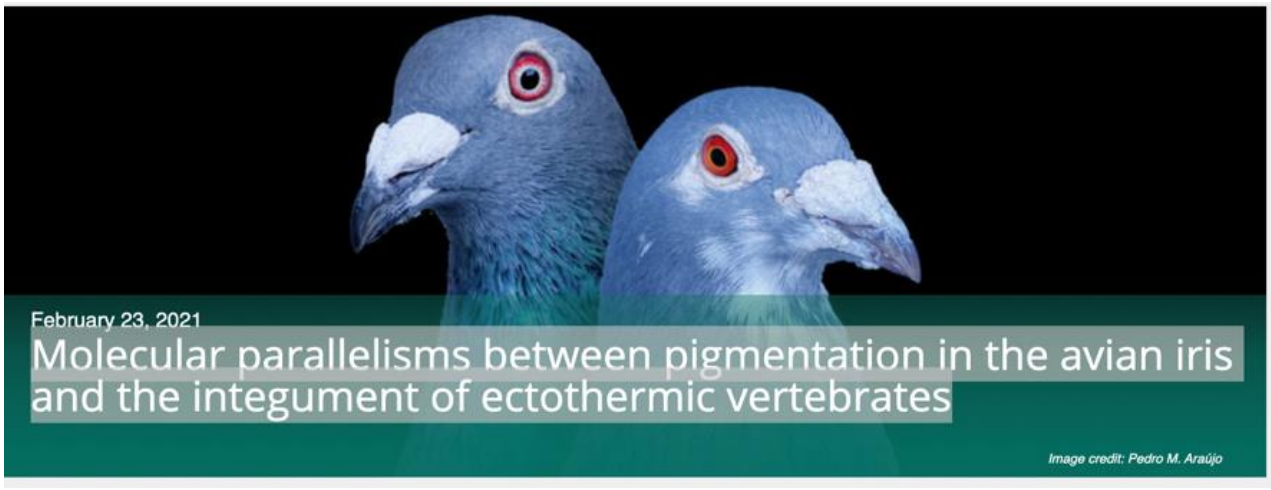
Description:

The evolution of life on Earth has generated an impressive diversity in the spatial dynamics of migratory populations. Animal migration plays an important role because it acts at multiple scales, and can shape the fate of individuals and populations, communities and ecosystem structures, and influence evolutionary processes and patterns of local and global biodiversity. Birds comprise perhaps the most iconic examples of how migration shapes the biology of animals. Although a large body of work has been amassed to describe the multiple phenotypic adaptations that underlie migration in birds, the genes and pathways that control for the expression of these traits are still largely unknown.

The extreme athletic and navigational skill of racing pigeons offer an amazing opportunity for exploring questions in evolutionary and functional biology. However, we still lack a clear understanding on how specific morphological and physiological traits are associated with different aspects of flight performance, and how these traits are controlled at the cellular and molecular level.

Racing pigeons are one of the fastest and most effective flying birds on the planet. To study the morphological adaptations that make pigeons efficient racers, we will select highly conserved breeding lines of racing pigeons based on their racing performance in competitions up to 300 kms (speed), and on races of more than 550 km (endurance). This will enable us to answer the following questions: 1) Is there any relationship between wing morphology and flight performance in racing pigeons? 2) Does flight performance vary according to the distance that racing pigeons cover? 3) How does energy expenditure vary across flight distance?

This project is open for one student interested in genetics and molecular evolution. He/She will perform captivity experiments with racing pigeons in MARE UC facilities. The genomic work will be performed at the laboratories of Cibio/InBIO of University of Porto with support of all supervisors. This will result in one master thesis to be concluded in 2025, which would be expected to be published in a scientific journal.



28. Fish-Omics: unveiling fish nutritional quality by NMR-metabolomics

Contact:

Mariana Palma (mpalma@uc.pt) https://cfe.uc.pt/profile/members/1722

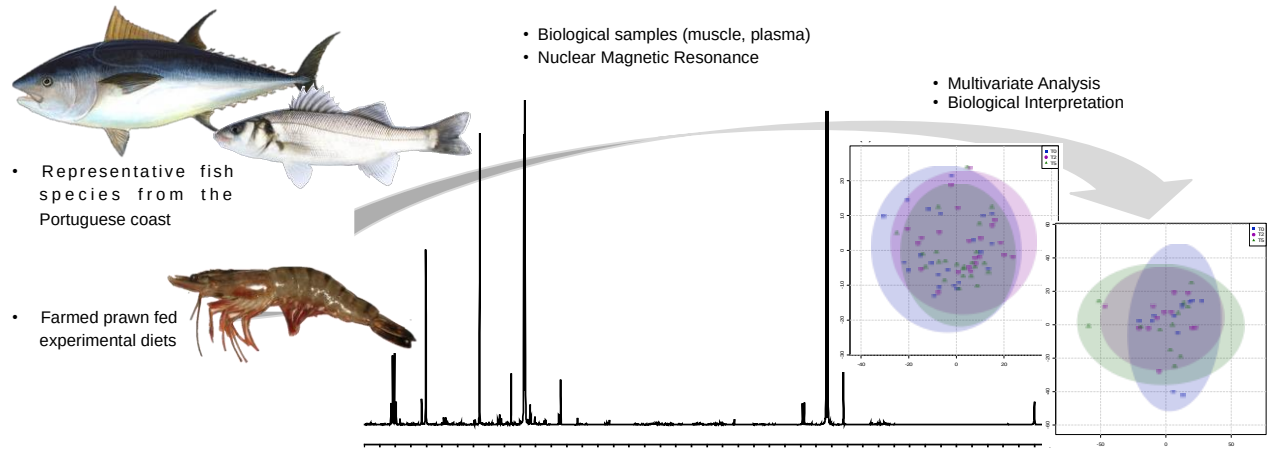
Ivan Viegas (iviegas@uc.pt) https://apps.uc.pt/mypage/staff/uc41517/

Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

Description:

Studies on animal science often require assessing physiological information, either to establish baseline profiles or to evaluate changes promoted by experimental conditions. Some tools, like Metabolomics have proved to be a reliable approach to address the multivariate and large-scale analysis of the metabolome, as a final expression of the environment (natural or experimental) on the biological systems. We use this approach, specifically the Nuclear Magnetic Resonance (NMR)-Metabolomics, to assess research question on the Aquaculture and Seafood Quality fields.

We are at the moment developing projects on i) seafood species from the Portuguese coast, and how their fillet composition vary between the coastal regions, and ii) on how experimental diets affect the composition of farmed prawn species. Get in touch and embrace a challenging MSc project on Marine Biology and NMR technologies.



29. Ecological state of coastal and estuarine ecosystems

Contact:

Helena Veríssimo (helena.verissimo@uc.pt) http://www.mare-centre.pt/pt/user/62)

Ana Cristina Rocha (acsrocha@uc.pt) http://www.mare-centre.pt/pt/user/7934

http://www.mare-centre.pt/pt

Description:

Global warming is a prevailing challenge to humankind. With the increasing frequency of extreme weather events and the sea level rise, the areas that are occupied by humans are at risk of being destroyed. This problem is of particular concern to the coastal and estuarine ecosystems, which will be highly susceptible to the impacts of climate change, such as increased erosion and higher risk of flooding in the coastal areas. This can result in alteration, fragmentation or loss of habitats, leading to instability in the management of water resources, having a negative impact not only in the environment and biodiversity but also on economic and social activities. It is paramount to assess the ecological state of coastal and estuarine ecosystems to preserve their richness and the services these areas provide.

Students enrolling in this project will be involved in monitoring campaigns in the Mondego estuary and the coastal area from Aveiro to Caldas da Rainha. Students will participate in the preparation and treatment of different samples (biological and environmental), in the measurement of several physico-chemical parameters and on the identification of aquatic organisms (macroinvertebrates). The compilation and statistical analysis of the produced data will allow the assessment of the ecological state of coastal and estuarine ecosystems under study considering the natural and anthropogenic stressors they are subjected to.

The work will be carried out at MARE-UC, specifically, at the MAREFOZ laboratory, at Figueira da Foz. The most important characteristics is that the students are genuinely interested in the topic and available to work in Figueira da Foz.

30. Microalgal lipid biosynthetic potential

Contact:

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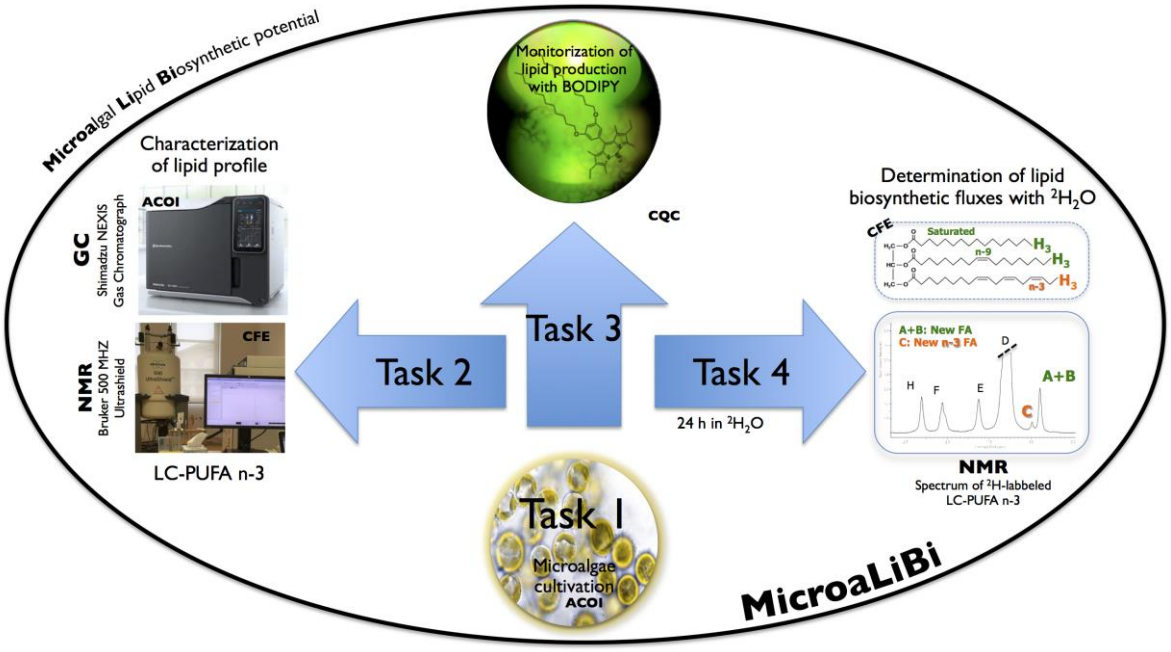
Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

Description:

Fish is a highly nutritious source of protein and long-chain polyunsaturated fatty acids (LC-PUFA), particularly omega-3 (n-3) which are extremely important for human health. Nonetheless, fish have a limited capacity to synthesize LC-PUFA relying extensively on dietary provision through their feed. While most feed formulation are nowadays shifting towards more sustainable plant ingredients, the levels of n-3 are becoming critically limited for feeds formulations. This is a major bottleneck for the growth of aquaculture and has a direct impact on the nutritional value of the final product. The supply of n-3 fatty acids in natural marine food webs is guaranteed by microalgae, therefore identifying and maintaining the species and/or strains that accumulate harvestable quantities of LC-PUFA may improve the supply of this high-value nutrient. This should be accompanied by an assessment of the cultivation conditions that maximize LC-PUFA yields as well as the development of reliable probes and tools to monitor lipid biosynthetic capacity of these microorganisms. We aim at i) characterizing the lipid profile of the most promising to assert the n-3 LC-PUFA content (in collaboration with ACOI - Coimbra Collection of Algae UC); and ii) improving on a new, simple and reliable method for lipid detection and quantification (in collaboration with CQC - Coimbra Chemistry Centre). Questions? Doubts? Get in touch!



31. Assessing **effects of low risk pesticides** in non-target terrestrial organisms

Contact:

Tiago Natal da Luz (tiagonluz@iav.uc.pt) http://cfe.uc.pt/profile/members/1711

José Paulo Sousa (jps@zoo.uc.pt) http://cfe.uc.pt/profile/members/1621

Research group: **E3G –** Environmental Ecology and Ecotoxicology Group
https://www.facebook.com/grupoE3G/

Description:

The current European Farm to Fork (F2F) strategy aims at a reduction of 50% in the application of the most hazardous pesticides by 2030. This goal prompted the boost of a new research field linked to the development and risk assessment of novel bio-pesticides, having either a microbial, plant or animal origin. The existing regulation in Europe is vague regarding the data requirements (i.e., the type of tests to be performed to assess effects in non-target organisms) for the ecological risk assessment of these compounds. This project, to be developed in collaboration with the SME CloverStrategy Lda and Ascenza Portugal aims to test new hybrid and bio-PPPs containing microbial and animal proteins as active substances on different species of non-target terrestrial organisms, namely honey-bees (*Apis mellifera iberiensis*) , parasitoid wasps (*Aphidius rhopalosiphi*) and soil collembola *Folsomia candida*.

The outcome of this study will contribute not only for the developmental phase of these products, but also to select the best ecotoxicological tests to incorporate in the future data requirements for these products.

By being partially conducted in a consulting laboratory, this project will allow students to enter in contact with a “working environment” from a private laboratory, gaining useful experience when entering the employment market.

32. Land use and land management effects on soil fauna soil functions and associated ecosystem services

Contact:

Luís Cunha (luis.cunha@uc.pt) http://cfe.uc.pt/profile/members/1809

José Paulo Sousa (jps@zoo.uc.pt) http://cfe.uc.pt/profile/members/1621

Research group: **E3G –** Environmental Ecology and Ecotoxicology Group
https://www.facebook.com/grupoE3G/

Description:

We have around 25% of the planet biodiversity in our soils. The organisms living in soil have important functions and provide ecosystem services that sustain the environment, through essential supporting (e.g. soil formation and aggregation, nutrient cycling) and regulatory services (e.g. carbon sequestration). Land use and land management are key drivers on how the soil biodiversity responds. Activities with high input of chemicals and intensive soil management reduces soil biodiveristy and consequently decrease the services provision. Integrated in the EU-funded project BENCHMARKS (https://soilhealthbenchmarks.eu/), we propose the following project:

- Assessing soil fauna and associated soil functions in a gradient of land management in inland central Portugal region

To assess soil fauna and different soil functions (e.g., OM decomposition and nutrient cycling, water retention, soil compaction), soil samples will be taken in the field in several farms. Soil fauna surveys are performed using standard methods (monoliths with 25 x 25 cm length per 20cm depth and Pitfall traps). The species will be identified using classical taxonomy and genetic barcoding techniques. Different soil functions will also be evaluated. The results of each project are expected to produce a paper in an indexed journal.

33. Plant-parasitic nematodes - a threat to Mediterranean agriculture

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Research group: **NEMATO-lab** & **CIEPQPF**
https://www.facebook.com/NEMATO-lab-429239727651127/
https://www.facebook.com/Ciepqpf/

Description:

Root knot (RKN, *Meloidogyne* spp.) and root lesion nematodes (RLN, *Pratylenchus* spp.) are amongst the world's most damaging agricultural plant-parasitic nematodes (PPN), attacking nearly all crops grown. They are distributed worldwide and are parasites of a wide range of economically important plants, which explain the high impact on agriculture and few chances for its control. In Portugal, *M. chitwoodi* and *M. enterolobii,* included in the European and Mediterranean Plant Protection Organization (EPPO) A2 List of pests recommended for regulation as quarantine organisms, and *M. luci*, added to the EPPO Alert List, were found associated with important crops and/or ornamental plants and weeds, representing a potential threat to several crops. Several species of RLN were also found, namely *P. crenatus*, *P. neglectus*, *P. penetrans* and *P. thornei* associated to potato crop.

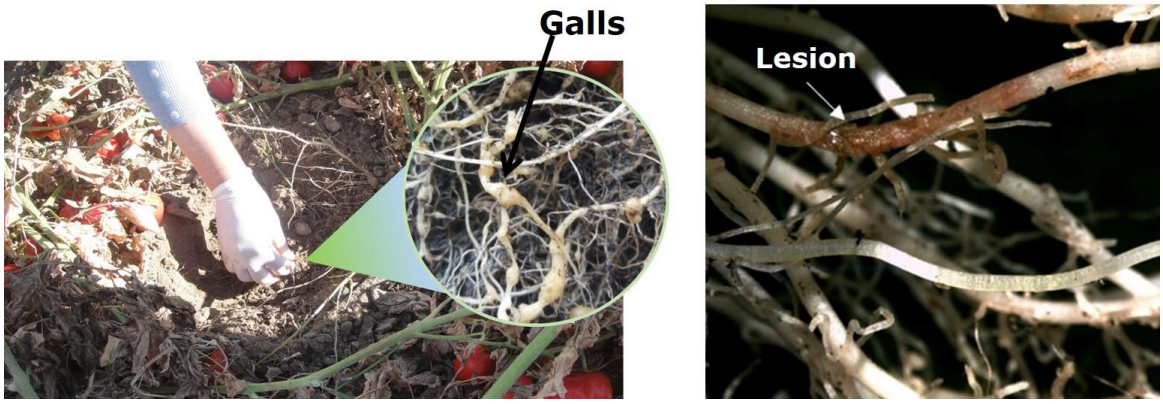
Research topics:

1) Validation of diagnostic molecular methods for the detection/identification of RKN and RLN;

2) Validation of a sustainable strategy for RKN management (field assay), using agro-industrial residues;

3) *In vitro* screening of plant-delivered compounds against PPN.

The project is open for up to 2 MSc students. The information gathered will contribute to international peer-reviewed publications.



Infected tomato and potato roots with RKN and RLN, respectively.

34. Biological control of plant pathogens

Contact:

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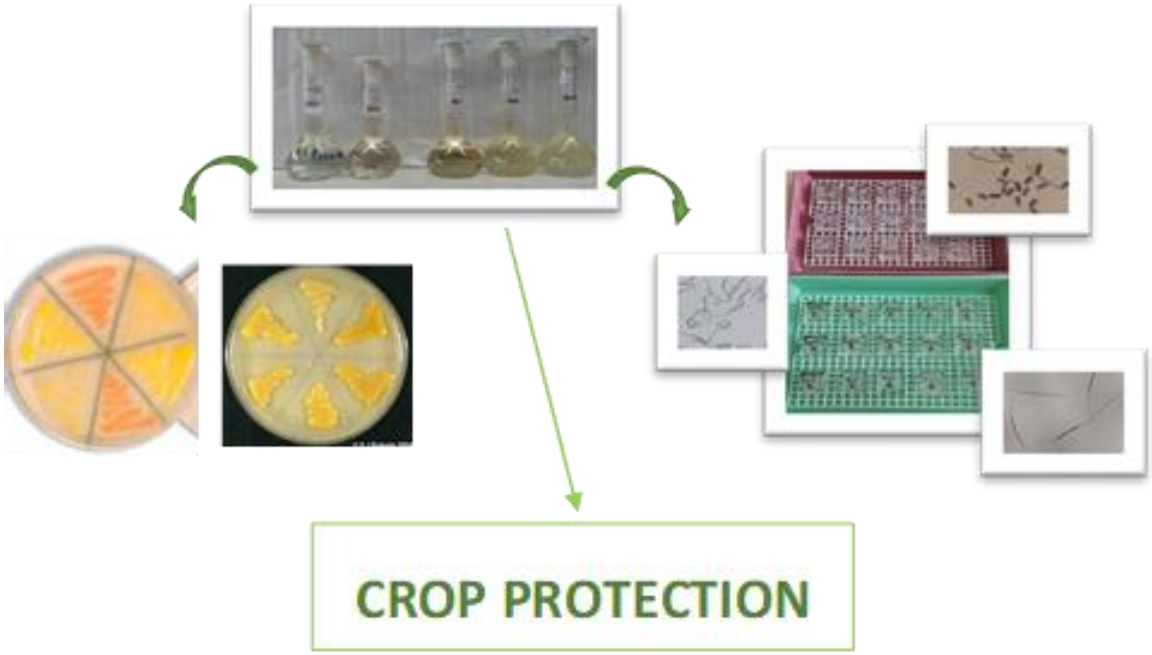
Research group: **NEMATO-lab**
https://www.facebook.com/NEMATO-lab-429239727651127/

WATCH IT ON YouTube https://youtu.be/lEAYuh88JC4
https://youtu.be/VS6qindLLZ8

Description:

Plant pathogens causes heavy losses in agriculture worldwide. They are an important problem especially in development countries where the agriculture is familiar and there is no money to use expensive tools like, for example, chemical pesticides or solarization. The development of natural products from soil organisms like bacteria and fungi can be an economical and heathy friendly alternative. Several products will be tested at several concentrations against plant pathogen organisms like, for example, bacteria and phytoparasitic nematodes. Hatching, mortality, viability, infectivity and reproduction of the plant pathogens organisms will be evaluated under different conditions. The plant pathogens organisms will be identified using morphological, biochemical and molecular methods before the in vitro bioassays. Inserido na investigação do projecto Internacional Ecostack: "Stacking of ecosystem services: Mechanisms and interactions for optimal crop protection, pollination enhancement, and productivity". (https://www.ecostack-h2020.eu/)



35. Bioaccumulation of mercury by *Gracilaria gracilis*. Risk for human use?

Contact:

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Marine Research Lab
https://mobile.twitter.com/marineresearchl
https://www.facebook.com/marineresearchlab/

MACOI – Portuguese Seaweeds Website, and Marine Algae Laboratory
http://www.seaweeds.uc.pt/

Description:

Aquaculture systems have been experiencing unparalleled growth to face the demand of seafood products in the context of a growing worldwide population. Since they present high productivity and can be economically viable, red macroalgae are being used due to their high growth rates, ability to be edible and the high possibility for biotechnology application.

Since one of the main problems in coastal and estuarine systems is the contamination by heavy metals, mainly due to the industrial activity, it is paramount to assess the potential of mercury bioaccumulation on *Gracilaria gracilis* (Rhodophyta), the most used red macroalgae.

The work is based on laboratory experiments, where the growth of the red algae occurs in different concentrations of mercury, in order to assess the possibilities to use this macroalgae in different scenarios of coastal and estuarine contamination. This work is important since the studies addressing this issue are mainly on the green macroalga Ulva. There is a lack of knowledge concerning this species in particular.

Further Reading: http://dx.doi.org/10.1016/j.ecss.2005.06.020, https://doi.org/10.1007/978-3-030-75315-3_10, https://doi.org/10.3390/md19030164

36. Searching for **pinewood nematode** pathogenic determinants

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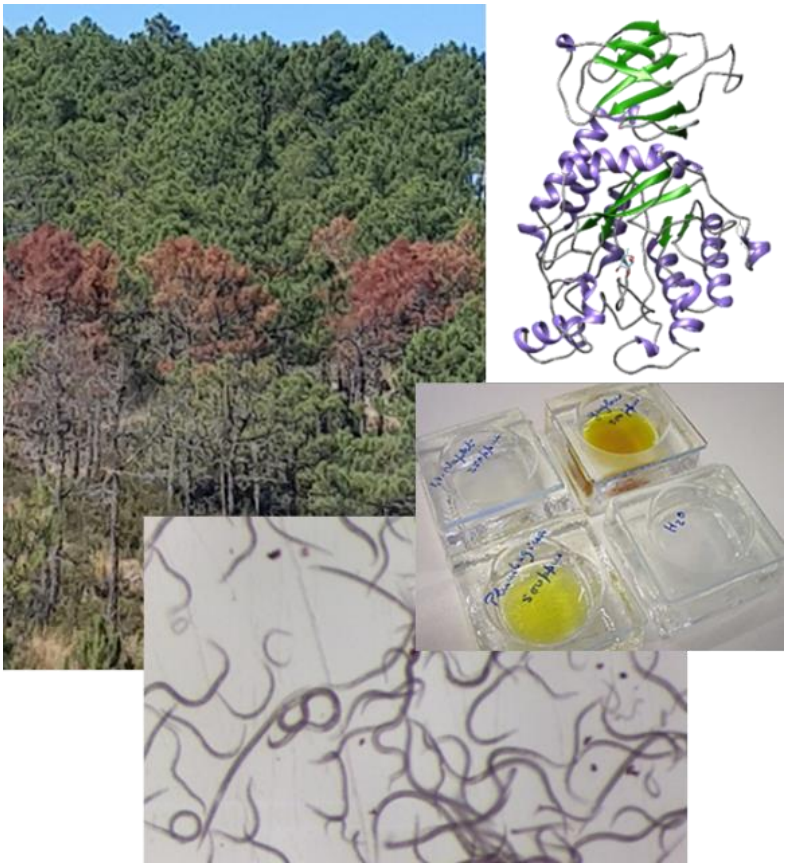
Joana M. Sá Cardoso (joana.cardoso@uc.pt) https://www.cienciavitae.pt/E813-1BD9-134C

Research group: **NEMATO-lab**
https://www.facebook.com/NEMATO-lab-429239727651127/

Description:

The pinewood nematode (PWN), *Bursaphelenchus xylophilus*, is the causal agent of Pine Wilt Disease and is a serious threat to Asian and European forests. The international ecological and economic impact caused by this pathogenic nematode highlight the need of further research on PWN pathogenic mechanisms and development of new control strategies. Secretome and proteome profiles of *B. xylophilus* are being obtained in order to identify the specific/differentially expressed proteins. These proteomic data will be analyzed, and proteins related to PWN pathogenicity and with potential to be considered as targets for nematode detection/control will be selected and molecularly characterized. Additionally, the effects of naturally occurring phytochemical compounds, in PWN morphological and physiological parameters and in the expression profile of genes involved in plant-PWN interaction will be evaluated.



37. Pelagic **seabirds** as sentinels of Ocean health

Contact:

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Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube https://www.lifeilhasbarreira.pt
https://avesmarinhasdecaboverde.info

Description:

Our sense of the ocean's power and omnipotence contributed to an assumption that nothing we did could ever possibly impact it. However, reality dictates that the world's oceans are in peril. Overfishing has dramatically reduced fish stocks and thousands of tons of rubbish dumped in the oceans wreak havoc on marine life. Thus, finding suitable sentinel species of the Human impacts on the Oceans is pivotal to applied biological conservation.

Using recently developed tracking technology (radar detector GPS-tags) on seabird species belonging to different ecological guilds, the project aims to accurately map (1) their foraging distribution and diet, (2) fishery activities and, (3) hotspots of plastic pollution, to help understand the impact of those two Human stressors on Key Biodiversity Areas (KBAs) and Marine Protected Areas (MPAs).

Main tasks during the project will include: (1) fieldwork on islands of the Portuguese or Cabo Verde archipelagos; (2) using individual tracking devices on seabird species; (3) collection of biological samples; (4) lab work on processing biological samples, (e.g. stable isotopes analysis); (5) data processing and statistical analysis, within the R environment (specially analysis of spatial data and modelling routines through the use of remote sensing information).

The project is open for two MSc students. The logistics of this work will be funded by projects from the LIFE EU program (https://avesmarinhasdecaboverde.info) and the Conservation Foundation MAVA (https://avesmarinhasdecaboverde.info). The information gathered will contribute to two international peer-reviewed publications.

38. AquaCSI - **AquaCulture** using Stable Isotopes

Contact:

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Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

Description:

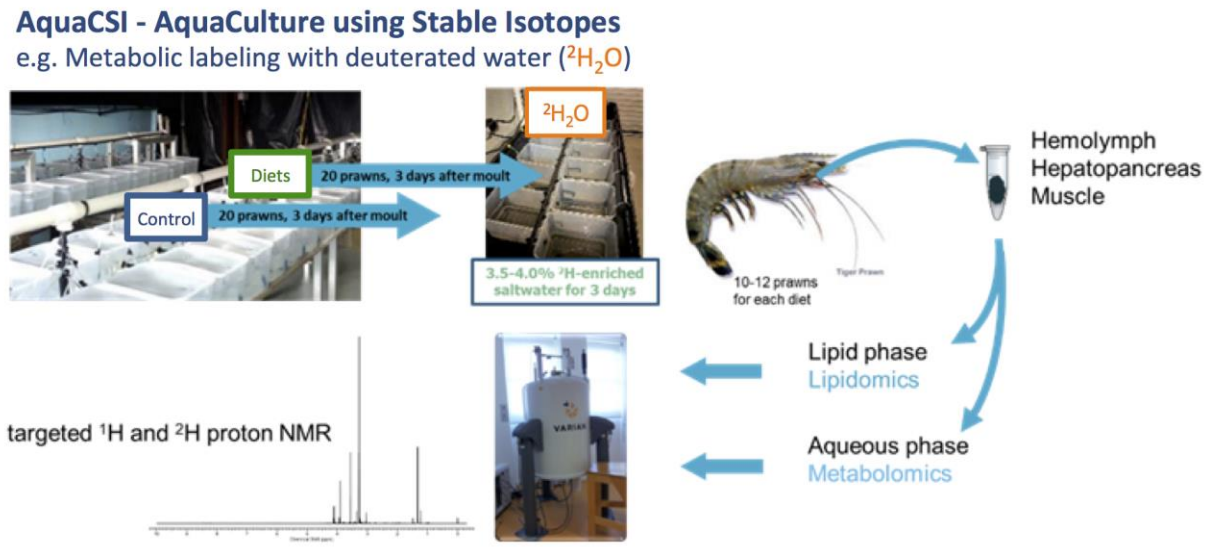
Aquaculture of carnivorous fish and shrimp remains highly dependent on fishmeal protein and its procurement still relies on exploiting wild fisheries. Any reduction in its utilization, especially if substituted by less expensive plant-derived ingredients like carbohydrates, would reduce the ecological burden of this industry and improve its sustainability. Our lab focuses on using the delivery of stable isotopes to understand nutrient utilization and evaluate the efficacy of novel ingredients. We are conducting several International projects with different contexts but that engage in using different stable isotopes and NMR (Nuclear Magnetic Resonance) technology to address the challenges of modern aquaculture:

i) subjecting Tambaqui, an Amazon fish species (*Colossoma macropomum*) with frugivorous feeding habits, to doses of ^{13}C-glucose and ^{13}C-fructose (with UNESP, Brazil);

ii) optimizing diets for Asian tiger shrimp (*Penaeus monodon*) after a 3-day residence in $^{2}H_2O$ (with CSIRO, Australia);

iii) using ^{13}C-butyrate to assess if tributyrin improves nutrient utilization in rainbow trout (*Oncorhynchus mykiss*) (with CIIMAR, Portugal; and INRA, France).

Questions? Doubts? Get in touch!



39. Growth dynamics of **hyperaccumulator plants** associated with **rhizobacteria** and arbuscular **mycorrhizal** fungi

Contact:

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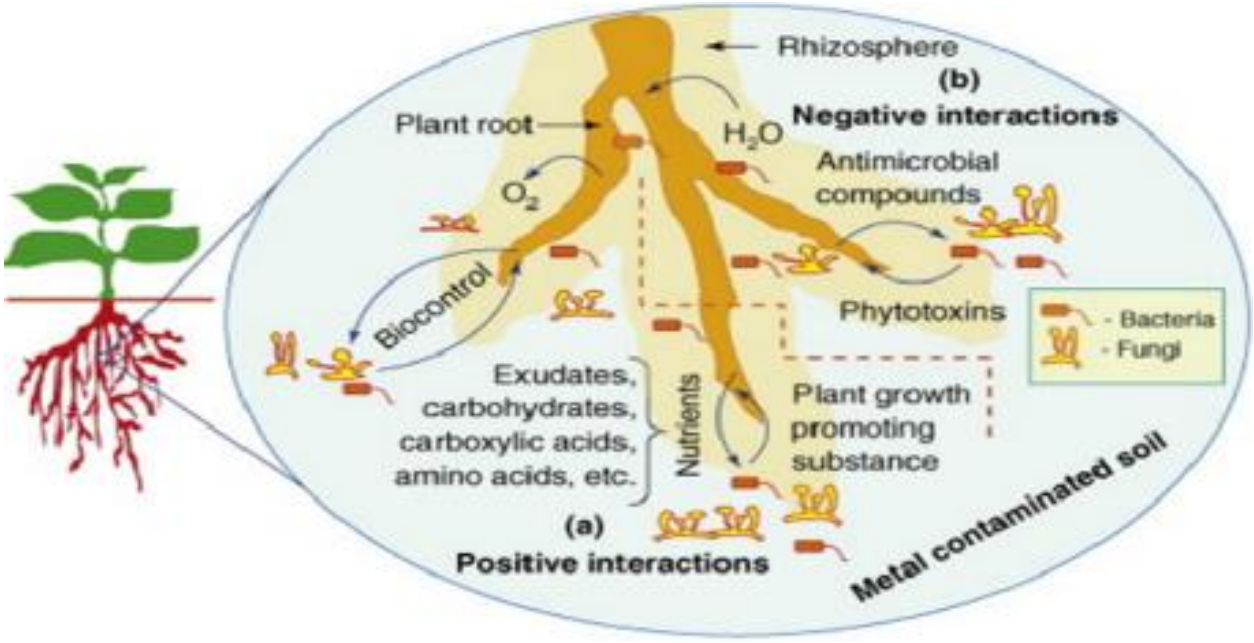
Description:

Plant growth-promoting bacteria (PGPB) and arbuscular mycorrhizal fungi (AMF) are used to improve phytoremediation of metal contaminated soils. However, one of the main limitations of microbial-assisted phytoremediation is the poor colonization capacity of PGPB and AMF. Although modern marker genes have been used as environmental tracers in the microecology of bacterial and fungal colonization, the mechanisms behind AMF-PGPB-plant interaction are poorly understood. The objectives of this project are to i) study the colonization dynamics of PGPB in the rhizosphere and tissue interior of hyperaccumulators and ii) clarify the mechanisms of AMF-PGPB-mediated plant growth promotion under metal stress. Experimental microcosms will be established where hyperaccumulator will be inoculated with PGPB and AMF. Plants will be challenged with concentration gradients of Zn and Cd for simulating multimetal contaminated environments to determine growth parameters (e.g. vigour index, photosynthesis, and antioxidant enzyme activities) under metal stress, and to explore the effects of PGPB and AMF inoculation on plant metal uptake. In vivo colonization, the distribution and dynamics of PGPB and AMF in the rhizosphere and tissue interior will be assessed through marker genes. It is expected that the results obtained in this project will originate from a scientific paper to be submitted to a peer-reviewed journal.



40. Biological control of the invasive invasive plants

Contact:

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Hélia Marchante (hmarchante@gmail.com) http://cfe.uc.pt/profile/members/1582

Research Line: **Biological Invasions** (Plataforma Invasoras.pt / Terrestrial Ecosystems and Global Change)

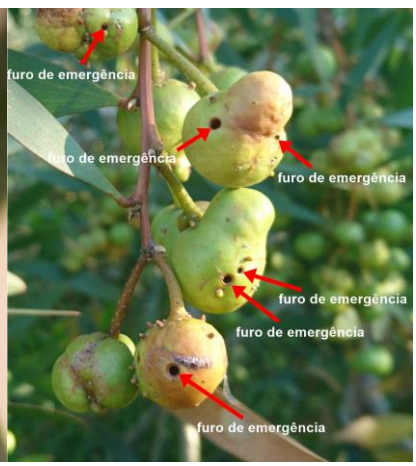
Description:

Acacia longifolia is one of the most widespread invasive plants along the Portuguese coast, decreasing plant diversity, drastically changing plant communities, altering soil and ecosystems dynamics, reducing forestry productivity and implying thousands of euros each year in control costs. Control methods used so far are not efficient, namely because the areas are quickly re-invaded through germination of the long-lived seeds accumulated on soil. Biological control of *A. longifolia* with the Australian gall wasp *Trichilogaster acaciaelongifoliae* (Hymenoptera, Pteromalidae) has proven to be an excellent option in South Africa and was introduced in Portugal, in 2015. In this context, we want to follow up not only the establishment of the biocontrol agent (BCA) but also its impacts on *A. longifolia* and native communities of plants and galls. The work will involve field trips to monitor the areas where the BCA was introduced, and eventually greenhouse and lab work. The output of this study will contribute to the sustainable management of *A. longifolia* in Portugal and to increased knowledge of the BCA as well. Additionally, will be part of an innovative way of managing invasive plants in Europe. The results may contribute for a paper to be published in an international peer reviewed journal.

Alternatively, biocontrol of other invasive plants can be explored, namely water hyacinth (*Eichhornia crassipes*), Japanese knotweed (*Fallopia japonica*), hottentog fig (*Carpobrotus edulis*), etc.

We are looking for someone with an interest in ecology, entomology or botany, who enjoys working with a team but also capable of carrying out independent field work if needed.

More information: https://invasoras.pt/controlo-natural-da-acacia-de-espigas & https://youtu.be/5GpjRQX0lyE (in Portuguese)



41. Heartworm disease in Coimbra: a case study

Contact:

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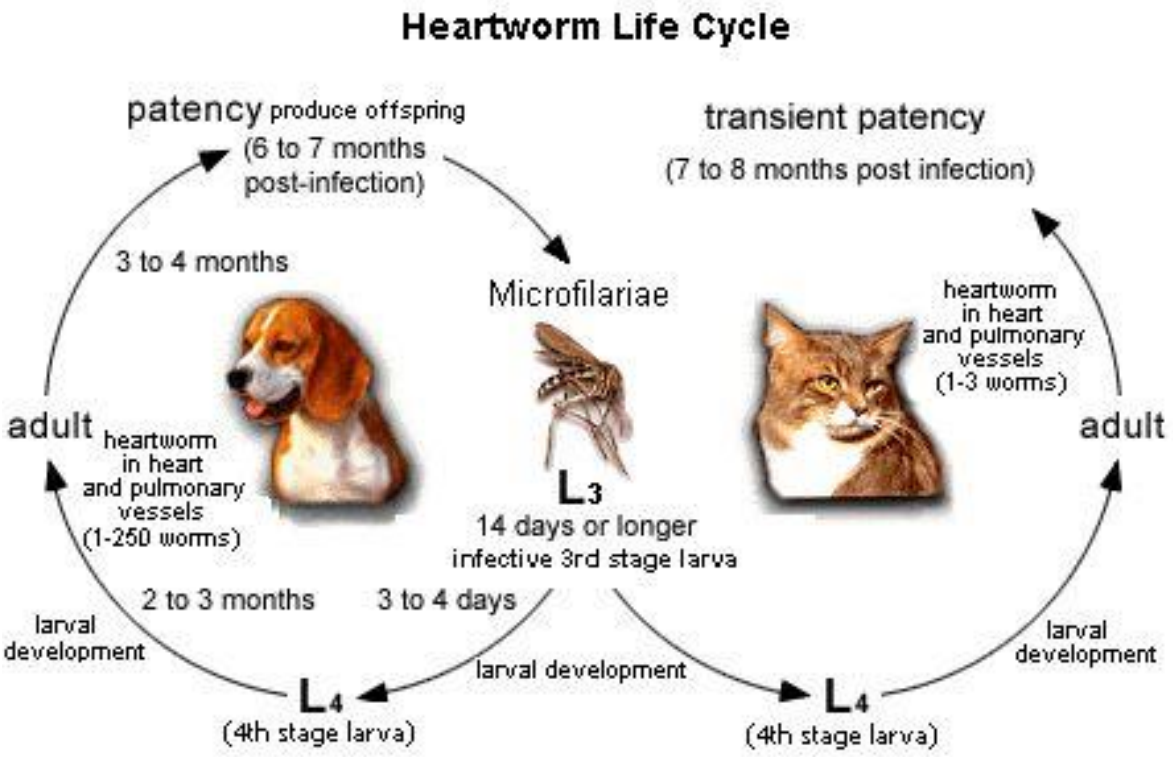
Sérgio Ramalho Sousa (ramalhosousa@gmail.com) https://www.cienciavitae.pt/BF12-584B-51D2

WATCH IT ON YouTube https://youtu.be/VS6qindLLZ8

Description:

Culicidae are mosquito vectors of several pathogens of importance in animal health. In Portugal, canine and feline heartworm disease is caused by *Dirofilaria immitis*. However, *D. repens* has been increasingly relevant in the current national panorama. Cases of canine and feline heartworm disease have been reported in Portugal, but the mosquito species present and their infection rates remain unknown. This heartworm can also infect humans and the most part of the infections are asymptomatic and can caused severe damage to lungs. In this work, we intend to carry out prospection of Culicidae mosquitoes in the municipality of Coimbra. The main objectives are to determine the fauna of Culicidae mosquitoes of the country, the bioecological aspects, rates of infection by *Dirofilaria* spp. and the risk factors for vector transmission. The identification of vectors and parasites will be done through morphological and molecular methods.



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42. How does (micro)plastic pollution affect coastal and marine ecosystems?

Contact:

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Research group: **Sistemas Costeiros e Oceano**
http://www.mare-centre.pt/pt

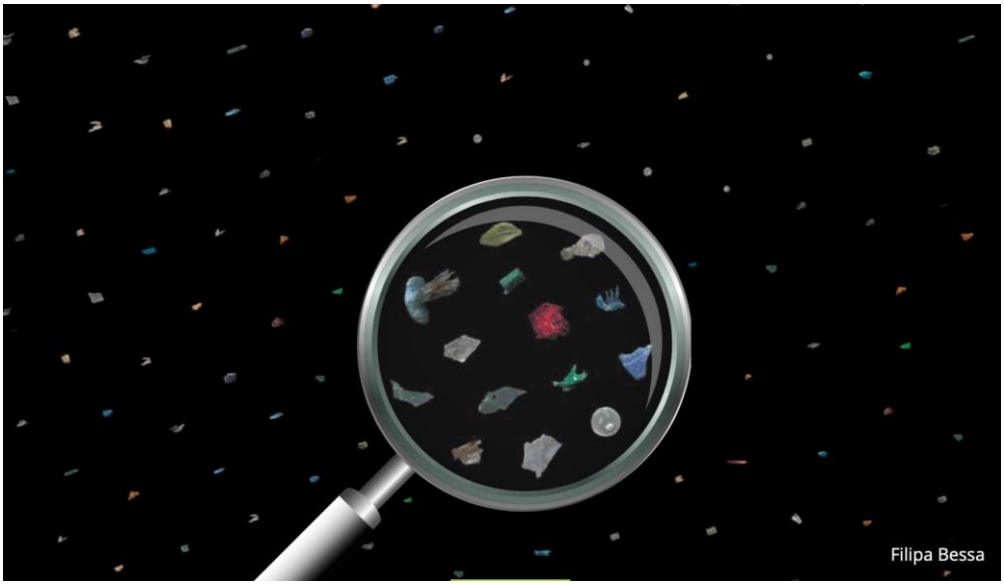
Description:

While plastic pollution is a major, long-term global environmental issue, there is growing concern around small particles of plastics defined as microplastics (< 5mm) that enter aquatic ecosystems. As well as affecting local waterways, microplastics can be transported and they can enter food webs at various points through accidental ingestion by animals. Furthermore, these plastics can attract and accumulate chemicals on their surfaces, with potential effects on biota. Despite the fact that many marine and freshwater environments, including rivers, lakes and estuaries, are heavily contaminated by plastic waste, the levels and effects of (micro)plastics contamination are still unknown.

In this project, we will investigate the issue of (micro)plastic pollution from marine and/or freshwater habitats, discussing current state-of-the-art research addressing the sources and pathways of microplastics, their accumulation, and potential effects on biota from these ecosystems. Recommendations on monitoring/mitigation will be established to provide managers with important information for policy-making decisions. Outreach and science communication activities will be also available. We have currently many offers in collaboration with several teams and researchers and some topics are available (not exclusively):

- Can (micro)plastics be considered a marker of the Anthropocene?
- Assessment of the unintentional releases of microplastics in aquatic environments
- Salt marsh sediments can act as a sink for microplastics?

Where you'll study: MARE – University of Coimbra and Laboratory MAREFOZ (Figueira da Foz).



43. Toxicity bioassays of **nanoplastics** to model stream biota

Contact:

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Matilde Moreira-Santos (matilde.santos@zoo.uc.pt) https://www.cienciavitae.pt/7913-7FCE-0AEA

Manuel A.S. Graça (mgraca@ci.uc.pt) http://www.mare-centre.pt/en/user/95

Research group: **Freshwater Ecology (MARE)**

WATCH IT ON YouTube https://youtu.be/kfphyqLBiFo

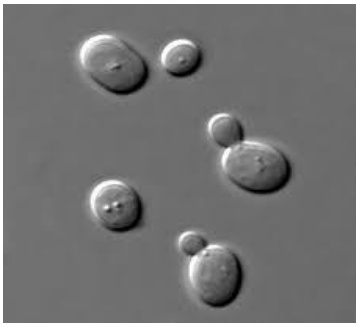
Description:

Until recently, freshwater bodies were mainly regarded as conduits of plastic transport to the oceans but nowadays freshwaters are recognized as reservoirs of plastic (nano)particles. Nanoplastics (NPs) are increasingly being acknowledged as an emerging threat to freshwater ecosystems, with their toxicity being governed by particle size and types. In forested streams, plant litter is the key carbon and energy source, being its decomposition in streams a critical ecosystem level process, driven mainly by fungi followed by bacteria. These microbes are responsible for the energy transfer to invertebrates.

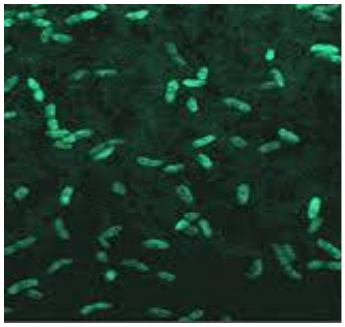
Here we propose to conduct toxicity bioassays using a range of concentrations of different sizes and types of NPs on key model organisms, namely fungi (eg., *Saccharomyces cerevisiae*), bacteria (eg., *Vibrio fischeri*) and invertebrate (eg., *Daphnia magna*), all widely used in freshwater ecotoxicity assessments including at the regulatory level. In addition, three key stream invertebrates from different feeding groups (a shredder caddisfly, collector isopod and a scraper gastropod) will be collected from streams in central Portugal to perform bioassays. We will determine the dose-response curves of the (model) stream biota upon exposure to different sizes and types of NPs, to determine median effective (EC50) and no effect concentrations (EC10 for 10% responses, or NOEC), to explore sensitivity differences among key functional groups in stream communities. This will be the first study aiming to evaluate toxic of NPs to stream biota that can guide future legislations for streams protection. The results of this study would lead to two master theses and two scientific papers to be published in an international peer reviewed journals.

Key functional/taxonomic stream biota

Daphnia Magna



Saccharomyces cerevisiae



Vibrio fischeri

44. Unravelling functional associations between soil fauna and carbon dynamics in Portuguese forest ecosystems

Contact:

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José Paulo Sousa (jps@zoo.uc.pt)

Environmental Ecology and Ecotoxicology Group (Centre for Functional Ecology)
https://www.facebook.com/grupoE3G/

Description:

Ongoing climate change will alter terrestrial ecosystem functioning in ways that still need further understanding, and the magnitude and direction of this change will be driven by multiple effects on abiotic and biotic factors. In this context, it is of primary importance to understand how the carbon cycling may be modified in response to shifts in the patterns of precipitation and temperature and how these alterations may ultimately affect both below- and above-ground communities.

In this project, we aim to characterize the soil fauna communities of Portuguese forests from a functional perspective by investigating their relationships with soil carbon dynamics. Specifically, we seek to decipher how macro- and mesofauna communities are functionally dependent on carbon inputs (i.e. namely litterfall) and carbon outputs (i.e. namely CO2 emissions and dissolved organic carbon), on environmental factors and on the inherent nature of the dominant tree species growing in Portuguese forests (e.g. Eucalyptus globulus, Acacia dealbata, Pinus pinaster and Quercus robur).

This research is being conducted as part of the MyFOREST project (https://f4f.serq.pt/pt/objetivos) on beautiful plots in Lousã, Ansião, Castelo Branco and Sabugal. It is expected that master students willing to work with us will be involved in fieldwork, sample processing in the laboratory, soil fauna identification (e.g. mites, springtails, spiders, ants, beetles, etc), statistical analyses in the R environment, and manuscript writing. This is a good opportunity to acquire both ecological and scientific knowledge in a learning by doing environment with many different tasks.

45. Antarctic food webs research: Assessing the role of Antarctic organisms in a climate change context

Contact:

José Xavier (jxavier@zoo.uc.pt) http://cientistapolarjxavier.blogspot.com/
https://www.youtube.com/playlist?list=PLB2RllbJSkyLS4KUdVrtDC3fkCTkGuS9d

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube https://youtu.be/x_qBcjCMMWk

Description:

The Antarctic strongly influences the global climate, harbours unique and diverse biological communities. Seabirds, marine mammals and other organisms are often cited as sentinels of ecosystem change, this is because they integrate biological and environmental variability across spatial and temporal scales and across various trophic levels.

As part of international research programs, the project contributes a piece of the puzzle of the key question “How are the structure and key functioning processes of Antarctic Ocean from a conservation perspective”, particularly on the feeding ecology and population dynamics of penguins, seals, albatrosses, squid, fish and zooplankton under a climate change context. Research work will focus on collecting and/or analysing samples from these organisms), using a range of methods (e.g. stable isotopic analyses, trace metals, modelling), to assess the role of certain species in Antarctic Peninsula and adjacent areas. To achieve this, work will be carried out at the University of Coimbra and/or at the British Antarctic Survey (Cambridge).

The most important characteristic is that the students are genuinely interested in marine ecology, used to work hard in the lab. and in an independent way to answer ecological questions. The student will get familiar with scientific techniques while learning application of them to conservation (when possible).

46. Linking pine **cell wall** composition and structure to **pinewood nematode** resistance under climate change

Contact:

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Luís Fonseca (luis.fonseca@uc.pt) https://www.cienciavitae.pt/0C1B-408D-8216

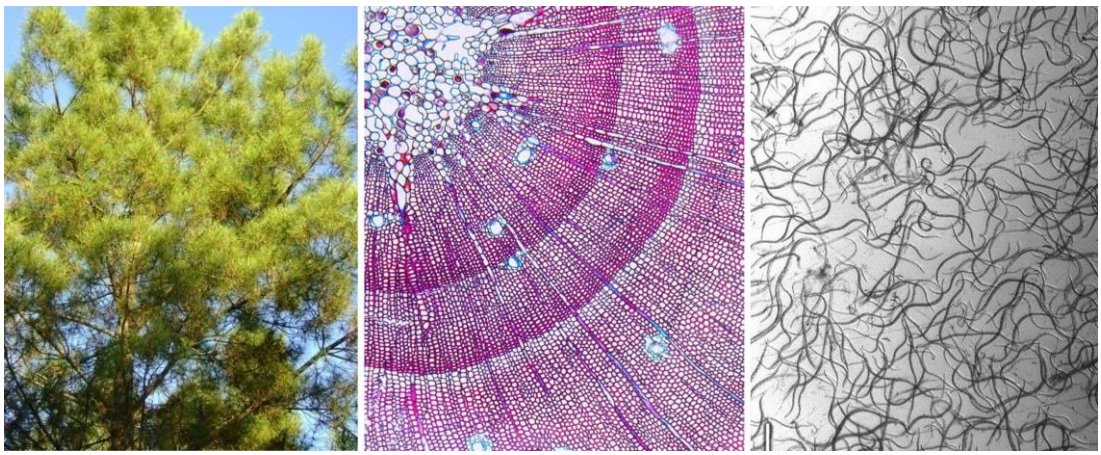
Research groups: **NEMATO-lab and "Molecular Physical-Chemistry" R&D Unit –QFM-UC**
https://www.facebook.com/NEMATO-lab-429239727651127/
http://www.ci.uc.pt/qfm/1150-2/index.html

Description:

Pine-related goods and activities make up a substantial share of the Portuguese forestry sector, and more generally, of the Portuguese Economy. The pinewood nematode (PWN), *Bursaphelenchus xylophilus*, is a major threat to this sector, as it causes the pine wilt disease (PWD), leading to high losses in conifer forests. The PWN infects various Pinus spp., namely the maritime pine (P. pinaster), which is widely distributed in Portugal and is one of the most susceptible species. Other Pinus species, such as the stone (*P. pinea*) and Aleppo (*P. halepensis*) pines are less, or even non-susceptible to the PWN. However, the reasons for these differences in susceptibility to PWN are not well understood.

The work in this MSc project will be integrated in the PineWALL project, which focuses on an often-overlooked aspect, which is how the pine cell wall (CW) composition and structure can influence the host susceptibility/resistance to PWN infection under a climate change scenario.

There are six interconnected tasks that will make up the workplan for PineWALL:
Task 1: *Bursaphelenchus xylophilus* isolate maintenance on fungus cultures and Pinus spp. saplings inoculation
Task 2: Pine anatomical and ultrastructural characterisation
Task 3: Cell wall characterisation via vibrational spectroscopy
Task 4: Cell wall characterisation via analytical chemistry method
Task 5: Cell wall glycan characterisation via immunological approaches
Task 6: Data modelling



47. Sustainable pharmaceuticals degradation in wastewaters: the way forward

Contact:

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Mário Calvete (mcalvete@qui.uc.pt) www.cienciavitae.pt/portal/4419-D2ED-E265

Description:

The widespread detection of pharmaceuticals in the aquatic environment, namely surface- and ground-waters, drinking water and sediments, though often at trace concentrations (at or below ng/L) signals great concerns regarding its increased use by the human population; their general high polarity and low volatility means they are likely to be transported to the water compartment. Moreover, the exposure of aquatic biota to pharmaceuticals is most likely to occur from sewage treatment plants (particularly from hospital facilities), which have been demonstrated to be ineffective, given that parent compounds as toxic metabolites or transformation products have all been detected in wastewaters. There is therefore an urgent need for new treatment methods to remove pharmaceuticals from wastewaters, which requires both the improvement of remediation and analytical techniques, i.e., of the chemical degradation efficacy, and of the often-neglected ecological efficacy, i.e., whether decontamination was achieved. To accomplish the sustainable degradation of pharmaceuticals in wastewaters, while contributing to the EU Green Deal commitment of zero-pollution ambition, the present study project is a collaboration between the Department of Chemistry and Life Sciences of FCTUC to conduct research on innovative efficient chemical degradation systems of pharmaceuticals that are also able to guarantee environmental safety. The latter will be assessed by performing standard ecotoxicity assays with a battery of organisms, in accordance with the European Medicines Agency guideline on the Environmental Risk Assessment of medicinal products for human use.

The work conducted within this research project is to be published as a scientific manuscript in a peer reviewed international scientific indexed periodical.

48. Small-scale fisheries: implications of gear used, and fish species caught on local economy, environment and society

Contact:

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João M. Neto (jneto@ci.uc.pt) http://www.mare-centre.pt/joaoneto

Research group: **Ocean and coastal systems (MAREFOZ)**
http://www.mare-centre.pt/en
https://laboratoriomarefoz.wixsite.com/laboratoriomarefoz

Description:

Fish is considered by the FAO to be a superfood for human populations, constituting an important element in natural food webs. With that in mind, and with the aim of mobilizing the scientific community, policymakers, industry and engaging society around a common research and technological innovation agenda (integrated in the United Nations Decade of Ocean Science for Sustainable Development: 2021-2030), the United Nations (UN) has designated 2022 as the International Year of Artisanal Fisheries and Aquaculture (IYAFA). In this context, artisanal fishing, whether professional or amateur, must be addressed as a fundamental part of the social, economic and environmental global balance, aiming to contribute with natural and innovative solutions to global challenges (whether they are linked to climate change or eradication of poverty). Fishing is an extremely important economic and social activity, where knowledge of the abundance of some key fishing/harvesting species, their feeding habits, the pressures to which they are subject or their resilience, can have a great impact on the sustainability of the natural resources, the environment and the goods and services they can represent for society.
Students interested in different aspects of small-scale fisheries and local aquaculture are welcome to join the group on its international research activities, integrating knowledge from ecology and economic and social sciences, fundamental for the development of the best management skills for resources and marine systems, essential for countries like Portugal, which depend heavily on their marine resources for a balanced and sustainable situation (Portugal is the biggest consumer of fish in the EU-27 and the third in the world).

49. (Less)PlasticBrain – Bio replacing plasticizers – impact in the human brain development

Contact:

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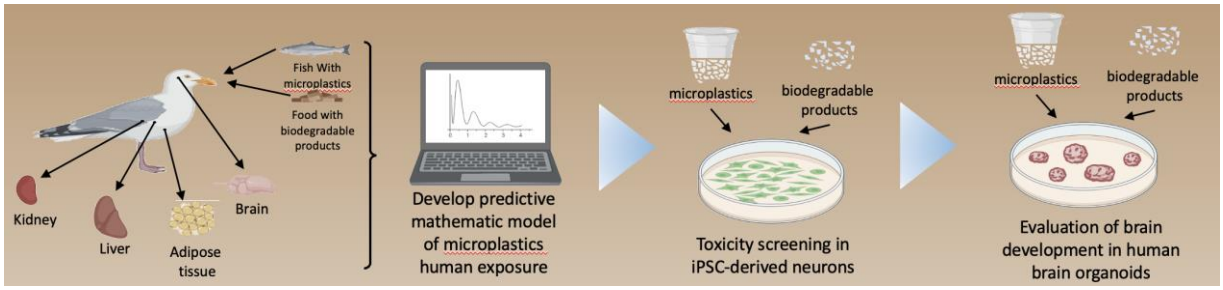
Catarina Miranda (miranda.catarina@gmail.com) https://www.cnc.uc.pt/pt/people/c-miranda

Research groups
EcoTop - Ecology and Conservation of Top Predators https://www.facebook.com/ecotop.mareuc/
Gene and Stem Cell Therapies for the Brain https://www.cnc.uc.pt/en/research-group/terapias-genicas-e-estaminais-para-o-cerebro
https://www.youtube.com/watch?v=7Og2LILHw84&feature=youtu.be (minutes 7:30 – 11:30)

Description:

Plastic additives or plasticizers are ubiquitous in the environment and are known to be transferred to humans through the trophic chain, causing serious health problems as cancer, immune disorders, obesity, infertility, or cognitive impairments. Therefore, it is urgent to find innocuous alternatives to plasticizers. *(Less)PlasticBrain* aims to evaluate and compare the effects of plasticizers and bioproducts on in vitro models of the human brain. If these bioproducts demonstrate to be innocuous for the brain, they will constitute a safe, environmentally clean, and cheap alternative to plasticizers. Induced pluripotent stem cells (iPSC)-derived neurons will be used as a preliminary model to evaluate survival and function of neurons and its impact on neuronal development will be determined in human brain organoids. Students that will work in this project will have the opportunity to learn cutting-edge cellular and molecular biology while integrating Ecology knowledge and concepts.

This project was winner of the 3rd Edition of The Seed Projects awarded by the Interdisciplinary Research Institute of the UC (iiiUC) and Santander (https://www.uc.pt/iii/iiiuc-apoia/projetos-semente-de-investigacao/projetos-vencedores/saude/), so the logistics part of it is covered. Besides MARE and CNC, it will also count on the collaboration of Researchers from the Centre for Mechanical Engineering, Materials and Processes (CEMMPRE): Patrícia Nunes Pereira (0000-0002-5665-5271) and Jorge Coelho (0000-0001-9351-1704).



50. Assessing pharmaceuticals accumulation in non-target organisms

Contact:

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Miguel Pardal (mpardal@uc.pt) https://cfe.uc.pt/profile/members/1658

Research group: **Marine Research Lab**
http://cfe.uc.pt/profile/lines/3

WATCH IT ON YouTube https://youtu.be/Y3amdTqGi8g

Description:

The continuous release of pharmaceuticals to the ecosystems entangles serious safety concerns, representing potential risks. Antibiotics are biologically active substances designed to prevent and treat diseases but represent a potential hazard when their active ingredients (either the parent compound or metabolites) come in contact with non-target organisms.

This project will focus on the effects of pharmaceuticals on non-target species, particularly macroalgae. Through experimental laboratorial assays, algae will be exposed to different classes of antibiotics (mainly used in aquaculture production) and different endpoints will be assessed.

51. Seabirds as bioindicators of chemical contaminants and environmental health in the North Atlantic

Contact:

Filipe ceia (ceiafilipe@zoo.uc.pt) http://www.mare-centre.pt/pt/user/61

Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube https://youtu.be/OKSFsHTvVaw

Description:

This research uses an array of techniques applied to wild seabirds for a marine and coastal ecological assessment in the North Atlantic. Using seabirds as bioindicators, this study will link oceanographic, pollutant and health information in the marine environment based on GPS tracking, stable isotope analyses, metal contamination and biochemical stress responses. Formation on these techniques will be provided by experienced researchers. Fieldwork with seabirds will be performed in Deserta (Ria Formosa - Algarve) and Berlenga (Peniche) Islands with proper supervision and within a group work. It includes tracking the breeding adults of three different species (Cory's shearwaters *Calonectris borealis*, Yellow-legged gulls *Larus michahellis* and Audouin's gulls *Larus audouinni*) using GPS loggers in order to map their foraging locations, and the collection of samples (blood and feathers) for laboratory analyses.

This project is open for students interested in marine ecology, particularly trophic, contamination and oceanographic issues. The students will perform fieldwork surveys, laboratory procedures and data analyses. This work will be performed at the laboratories of MARE-University of Coimbra with support of supervisors and ECOTOP team. Data gathered will be used conjunctly to relate contaminants and oxidative stress biomarkers with trophic and spatial data in seabirds (in which the students will directly be involved at MARE-UC). This will result in students' master theses, which would be expected to be then published in scientific journals.

52. Marine fish ecology under a changing climate

Contact:

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Miguel Pardal (mpardal@uc.pt) https://cfe.uc.pt/profile/members/1658

Research group: **Marine Research Lab**

For videos of our animal research go to the WEBSITE

Description:

Fishes are the most diverse group within vertebrates, and display adaptations that allows them to live from high alpine lakes to abyssal depths in the ocean. Thus, studying fish ecology contributes to our understanding of the functioning of aquatic ecosystems, and plays a vital role in monitoring environmental health and sustaining global fisheries, ensuring food security for future generations, particularly under a global change scenario.

As a part of several ongoing research programs, this project will contribute to a better understanding of how marine and estuarine fish communities respond to long-term changes in climate, as well as how migrations, connectivity, growth, and early life history in marine fish between coastal areas and estuaries are driven by factors such as sea surface temperature, upwelling, coastal circulation, and large-scale atmospheric patterns. In addition, using natural tags such as otoliths, we will contribute to disclosing fish population and stock structure at large geographical areas, which is instrumental for better aligning fish biological populations with management units.

Research work will focus on collecting fish samples from several areas in the Portuguese coast and/or analyzing samples from other areas to investigate how fishes respond to a changing climate at several geographical and temporal scales, using a set of methodologies that include species identification, analysis of otolith shape, microstructure and chemical composition (to age, growth, estimate stock structure and habitat use), comparison with other structures (e.g., fin rays) as non-lethal ageing structures, and data analysis using cutting-edge modelling approaches. Expected collaborations include researchers from Portuguese and International research centers.

53. Plant diversification and sympatric speciation through polyploidization processes

Contact:

João Loureiro (jloureiro@bot.uc.pt)

Sílvia Castro (scastro@bot.uc.pt)

Mariana Castro (mcastro@uc.pt)

Research group: **FLOWer Lab**
https://www.facebook.com/cfeFLOWerLab/

Description:

Polyploidy, i.e. whole genome duplications, is a widespread process in flowering plants and has long been considered as a major mechanism of sympatric speciation. After new polyploid emergence theoretical models predict that its establishment is restricted by strong negative frequency-dependent selection, and thus, neopolyploid success is conditioned by its advantage when compared with its progenitors, otherwise it will be eliminated from the population. Although the importance of this mechanism in speciation processes, only a few studies were focused on the ecological requirements of neopolyploids. Therefore, in the FLOWer Lab we explore the ecological and evolutionary consequences of genome duplications and the factors affecting the establishment and persistence of new polyploids using a diploid-tetraploid complexes. We employ innovative multidisciplinary approaches that consider reproductive and ecological traits of diploids, neopolyploids (already synthesized) and established polyploids.

54. Are you singing to me? Birdsong communication and development

Contact:

Paulo Gama Mota (pgmota@uc.pt)

https://cibio.up.pt/people/details/pjgmota

WATCH IT ON YouTube https://youtu.be/kf5TyBwXTpk

Description:

Birdsong is one of the most conspicuous forms of animal communication, which has caught the attention of humans since early times. The song of birds can have functions of territory defence or mate attraction. We know that the songs of male serins (*S. serinus*) have both a mate choice function (with females preferring the highest pitched songs), while they also function in male-male interactions. We have been using this model animal to test evolutionary questions related with the evolution of signals.

I am currently developing a number of different projects around the function, communication system and development (genes vs environment) of birdsong. Besides, we started to perform some experiments on cognition in loosely social small birds.

Those interested in animal behaviour, particularly in birds, can contact me.

55. Assessment of ecosystem services of agriculture and forests

Contact:

Paula Castro (pcastro@ci.uc.pt)

Research line: Societies and Environmental Sustainability (CFE)
http://cfe.uc.pt/profile/lines/7

Description:

If you are interested in issues related to the sustainability and resilience of agricultural systems and forests, come and discover more about potential research projects for your Master's thesis. We want to commit to a productive agriculture that satisfies societies' food needs, but at the same time promotes its ecology and the conservation of biodiversity (plant and animal) and its multiple services.

Our research is also focused on understanding the services provided by forest ecosystems and how we may strengthen their multifunctionality and sustainability.

The relationship with the various stakeholders that interface with these systems is another key topic. The involvement of local communities and local actors in the development of sustainable strategies for agricultural and agroforestry exploitation is essential in our research.

You may explore research topics as:

Mapping cultural ecosystem services of agriculture landscapes

Mapping ecosystem services of forests

Biodiversity and ecosystem services in agroecosystems: ways to go!

And much more…

In these research projects you can join a multidisciplinary team with experts from the natural and social sciences!

56. New tools against phytoparasitic nematodes

Contact:

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WATCH IT ON YouTube https://youtu.be/VS6qindLLZ8

Description:

Plant parasitic nematodes (PPN) especially root-knot nematodes (RKN, *Meloidogyne* spp.) and potato cyst nematodes (PCN, *Globodera* spp.) are globally distributed plant pathogens that cause loss of function, leading to significant yield losses. Although RKN are polyphagous, potato, Solanum tuberosum, is becoming more infested by this genus, and RKN damage to this crop is particularly evident in protected culture. The presence of both RKN and PCN in the same field is becoming more frequent. More environmentally friendly control methods are required as an alternative to chemical nematicides. In UK and Holland, a trap crop, *S*. *sisymbriifolium*, is being used for several years to control PCN, with promising results. The plant is resistant to both species of PCN and to some RKN species; it promotes PCN hatch and can reduce densities of nematode populations in the soil. However, as a non-native plant, its introduction must be controlled. Other plants already present in some regions of Portugal may exhibit similar resistance, namely *S. linnaeanum*. The behaviour of infective juveniles of the four most common RKN species (*M*. *arenaria*, *M*. *hapla*, *M*. *incognita* and *M*. *javanica*) in the rootzone of plants of S. *sisymbriifolium* cvs. and *S*. *linnaenum* accessions will be assessed by in vitro tests. Successful interactions will be further explored in host reaction tests in pot assays in controlled conditions. Plant extracts effects will also be studied in controlled conditions. Knowledge acquired on non-crop Solanum species-PPN interactions will contribute to the development of sustainable tools to manage PPN in agriculture reducing dependence on nematicides and improving crop productivity, soil health and food quality in face of climate changes and water scarcity.

57. Sexual segregation and grouping behaviour in ungulates

Contact:

Joana Alves (jalves@uc.pt | joanasilvaalves@gmail.com) http://cfe.uc.pt/profile/members/13

Research group: **BEWild** – Behavioural Ecology and Wildlife Conservation Research group

https://youtu.be/PuxPur57PBI

Description:

The degree of sexual segregation and its patterns varies across different populations of the same species as well as between species. Sexual segregation has three components, i.e. habitat segregation, spatial segregation and social segregation, and these components may independently or together be responsible for the temporal patterns of sexual segregation. To understand this widespread phenomenon, it is necessary to identify the factors capable of modelling sexual segregation in vertebrates. Depending on which factors are expected to contribute to sexual segregation, different hypotheses arise. Sexual segregation is often associated with habitat preferences, so comparing patterns from different species inhabiting in the same environment and different populations of the same species inhabiting in different environmental conditions will help to decipher the factors modelling sexual segregation patterns.

The project will be based in the collection of behavioural data from video recordings, and aims to test different hypotheses in sexual segregation and grouping behaviour.

This project counts with the collaboration of international researchers, in particular Kathreen Ruckstuhl, from the University of Calgary, Canada, and Muyang Wang from the Chinese Academy of Sciences.

58. Communication and acclimation strategies in microalgae

Contact:

Paulo Rocha (procha@uc.pt) www.greenproject.pt

Research Line: **Bioelectronics & Bioenergy Research Lab** (CFE)

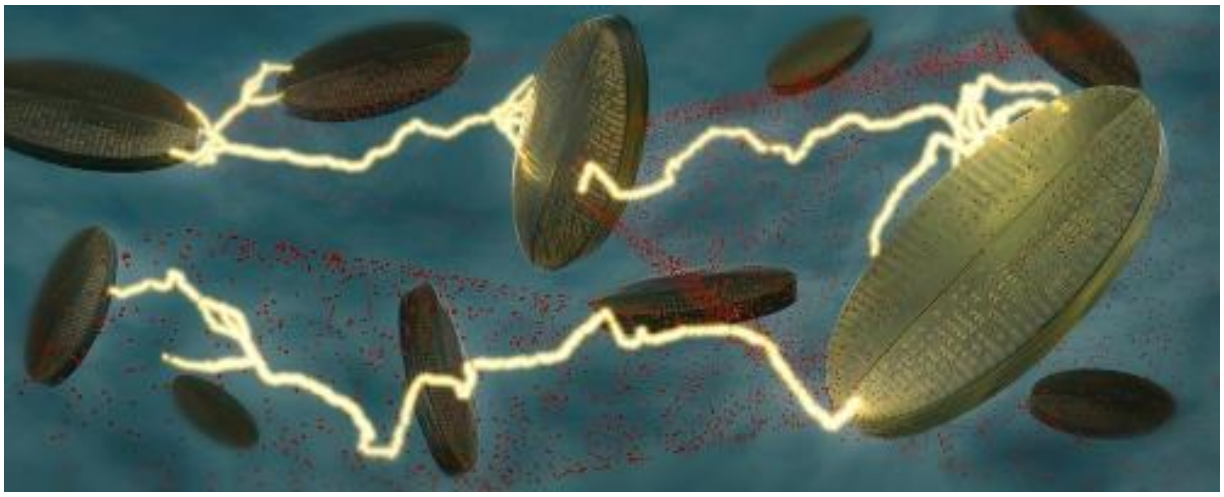
https://cfe.uc.pt/profile/lines/10

Description:

Algae are among the most exciting microorganisms in the world. They produce more than 20% of the oxygen we breathe and contribute to ameliorate climate change by reducing carbon dioxide emissions. Studying Algal Ecology contributes to our understanding of the functioning of aquatic ecosystems as they mirror the health of their environment through their density, growth, communication and diversity. As worry over environmental health intensifies, the critical role of algae is becoming more evident for everyone.

As a part of an international research program to study environmental health and combat climate change, the student, together with a multidisciplinary team of researchers will contribute to disclosing what are the driving factors leading to communication and acclimation strategies in microalgae. The research work will focus on culturing and maintaining microalgae under different conditions and on investigating how microalgae respond to a changing climate. To pursue these aims the student will be trained on state-of-the-art optical analysis tools and methods to identify strains and growth stages, and on sensitive sensors that together with data analysis will help to characterize and decode the microalgae language under different environment conditions.

You may read more on Ref [1].



R. Amaral et al, Ion-driven communication and acclimation strategies in microalgae, Chemical Engineering Journal, 473, 144985, 2023 (https://doi.org/10.1016/j.cej.2023.144985)

59. Using baited remote underwater video (BRUV) to assess marine megafauna traits

Contact:

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Description:

Marine megafauna including teleosts, elasmobranchs, and cephalopods are typically difficult to detect due to their high mobility and elusive behavior. Fisheries-dependent data have been often used to estimate abundance and distribution of these species, but such an approach has several constraints which hamper its effectiveness, particularly when dealing with e.g. no-fishing areas.

This project will use Baited Remote Underwater Video (BRUV) to examine the diversity and distribution of relevant marine megafauna around Marine Protected Areas (MPAs) from the tropical and temperate Atlantic Ocean. BRUVs are autonomous, image-based sampling devices that provide high-quality data on vagile marine species by precluding potential interference by human observers (Fig. 1).

Successful candidates will be able to assist with field sampling in the Berlengas Archipelago and elsewhere, conduct BRUV maintenance and video sample processing, learn to identify marine megafauna taxa and their behaviors, and perform data analysis using top-notch software and statistical modeling. Laboratory work will be conducted at the University of Coimbra.

Figure 1. A lemon shark, *Negaprion brevirostris*, sampled with a BRUV at the Fernando de Noronha Archipelago, Brazil.

6o. Spatial and **foraging ecology of waterbirds** in relation to human stressors

Contact:

Jaime Ramos (jramos@ci.uc.pt) http://www.mare-centre.pt/en/user/68

Ana Cláudia Norte (aclaudia.norte@gmail.com) http://www.mare-centre.pt/pt/user/45

Vitor Paiva (vitorpaiva@uc.pt) http://www.mare-centre.pt/pt/user/137

Research group: **EcoTop** - Ecology and Conservation of Top Predators
https://www.facebook.com/ecotop.mareuc/

WATCH IT ON YouTube https://youtu.be/FPay7bGmYs0

Description:

Coastal areas are exposed to anthropogenic stressors, such as human disturbance, pollution and overfishing, which cause a loss of biodiversity and ecosystem services. Estuarine and coastal waterbirds are top predators that are usually used as indicators of ecosystem health, since they are sentinels of changes occurring at lower trophic levels. However, appropriate management measures require information about the impact of human stressors in breeding success and exposure to different contamination levels, and in shaping the spatial and foraging ecology of top predators.

This project will address the impact of different stressors in the spatial, foraging and reproductive ecology of estuarine and coastal waterbirds, with a view to contribute for their conservation and the management of coastal marine reserves: 1) GPS loggers will be placed on Little Terns to evaluate its spatial ecology in relation to human disturbance, because this species is very sensitive to the presence of humans. 2) Shorebirds (avocets, stilts and plovers) and coastal seabirds (gulls) are exposed to plastic pollution, that they may ingest or use as nesting material. Biological samples will be used to assess plastic assimilation by waterbirds, and evaluate its effects on breeding success and health measures. This study will be performed in Ria Formosa Natural Park (Algarve), a protected area with a high diversity of waterbirds.

The project is open for two MSc students. Part of the logistics of this work will be funded by projects from the LIFE EU program. The information gathered will contribute to two international peer-reviewed publications.

Little tern incubating on a sandy beach at Ria Formosa, Algarve

61. Wastewater reuse as a potential source of Giardia and Cryptosporidium

Contact:

Elsa Rodrigues (etrodrig@uc.pt) https://cfe.uc.pt/profile/members/16

Maria do Céu Sousa (mcsousa@ci.uc.pt)

Research group: **Marine Research Lab**

Description:

We are looking for a highly-motivated MSc student with a strong interest in environmental microbiology. The student will join both the Marine and Coastal Ecosystem Research Group at the Centre for Functional Ecology (CFE-UC) and the Center for Neuroscience and Cell Biology (CNC/UC), and will work under the supervision of Elsa Teresa Rodrigues (FCTUC-DCV) and Professor Maria do Céu Sousa (FFUC)

According to the World Health Organization (WHO), giardiasis and cryptosporidiosis are recognized as important emerging diseases of the 21st century. Seeing that the world is facing increasing pressure as regards water resources, and as treated wastewater reuse is a key subject for the rational management of water, determine the presence of Giardia and Cryptosporidium pathogenic parasites in effluents (treated wastewater) become essential. Using wastewater samples collected monthly in 2020, and by means of molecular tools, the present project aims to determine the occurrence of Giardia and Cryptosporidium parasites in 11 influent and 12 effluent samples in order to identify potential sources of contamination, as well as possible limitations to reuse treated wastewater for certain situations.

62. Acute contact toxicity of pesticides to the invasive Vespa velutina: Lab & field validation of ecotoxicological endpoints

Contact:

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Environmental Ecology and Ecotoxicology Group (Centre for Functional Ecology)
https://www.facebook.com/grupoE3G/

Description:

Vespa velutina nigrithorax Buysson, 1905 (Hymenoptera: Vespidae) is an invasive species in Europe that was first identified in France in 2004 from China. As a predator with high voracity, this hornet poses a major threat to native insects, especially honeybees and other pollinators. Chemical control, by pesticide injection, is the most common method to eliminate hornet colonies. Despite the intervention by the responsible authorities, most nests are not removed due to difficult access and being time-consuming, thus becoming a potential environmental hazard if other species enter in contact with it or feed on hornet dead adults/larvae.

As part of the CONTROLVESPA FCT project, **we have two projects available for students interested in studying V. v. velutina control and combat**:

i) To test in laboratory commercially available pesticides in different concentrations for their acute contact toxicity on adults of V. v. nigrithorax. From this study it will be possible to improve the inactivation of nests, resulting in a more effective and environmentally conscious control. The master's student will be involved in field trips to collect Asian hornets, in addition to having the opportunity to learn ecotoxicology techniques and writing a scientific manuscript.

ii) To obtain knowledge on pesticide lethality and prevalence in nests, to select the more suitable to be used for nest elimination, resulting in a more effective and environmentally conscious control of this invasive species. The master's student will be involved in field trips to install camera traps close to Asian hornet's nests to observe whether there is predation on adults and larvae after the insertion of pesticides, in addition to collecting samples of adults, larvae, and nest parts for pesticide quantification and persistence analyses, as well as write a scientific manuscript.

This is a good opportunity to, in addition to acquiring ecological and scientific knowledge, contribute in a practical way to the search for a more effective solution to a major current problem in Europe.