

RESEARCH TOPICS & SUPERVISORS

2023-24



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.

If you need any help, including for internships, contact the MSc coordinator Prof. José Xavier (jxavier@zoo.uc.pt)

List of Research Topics

1. Variability of Wandering Albatross populations in the last 8 000 years recorded by peat on sub-Antarctic South Georgia
2. How old the Arctic squids are? Age study of the most abundant Arctic cephalopod, *Gonatus fabricii*
3. Particle tracking experiment to test how deep-sea prey become available to Antarctic surface predators
4. How does microplastic pollution affect coastal and marine ecosystems?
5. Seabirds as bioindicators of chemical contaminants and environmental health in the North Atlantic
6. Growth variability in juvenile flatfishes on the Portuguese coast
7. Otoliths and fin rays: how different structures tell a fish story
8. Discovery of novel squid camouflage proteins
9. ConTribuT: Conversion of dietary tributyrin in rainbow trout (*Oncorhynchus mykiss*)
10. FishOmics: Unveiling fish nutritional quality by NMR-Metabolomics
11. PrawnOmics: Evaluation of novel diets for aquaculture prawn species by NMR
12. How can ground nesting seabirds cope with heatwaves: the role of nesting microhabitat conditions in determining foraging patterns, physiology and breeding parameters
13. Life history of the colossal squid *Mesonychoteuthis hamiltoni*
14. Cultivation and growth of macroalgae of interest
15. Essential mineral content variation on portuguese marine macroalgae: Characterisation along the portuguese coast
16. Bioaccumulation of mercury by *Gracilaria gracilis*. Risk for human use?
17. Concentration of heavy metals on portuguese marine macroalgae. is there a risk of human consumption?
18. Characterization of the rocky intertidal community in the Research of the Biosphere of the Ilha das Flores (Azores Islands)
19. Assessing pharmaceutical contamination on the Portuguese coast through seaweed
20. The potential of rooted macrophytes in pharmaceutical contamination monitoring in Portuguese estuaries
21. Using Baited Remote Underwater Video (BRUV) to assess marine megafauna traits
22. Trophic and ecological characterisation of key aquatic species present in estuarine communities
23. Small-scale fisheries. The implication of gear used, and fish species caught on local economy, environment and society
24. Mercury levels in the highly threatened Wandering albatrosses
25. Microplastics in commercial flatfishes from the Portuguese coast
26. The Great Cormorants (*Phalacrocorax carbo*) and the problems with aquaculture in the Mondego estuary
27. The nutritional value and beneficial properties of macroalgae collected in Portugal

- 28. Portuguese halophytes with potential economic value for the agri-food industry
- 29. Marine macroalgae: alternative recipes for a daily nutritional diet
- 30. Application of marine macroalgae as biofertilizers in agriculture

. Variability of Wandering Albatross populations in the last 8 000 years recorded by peat on sub-Antarctic South Georgia

Research group: EcoTop (Ecology and Conservation of Top Predators)

<https://www.facebook.com/ecotop.mareuc/>

Contact:

José Xavier (jccx@cantab.net)

Paste link to homepage here (<http://cientistapolarjxavier.blogspot.com/>)

Videos of our animal research go to the [WEBSITE](#)

Supervisors

Prof. Dr. José C. Xavier – University of Coimbra

Dr. Alex Whittle – British Antarctic Survey (aleitt@bas.ac.uk)

(co-supervisors: Dr. Dominic Hodgson, Dr. Stephen Roberts, Prof. Richard Phillips (all from the British Antarctic Survey))

Description:

South Georgia bustles with an extraordinary density of seabird and marine mammal life, with Bird Island being home to a staggering 50,000 breeding pairs of penguins, 700,000 nocturnal petrels, 65,000 breeding fur seals and 14 000 breeding pairs of albatrosses. Monitoring of Wandering Albatrosses indicates a significant population decline concurrent with the onset of a tranche of new challenges associated with our changing climate and expanding fisheries in the Southern Ocean. However, time-series produced by monitoring these colonies are temporally limited to the past few decades.

This project aims to access natural variability in Wandering Albatross populations across eight millennia, using records stored by the slow accumulation of peat (an organic rich soil) in nesting areas. Ultimately, we ask the question; Can a peat (soil) core be used to provide the first multi-millennial record of changes in the size of breeding Wandering Albatross populations on South Georgia?

The ideal student will be interested in Antarctic marine ecology, have experience in identifying fish otoliths, squid beaks or other sub-fossil organic material and experience (or an interest) in microscopy (light and/or SEM). The student will also need to be prepared to go to the United Kingdom for a brief period (at least, 1 month) at British Antarctic Survey (Cambridge, UK) for core sample preparation, and 1 week at University of Manchester or Aberystwyth University for geochemical core scanning. Further laboratory time will be required at the host institution for identification and classification of sub-fossil material.

. How old the Arctic squids are? Age study of the most abundant Arctic cephalopod, *Gonatus fabricii*

Research group: EcoTop (Ecology and Conservation of Top Predators)

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Supervisors

Prof. Dr. José C. Xavier – University of Coimbra

Dr. Alexey Golikov – GEOMAR Helmholtz Centre for Ocean Research, Germany (agolikov@geomar.de)

(co-supervisors: Dr. Catalina Perales-Raya, Centro Oceanográfico de Canarias (Instituto Español de Oceanografía, CSIC))

Description:

Cephalopods are a commercially and ecologically important group of marine invertebrates, who are generally assumed to have 'live fast and die young' life histories, for about 1 year. While it is true for tropical shallow water species, deep-sea species are much of a challenge to study in this aspect, and are suspected to have much longer life. The beaks of the Arctic squid *Gonatus fabricii*, a species that plays an important role in the diet of numerous Arctic predators, might be used to identify species age and growth patterns. Age and growth patterns will be determined using an established technique of counting micro-increments in the lower beak. This work will be carried out between the University of Coimbra (Coimbra, Portugal) and the Instituto Español de Oceanografía – Centro Oceanográfico de Canarias (Santa Cruz de Tenerife, Spain). The student needs to be prepared to spend several hours at the microscope (attached to a monitor) and at the computer counting and measuring beak increments. The student will also need to be prepared to spend several months at Tenerife (up to 6 months with no funds available), where the laboratorial work will take place.

Key bibliography

Golikov AV, Blicher ME, Jørgensen LL, Walkusz W, Zakharov DV, Zimina OL, Sabirov RM. 2019. Reproductive biology and ecology of the boreoatlantic armhook squid *Gonatus fabricii* (Cephalopoda: Gonatidae). *Journal of Molluscan Studies* 85:287–299

Perales-Raya C, Bartolomé A, García-Santamaría MT, Pascual-Alayón P, Almansa E. 2010. Age estimation obtained from analysis of octopus (*Octopus vulgaris* Cuvier, 1797) beaks: improvements and comparisons. *Fisheries Research* 106:171–176

. Particle tracking experiment to test how deep-sea prey become available to Antarctic surface predators

Research group: EcoTop (Ecology and Conservation of Top Predators)

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Supervisors

Prof. Dr. José C. Xavier - University of Coimbra

Dr. Dan Jones - British Antarctic Survey (dannes@bas.ac.uk)

Dr. Emma Young - British Antarctic Survey

Description:

Researchers have found that the diets of seabirds, including non-diving wandering albatrosses in the South Atlantic Ocean, can include numerous deep-sea prey, such as fish and squid. We aim to test the hypothesis that deep-sea non-migratory prey may be brought near the surface by strong currents, particularly near topographic features. To locate potential pathways of deep-to-surface transport, we will perform numerical particle tracking experiments using existing software and velocity data products. The selected student will principally work at the British Antarctic Survey as part of the Polar Oceans team under the NERC BIOPOLE project on biogeochemical processes and ecosystem function in changing polar systems and the ICED project on the integrated analysis of Southern Ocean climate and ecosystem dynamics. Building on previous successful efforts, numerical calculations will be carried out on JASMIN using Ariane particle tracking software, with NEMO velocity fields as inputs.

The ideal student will have strong numerical and computing skills, including some background in programming. During this REP, the student will gain competence with an important numerical analysis technique, as well as familiarity with handling, visualising, and analysing large oceanographic datasets. The student will become familiar with oceanography and ecology as active areas of research through interacting with scientists at two different institutes and performing a literature review. The student will retain ownership of their work and will be credited in any publications that use their results. The student will also need to be prepared to spend several months in Cambridge (up to 6 months – no funds available) where considerable modelling work will take place.

Key bibliography

Jones, D.C., F.R. Ceia, E. Murphy, K. Delord, R.W. Furness, A. Verdy, M. Mazloff, R.A. Phillips, P.M. Sagar, J.-B. Sallée, B. Schreiber, D.R. Thompson, L.G. Torres, P.J. Underwood, H. Weimerskirch and J.C. Xavier. 2021. Untangling local and remote influences in two major petrel habitats in the oligotrophic Southern Ocean. *Global Change Biology*. doi:10.1111/gcb.15839

. How does microplastic pollution affect coastal and marine ecosystems?

Research group: Sistemas Costeiros e Oceano

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

Contact:

Filipa Bessa (afbessa@uc.pt) <https://www.mare-centre.pt/pt/user/46>

Supervisors

Dr. Filipa Bessa - Universidade de Coimbra

Description:

Plastic debris, and especially microplastics (particle size <5 mm) are polluting the environment, including terrestrial, marine, coastal, freshwater, polar and even the atmosphere. Microplastics are well established as a significant threat to aquatic biota, and are ingested by many organisms worldwide. It is important to understand how these species are vulnerable to microplastic ingestion and their potential sources and effects. To this regard, we aim at assessing the levels of microplastics in coastal and estuarine species, in particular those from different trophic levels and commercial interest such as mussels, clams and crabs and their interactions with the environment. 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):

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

In this project, the student will have access to field campaigns and laboratory work to extract and analyse microplastics from different environmental samples. The work will be conducted both in Coimbra and Figueira da Foz at the labs from MARE-UC and MAREFOZ.

Key bibliography

Koelmans, B., Bessa, Filipa., et al. 2019. A Scientific Perspective on Microplastics in Nature and Society. SAPEA, Science Advice for Policy by European Academies. <https://www.sapea.info/wpcontent/uploads/report.pdf>.

Filipa Bessa; Norman Ratcliffe; Vanessa Otero; Paula Sobral; João C. Marques; Claire M. Waluda; Phil N. Trathan; José C. Xavier. (2019). "Microplastics in gentoo penguins from the Antarctic region". Scientific Reports 9: 14191. <https://doi.org/10.1038/s41598-019-50621-2>.

Bessa, F., Barría, P., Neto, J.M., Frias, J.P.G.L., Otero, V., Sobral, P., Marques, J.C. Occurrence of microplastics in commercial fish from a natural estuarine environment (2018). Marine Pollution Bulletin, 128, pp. 575-584. Cited 189 times. 10.1016/j.marpolbul.2018.01.044

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

Research group: EcoTop (Ecology and Conservation of Top Predators)

<https://www.facebook.com/ecotop.mareuc/>

Contact:

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

Supervisors

Prof. Dr. Jaime Ramos – University of Coimbra (MARE – UC)

Dr. Filipe Ceia – University of Coimbra (MARE – UC)

Dr. Sara Novais - Polytechnic Institute of Leiria – Peniche (MARE - IPLeiria)

Description:

This research uses an array of technics 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 audouinii*) 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 on scientific journals.

Key bibliography

Laranjeiro MI, Alves LMF, da Silva JM, Pereira JM, Norte AC, Paiva VH, Lemos MFL, Ramos JA, Novais SC, Ceia FR (2021) Year-round element quantification of a wide-ranging seabird and their relationships with oxidative stress, trophic ecology, and foraging patterns. *Environmental Pollution*, 284: 117502. (DOI:10.1016/j.envpol.2021.117502)

Laranjeiro MI, Alves LMF, Silva JM, Calado J, Norte AC, Paiva VH, Lemos MFL, Ramos JA, Novais SC, Ceia FR (2020) Assessment of environmental health based on a complementary approach using metal quantification, oxidative stress and trophic ecology of two gull species (*Larus michahellis* & *Larus audouinii*) breeding in sympatry. *Marine Pollution Bulletin*, 159: 111439. (DOI:10.1016/j.marpolbul.2020.111439).

. Growth variability in juvenile flatfishes on the Portuguese coast

Research group: Marine Research Lab

<http://cfe.uc.pt/profile/lines/3>

Contact:

Filipe Martinho (fmdm@ci.uc.pt)

<http://cfe.uc.pt/profile/members/1571>

Videos of our animal research go to the [WEBSITE](#)

Supervisors

Dr. Filipe Martinho – University of Coimbra

Dr. Miguel Pardal – University of Coimbra

Description:

Flatfishes display some of the most extreme changes in ontogenic development and habitat use in the marine environment. Migrations between spawning and nursery sites requires their larvae to develop, metamorphose, acquire sufficient size to avoid being predated, to be able to swim and feed themselves.

In this project, we will assess cohort-specific growth variability in two flatfishes – European flounder (*Plathichtys flesus*) and common sole (*Solea solea*) in the Portuguese coast. Available data includes a 12-year dataset (2010-2022), and you will use otoliths as sources of temporally resolved information at a daily scale. Specific growth patterns will be compared against the main climatic and oceanic drivers (North Atlantic Oscillation, Eastern Atlantic Pattern, Atlantic Multidecadal Oscillation, Sea water temperature).

You will be able to perform field sampling in the Mondego estuary, learn laboratory work on fish biometrics, otolith extraction and preparation, digital imaging analysis to determine fish age, birth date and daily growth rates, and finally, data analysis using cutting-edge modelling approaches.

Key bibliography

Pinto, M., Monteiro, J. N., Crespo, D., Costa, F., Rosa, J., Primo, A. L., Pardal, M.A., Martinho F. (2021). Influence of oceanic and climate conditions on the early life history of European seabass *Dicentrarchus labrax*. Marine Environmental Research, 169, 105362. doi:10.1016/j.marenvres.2021.105362

Martinho, F., van der Veer, H. W., Cabral, H. N., & Pardal, M. A. (2013). Juvenile nursery colonization patterns for the European flounder (*Platichthys flesus*): A latitudinal approach. Journal of Sea Research, 84, 61–69. doi:10.1016/j.seares.2013.07.014

Fox, C., Geffen, A., Taylor, N., Davison, P., Rossetti, H., & Nash, R. (2007). Birth-date selection in early life stages of plaice *Pleuronectes platessa* in the eastern Irish Sea (British Isles). Marine Ecology Progress Series, 345, 255–269. doi:10.3354/meps06967

. Otoliths and fin rays: how different structures tell a fish story

Research group: Marine Research Lab

<http://cfe.uc.pt/profile/lines/3>

Contact:

Filipe Martinho (fmdm@ci.uc.pt)

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Supervisors

Dr. Filipe Martinho – University of Coimbra

Dr. Patrick Reis-Santos – University of Adelaide (Australia)

Description:

Hard structures such as otoliths, fin rays, scales, and vertebrae are the fundamental tools in fisheries biology for elucidating fish life history and migrations. However, studies based on most of these structures require sacrificing fish, which sometimes is not desirable, such as in the case of protected or endangered species.

In this project, we will evaluate the potential of using fin rays as non-lethal ageing structures and compare them to traditional otolith-based age estimates. In addition, we will also investigate the concordance between elemental analyses of both fin rays and otoliths to unravel habitat use patterns using Sr:Ca and Ba:Ca ratios on core-to-edge transects. We will use the European flounder (*Plathichtys flesus*) as model species, with samples collected on the Portuguese coast. Laboratorial work will be performed at the University of Coimbra, and otolith and ray chemical analyses performed at the University of Adelaide, Australia.

You will be able to perform field sampling in the Mondego estuary, learn laboratory work on fish biometrics, otolith and fin ray extraction and preparation, digital imaging analysis to determine fish age using both otoliths and fin rays, and data analysis using cutting-edge modelling approaches.

Key bibliography

Martinho, F., Pina, B., Nunes, M., Vasconcelos, R. P., Fonseca, V. F., Crespo, D., et al. (2020). Water and Otolith Chemistry: Implications for Discerning Estuarine Nursery Habitat Use of a Juvenile Flatfish. *Frontiers in Marine Science*, 7, 347. doi:10.3389/fmars.2020.00347

Reis-Santos, P., Tanner, S. E., Aboim, M. A., Vasconcelos, R. P., Laroche, J., Charrier, G., et al. (2018). Reconciling differences in natural tags to infer demographic and genetic connectivity in marine fish populations. *Scientific Reports*, 8, 10343. doi:10.1038/s41598-018-28701-6

Rude, N. P., Hintz, W. D., Norman, J. D., Kanczuzewski, K. L., Yung, A. J., Hofer, K. D., & Whitledge, G. W. (2013). Using pectoral fin rays as a non-lethal aging structure for smallmouth bass: precision with otolith age estimates and the importance of reader experience. *Journal of Freshwater Ecology*, 28(2), 199–210. doi:10.1080/02705060.2012.738253

. Discovery of novel squid camouflage proteins

Research groups: Research group: EcoTop (Ecology and Conservation of Top Predators)

<https://www.facebook.com/ecotop.mareuc/>

Biomolecular engineering Lab: https://sites.fct.unl.pt/biomolecular_eng/

SeaTox Lab: <https://sites.fct.unl.pt/seatox/>

Contact:

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[Videos of our animal research go to the WEBSITE](#)

Supervisors

Prof. Dr. José C. Xavier – University of Coimbra

Prof. Dr. Ana Cecília Roque – UCIBIO, NOVA School of Science and Technology (FCT-NOVA)
(cecilia.roque@fct.unl.pt)

Prof. Dr. Pedro M. Costa – UCIBIO, NOVA School of Science and Technology (FCT-NOVA)
(pmcosta@fct.unl.pt)

Description

Cephalopods are remarkably well-adapted to a wide range of marine habitats, from abyssal plains to coral reefs and the polar regions. They are intelligent invertebrate predators known to secrete unique proteins that account for their competitive leverage. Among these proteins are included iridophore-specific proteins (reflectins, in particular), which hold great biotechnological potential and appear to be specific to cephalopods, squid in particular, playing a major role in camouflage and communication. They can be recombinantly expressed, produced in high yields, and further processed to form high-performance, biodegradable and environmentally friendly materials. Such materials can be processed in different formats and yield solutions for biomedicine, textile industry, smart clothing and other wearables, or even bioplastics. The aim of this master's thesis is to screen for novel reflectins in various tissues and species of cephalopods collected from polar waters, a group that has been little explored by marine biotechnologists. The applicant must have a strong interest to learn about bioinformatics and molecular biology. To obtain a comparative assessment of relevant transcript signature and expression, RNA-Seq will be employed following RNA extraction from various organs (such as skin and mantle), with replication to assure statistical significance and account for inter-individual variability. The procedure will follow previous pipelines for marine invertebrates. Data processing and statistical analysis will be done using R and dedicated packages.

Key bibliography

Cai, T. et al. Reconstruction of Dynamic and Reversible Color Change using Reflectin Protein. *Sci. Rep.* 9, 1–11 (2019).

Rodrigo, A. P., Grosso, A. R., Baptista, P. V., Fernandes, A. R. & Costa, P. M. A Transcriptomic Approach to the Recruitment of Venom Proteins in a Marine Annelid. *Toxins (Basel)*. 13, 97 (2021).

Mancio-silva, L. et al. Nutrient sensing modulates malaria parasite virulence. *Nature* 547, 213–216 (2017).

Grosso, A. R. et al. Pervasive transcription read-through promotes aberrant expression of oncogenes and RNA chimeras in renal carcinoma. *Elife* 4, e09214 (2015).

. ConTribuT: Conversion of dietary tributyrin in rainbow trout (*Oncorhynchus mykiss*)

Research Group: Marine Research Lab

(<https://cfe.uc.pt/profile/lines/3>)

Contact:

Ivan Viegas (iviegas@uc.pt)

Mariana Palma (mpalma@uc.pt)

Supervisors:

Ivan Viegas - CFE, University of Coimbra (<https://apps.uc.pt/mypage/staff/uc41517>)

Mariana Palma - CFE, University of Coimbra (<https://cfe.uc.pt/profile/members/1722>)

Description:

Aquaculture of carnivorous fish 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, would reduce the ecological burden of this industry and improve its sustainability. The shift towards plant protein still entails a series of implications like essential amino acid limitations or the presence of biologically active antinutritional factors ultimately lead to detrimental zootechnical performance, impaired intestinal function and gut inflammation. Rainbow trout (*Oncorhynchus mykiss*) is a carnivorous freshwater species whose production has consistently contributed to European aquaculture, being considered one of the most studied fish models for aquaculture.

Short-chain fatty acids (SCFA) result from anaerobic bacterial intestinal fermentation of fibre carbohydrates being butyrate one of the most relevant. If supplemented with butyrate, carnivorous fish are able to withstand substantial levels of plant-based protein. In order to contribute to a deeper understanding of these mechanisms and its implication in an aquaculture setting, the "ConTribuT" team gathers four partners of different backgrounds to follow the conversion of dietary tributyrin in rainbow trout: CFE, CIIMAR and CESAM (Portugal) and INRAE (France).

In this project we used ^{13}C -butyrate to assess if tributyrin improves nutrient utilization in rainbow trout (*Oncorhynchus mykiss*). The project will be developed in University of Coimbra in collaboration with other members of the Marine Research Lab. The students will have the opportunity to work in multidisciplinary teams and actively contribute to the development of a research project. Get in touch and embrace a challenging MSc project on Marine Biology and NMR technologies.

. FishOmics: Unveiling fish nutritional quality by NMR-Metabolomics

Research Group: Marine Research Lab

(<https://cfe.uc.pt/profile/lines/3>)

Contact:

Mariana Palma (mpalma@uc.pt)

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Supervisors:

Mariana Palma - CFE, University of Coimbra (<https://cfe.uc.pt/profile/members/1722>)

Ivan Viegas - CFE, University of Coimbra (<https://apps.uc.pt/mypage/staff/uc41517>)

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. In our group we use this approach, specifically the Nuclear Magnetic Resonance (NMR)-Metabolomics, to assess research questions on the Aquaculture and Seafood Quality fields.

The project will be developed on seafood species from the Portuguese coast and aim to address how the fillet composition of representative species varies between the coastal regions. The NMR-metabolomics results will complement other datasets, such as the potential presence of presence of heavy metal and contaminants. All together, it is also expected to observe if the muscle composition and overall quality is affected by any of the referred compounds.

The project will be developed in University of Coimbra in collaboration with other members of the Marine Research Lab. The students will have the opportunity to work in multidisciplinary teams and actively contribute to the development of a research project. Get in touch and embrace a challenging MSc project on Marine Biology and NMR technologies.

. PrawnOmics: Evaluation of novel diets for aquaculture prawn species by NMR

Research Group: Marine Research Lab

(<https://cfe.uc.pt/profile/lines/3>)

Contact:

Ivan Viegas (iviegas@uc.pt)

Mariana Palma (mpalma@uc.pt)

Supervisors:

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Mariana Palma - CFE, University of Coimbra (<https://cfe.uc.pt/profile/members/1722>)

Description:

Aquaculture of shrimp remains highly dependent on fishmeal protein and its procurement still relies on exploiting wild fisheries. To increase the sustainability of the aquaculture production, the industry will have to rely on the development of sustainable feed formulations. In this project it will be evaluated the effects of novel experimental diets on the black tiger prawn (*Penaeus monodon*) on the aqueous-metabolome and lipid profiles of hemolymph, muscle and hepatopancreas. To do that it will be used Nuclear Magnetic Resonance (NMR), resorting to ^1H -(proton) and ^2H -(deuterium) NMR experiments to assess the aqueous metabolome and the lipid profile respectively. Our lab focuses on using the delivery of stable isotopes to understand nutrient utilization and evaluate the efficacy of novel ingredients.

This project is being developed in collaboration with CSIRO, Australia. The students will have the opportunity to work in multidisciplinary teams and actively contribute to the development of a research project. Get in touch and embrace a challenging MSc project on Marine Biology and NMR technologies.

. How can ground nesting seabirds cope with heatwaves: the role of nesting microhabitat conditions in determining foraging patterns, physiology and breeding parameters

Research group: EcoTop (Ecology and Conservation of Top Predators)

<https://www.facebook.com/ecotop.mareuc/>

Contacts and supervisors:

Jaime Ramos (jramos@uc.pt)

Vitor Paiva (vitorpaiva@uc.pt)

Ana Cláudia Norte (acgnorte@ci.uc.pt)

Description:

Ground nesting seabirds face increasing stress levels during extreme events such as heatwaves. Nesting microhabitat conditions such as percentage vegetation cover and vegetation height should be important to provide shade and a fresher ambience for nesting adults and young chicks, particularly during periods of increasing heat stress. In this project we will use the vulnerable Audouin's gull *Ichthyaeetus audouinii* that breeds in Deserta Island, Ria Formosa, to address this aspect. This species nests in areas differing in nesting microhabitat conditions, which are likely to influence foraging patterns at sea, physiology and breeding parameters. Birds nesting in areas with denser and taller vegetation should cope better with periods of high temperature, which will be reflected in their breeding parameters (higher hatching success and chick growth) and less foraging effort at sea. (short trips for example).

In this study the student will select two sub-colonies differing in nesting microhabitat conditions to study the reproductive and foraging ecology of Audouin gulls using recent individual tracking technology (GPS-loggers) to describe foraging patterns at sea and loggers to measure heart rate and temperature (dummy eggs) during the whole nesting season. Parameters for periods with higher temperature (high heat stress) will be compared with those for lower temperatures (low heat stress) between the two sub-colonies differing in micro-habitat conditions. The outcome of these events on fitness measures (adults' physiology and body condition, breeding success and early chick growth rate) will also be assessed.

It is expected that the student will perform intensive fieldwork for about 40 days, from 20 April to 30 May in Deserta Island, Algarve, Southern Portugal

. Life history of the colossal squid *Mesonychoteuthis hamiltoni*

Research group: EcoTop (Ecology and Conservation of Top Predators)

<https://www.facebook.com/ecotop.mareuc/>

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Supervisors

Prof. Dr. José C. Xavier – University of Coimbra

Dr. Catalina Perales-Raya – Centro Oceanográfico de Canarias (Instituto Español de Oceanografía, CSIC)
(catalina.perales@ieo.es)

Description:

Cephalopods play a major role in the Antarctic food webs. They are the major link between lower trophic levels and top predators such as seabirds, marine mammals, and fish. The colossal squid *Mesonychoteuthis hamiltoni* is an oceanic squid endemic of the Southern Ocean, and it is the heaviest marine invertebrate of the world. Despite previous studies hypothesised a long-life span, nothing is known on the life history of this species.

This project will focus on the study of colossal squid's life history, i.e. age, life span and growth patterns. In detail, the project will use beaks previously collected from the diet of Antarctic and Patagonian toothfish on the Scotia Sea and Ross Sea regions (Southern Ocean). Age and growth patterns will be determined using an established technique of counting micro-increments in the lower beak. This work will be carried out between the University of Coimbra (Coimbra, Portugal) and the Instituto Español de Oceanografía – Centro Oceanográfico de Canarias (Santa Cruz de Tenerife – Spain).

The most important characteristic is that the students are motivated and genuinely interested in marine ecology. The student needs to be prepared to spend several hours at the microscope (attached to a monitor) and at the computer counting and measuring beak increments. The student will also need to be prepared to spend several months at Tenerife (up to 6 months – no funds available) where the laboratorial work will take place.

Key bibliography

Rosa R, Lopes VM, Guerreiro M, Bolstad KS, Xavier JC (2017) Biology and ecology of the world's largest invertebrate, the colossal squid (*Mesonychoteuthis hamiltoni*): a short review. Polar Biol 40:1871–1883. doi: 10.1007/s00300-017-2104-5

Perales-Raya C, Bartolomé A, García-Santamaría MT, Pascual-Alayón P, Almansa E (2010) Age estimation obtained from analysis of octopus (*Octopus vulgaris* Cuvier, 1797) beaks: Improvements and comparisons. Fish Res 106:171–176. doi: 10.1016/j.fishres.2010.05.003

Xavier, J., Croxall, J., Trathan, P., & Rodhouse, P. (2003). Inter-annual variation in the cephalopod component of the diet of the wandering albatross, *Diomedea exulans*, breeding at Bird Island, South Georgia. Marine Biology, 142(3), 611-622.

. Cultivation and growth of macroalgae of interest

Research group: Marine Algae Laboratory

Contact:

Leonel Pereira: leonel@bot.uc.pt

Supervisor

Prof. Dr. Leonel Pereira – University of Coimbra

Description

Nowadays, macroalgae consumption and overall biochemical content is gaining interest and attention. Overall, macroalgae contain high levels of nutritional and bioactive content, with potential for applications in a wide field of industries, such as pharmaceutical, textile, nutraceutical, among others. However, reliance on environmental and wild harvest is unsustainable, as these organisms form the bottom layer of the trophic chain. So far, the harvest and collection of wild biomass has consequences to the biodiversity, but the extent of these consequences remains far unknown, besides the logic assumption that, as algae provide shelter, nursery and feeding grounds to several species, these would be lost upon aggressive harvest.

As such, cultivation and growth of specific species of interest can provide a solution to the problem. This project focuses on the cultivation of several algae species from our coast, that have demonstrated potential for biotechnological applications.

This work will be carried out between the University of Coimbra (Coimbra, Portugal) research groups and Lusalgae company. The students' most important feature is that they are highly motivated and genuinely interested in seaweed ecology and aquaculture. The learner must be prepared to develop technical critical thinking.

Key bibliography

Araujo, G. S.; Cotas, J.; Morais, T.; Leandro, A.; García-Poza, S.; Gonçalves, A. M. M.; Pereira, L. 2020. *Calliblepharis jubata* Cultivation Potential—A Comparative Study between Controlled and Semi-Controlled Aquaculture. *Applied Sciences* 10 21: 7553. DOI: 10.3390/app10217553.

García-Poza, S.; Leandro, A.; Cotas, C.; Cotas, J.; Marques, J.C.; Pereira, L.; Gonçalves, A. M. M. 2020. The Evolution Road of Seaweed Aquaculture: Cultivation Technologies and the Industry 4.0. *International Journal of Environmental Research and Public Health* 17 (18): 6528-6528. DOI: 10.3390/ijerph17186528.

Inácio, A.C.; Morais, T.; Cotas, J.; Pereira, L.; Bahcevandziev, K. Cultivation of *Gracilaria gracilis* in an Aquaculture System at Mondego River (Portugal) Estuary Adjacent Terrain. In *Proceedings of the 1st International Conference on Water Energy Food and Sustainability (ICoWEFS 2021)*; Springer International Publishing: Cham, 2021; pp. 83–92.

. Essential mineral content variation on portuguese marine macroalgae: Characterisation along the portuguese coast

Research group: Marine Research Lab - CFE - UC

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Contact:

Miguel Pardal (mpardal@uc.pt)

Supervisors

Prof. Dr. Miguel Pardal – University of Coimbra

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. 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 10 essential elements (Ca, K, Mg, Na, P, Cu, Fe, Mn, Se, and Zn) along the Portuguese coast. Differences in the mineral content 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.

Key bibliography

Rodrigues MJ, Franco F, Martinho F, Carvalho L, Coelho JP, Pereira ME, Pardal MA (2021). Mineral content in marine species is determined by taxonomical and ecological attributes. *Journal of Food Composition and Analysis* 103: 104118.

<http://dx.doi.org/10.1016/j.jfca.2021.104118>

Cabral-Oliveira J, Coelho H, Pratas J, Mendes S, Pardal MA (2016). Arsenic accumulation in intertidal macroalgae exposed to sewage discharges. *Journal of Applied Phycology* 28(6) 3697-3703.

<http://dx.doi.org/10.1007/s10811-016-0867-7>

Cabral-Oliveira J, Pratas J, Mendes S, Pardal MA (2015). Trace Elements in Edible Rocky Shore Species: Effect of Sewage Discharges and Human Health Risk Implications. *Human and Ecological Risk Assessment* 21 (1): 145-155.

<http://dx.doi.org/10.1080/10807039.2014.890480>

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

Research group: Marine Research Lab - CFE - UC

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MACOI – Portuguese Seaweeds Website, and Marine Algae Laboratory

<http://www.seaweeds.uc.pt/>

Contact:

Miguel Pardal (mpardal@uc.pt)

Leonel Pereira (leonel.pereira@uc.pt)

Supervisors

Prof. Dr. Miguel Pardal – University of Coimbra

Prof. Dr. Leonel Pereira – University of Coimbra

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.

Key bibliography

Coelho JP, Pereira ME, Duarte AC, Pardal MA (2005). Macroalgae response to a mercury contamination gradient in a temperate coastal lagoon (Ria de Aveiro, Portugal). *Estuarine Coastal and Shelf Science* 65: 492-500.

<http://dx.doi.org/10.1016/j.ecss.2005.06.020>

Inácio AC, Morais T, Cotas J, Pereira L, Bahcevandziev K (2021). Cultivation of *Gracilaria gracilis* in an Aquaculture System at Mondego River (Portugal) Estuary Adjacent Terrain. In: da Costa Sanches Galvão J.R. et al. (eds) *Proceedings of the 1st International Conference on Water Energy Food and Sustainability (ICoWEFS 2021)*. ICoWEFS 2021, 10-12 May, Peniche, Portugal. Springer, Cham.

https://doi.org/10.1007/978-3-030-75315-3_10

Cotas J, Pacheco D, Araujo GS, Valado A, Critchley AT, Pereira L (2021). On the Health Benefits vs. Risks of Seaweeds and Their Constituents: The Curious Case of the Polymer Paradigm. *Marine Drugs* 2021, 19: 164.

<https://doi.org/10.3390/md19030164>

. Concentration of heavy metals on portuguese marine macroalgae. is there a risk of human consumption?

Research group: Marine Research Lab - CFE - UC

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Contact:

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Supervisors

Prof. Dr. Miguel Pardal – University of Coimbra

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. Nevertheless 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.

Differences in the heavy metals on macroalgae 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.

Key bibliography

Cabral-Oliveira J, Dolbeth M, Pardal MA (2014). Impact of sewage pollution on the structure and functioning of a rocky shore benthic community. *Marine and Freshwater Research* 65 (8): 750-758.

<http://dx.doi.org/10.1071/MF13190>

Cabral-Oliveira J, Coelho H, Pratas J, Mendes S, Pardal MA (2016). Arsenic accumulation in intertidal macroalgae exposed to sewage discharges. *Journal of Applied Phycology* 28(6) 3697-3703.

<http://dx.doi.org/10.1007/s10811-016-0867-7>

Cabral-Oliveira J, Pratas J, Mendes S, Pardal MA (2015). Trace Elements in Edible Rocky Shore Species: Effect of Sewage Discharges and Human Health Risk Implications. *Human and Ecological Risk Assessment* 21 (1): 145-155.

<http://dx.doi.org/10.1080/10807039.2014.890480>

. Characterization of the rocky intertidal community in the Reserve of the Biosphere of the Ilha das Flores (Azores)

Marine Research Lab - CFE - UC

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Contact:

Miguel Pardal (mpardal@uc.pt)

Supervisor

Prof. Dr. Miguel Pardal – University of Coimbra

Description:

It is felt more and more today the crisis of biodiversity in global terms. The lack of data is increasingly noticed which does not allow a sustained management of the marine resources, particularly in the coastal areas. The characterization of benthic macrofauna in rocky areas is a priority in some countries.

This need is even more urgent in the marine reserves of the biosphere where data is absent. Such situation is the Reserve of Biosphere located in the ilha das Flores (Azores) where we collected samples for the first time in their rocky intertidal areas of this island. This project focuses in the characterization of the fauna of this island based on two sampling stations, through a vertical gradient, from the supralittoral area to the infralittoral area.

Such project will increase the knowledge on the biodiversity in this marine reserve, whose data will enable a sustained and more balance management of this natural patrimony.

Key bibliography

Cabral-Oliveira J, Pardal MA (2016). Sewage discharges in oceanic islands: effects and recovery of eulittoral macrofauna assemblages. *Journal of Coastal Conservation* 20: 307-314.

<http://dx.doi.org/10.1007/s11852-016-0442-z>

Cabral-Oliveira J, Bevilacqua S, Terlizzi A, Pardal MA (2014). Are eulittoral assemblages suitable for detecting the effects of sewage discharges in Atlantic and Mediterranean coastal areas? *Italian Journal of Zoology* 81 (4): 584-592.

<http://dx.doi.org/10.1080/11250003.2014.947336>

Cabral-Oliveira J, Mendes S, Maranhão P, Pardal MA (2014). Effects of sewage pollution on the structure of rocky shore macroinvertebrate assemblages. *Hydrobiologia* 726: 271-283.

<http://dx.doi.org/10.1007/s10750-013-1773-5>

Cabral-Oliveira J, Dolbeth M, Pardal MA (2014). Impact of sewage pollution on the structure and functioning of a rocky shore benthic community. *Marine and Freshwater Research* 65 (8): 750-758.

<http://dx.doi.org/10.1071/MF13190>

. Assessing pharmaceutical contamination on the Portuguese coast through seaweed

Research Group: Marine Research Lab

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Contact

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Supervisors

Dr. Sara Leston – University of Coimbra

Prof. Dr. Miguel Pardal – University of Coimbra

Description

Coastal pollution is one of the major environmental threats worldwide, where pharmaceuticals represent an important group of emerging contaminants. These biologically active substances are designed to induce specific physiological changes but constitute a potential hazard when their active ingredients come in contact with untargeted organisms in the ecosystems, constituting an additional stressor together with climate change and eutrophication. Pharmaceuticals are bioaccumulated in primary producers and thus enter the trophic web, where biomagnification can occur.

This project will focus on the sampling of seaweeds (red, green and brown macroalgae) along the Portuguese Coast, with special focus on estuaries and their subsequent laboratorial analyses for pharmaceuticals quantification. Laboratorial work, including extraction will be conducted at the University of Coimbra and chromatographic analyses through UHPLC-TOF-MS will be performed at INIAV (Instituto Nacional de Investigação Agrária e Veterinária). Several classes of pharmaceuticals will be surveyed based on the most prescribed drugs in human and veterinary medicine in Portugal. The work developed will give the student the opportunity of performing field trips with sampling campaigns in several locations. It will also increase the knowledge on the development and application of recent methodologies for the detection and quantification of pharmaceuticals in environmental matrices.

Key bibliography

Rosa, J, Lemos, MFL, Crespo, D, Nunes, M, Freitas, A, Ramos, F, Pardal, MA, Leston, S, 2020. Integrated multitrophic aquaculture systems – Potential risks for food safety. Trends in Food Science & Technology 96: 79-90. <https://doi.org/10.1016/j.tifs.2019.12.008>

Rosa, J, Leston, S, Crespo, D, Freitas, A, Vila Pouca, AS, Barbosa, J, Lemos, MFL, Pardal, MA, Ramos, F, 2020. Uptake of enrofloxacin from seawater to the macroalgae *Ulva* and its use in IMTA systems. Aquaculture 516: 734609. <https://doi.org/10.1016/j.aquaculture.2019.734609>

Leston, S, Freitas, A, Rosa, J, Barbosa, J, Lemos, MFL, Pardal, MA, Ramos, F, 2016. A multiresidue approach for the simultaneous quantification of antibiotics in macroalgae by ultra-high performance liquid chromatography–tandem mass spectrometry. Journal of Chromatography B 1033-1034: 361-367.

DOI 10.1016/j.jchromb.2016.09.009

. The potential of rooted macrophytes in pharmaceutical contamination monitoring in Portuguese estuaries

Research Group: Marine Research Lab

Link: <http://cfe.uc.pt/profile/lines/3>

Contact

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Supervisors

Dr. Sara Leston – University of Coimbra

Dr. João Pedro Coelho – University of Aveiro

Description

Water pollution is one of the most critical environmental concerns worldwide, with pharmaceuticals representing an important group of emerging contaminants. These biologically active substances and their metabolites constitute a potential hazard when their active ingredients come in contact with untargeted organisms in the ecosystems. Currently, very few pharmaceuticals are targeted by legislation, but concerns grow as more and more molecules have been detected in the environment. Macrophytes play a very important role as pollutant deposits as they are able to trap them and act on their degradation and elimination through several processes. This project will focus on the sampling of rooted macrophytes along selected Portuguese estuaries and their subsequent laboratorial analyses for pharmaceuticals quantification. Laboratorial work will include development and validation of a multi-residue UHPLC-TOF-MS methodology for the detection and quantification of pharmaceuticals in macrophytes tissues. The activities will be conducted at the University of Coimbra and chromatographic analyses will be performed at INIAV (Instituto Nacional de Investigação Agrária e Veterinária). The several classes of pharmaceuticals to be surveyed will be based on the most prescribed drugs in human and veterinary medicine in Portugal. The work developed will give the student the opportunity of performing field trips with sampling campaigns in several locations. It will also increase the knowledge on the development and application of recent methodologies for the detection and quantification of pharmaceuticals in environmental matrices.

Key bibliography

Rosa, J, Lemos, MFL, Crespo, D, Nunes, M, Freitas, A, Ramos, F, Pardal, MA, Leston, S, 2020. Integrated multitrophic aquaculture systems – Potential risks for food safety. Trends in Food Science & Technology 96: 79-90. <https://doi.org/10.1016/j.tifs.2019.12.008>

Rosa, J, Leston, S, Crespo, D, Freitas, A, Vila Pouca, AS, Barbosa, J, Lemos, MFL, Pardal, MA, Ramos, F, 2020. Uptake of enrofloxacin from seawater to the macroalgae *Ulva* and its use in IMTA systems. Aquaculture 516: 734609. <https://doi.org/10.1016/j.aquaculture.2019.734609>

Leston, S, Freitas, A, Rosa, J, Barbosa, J, Lemos, MFL, Pardal, MA, Ramos, F, 2016. A multiresidue approach for the simultaneous quantification of antibiotics in macroalgae by ultra-high performance liquid chromatography–tandem mass spectrometry. Journal of Chromatography B 1033-1034: 361-367.

DOI 10.1016/j.jchromb.2016.09.009

. Using Baited Remote Underwater Video (BRUV) to assess marine megafauna traits

Research Group: Ocean and coastal systems - MAREFOZ

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Contact

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Supervisors

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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.

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.

Key bibliography

Haberstroh, A.J., McLean, D., Holmes, T.H. *et al.* (2022) Baited video, but not diver video, detects a greater contrast in the abundance of two legal-size target species between no-take and fished zones. *Mar Biol* 169: 79. DOI: 10.1007/s00227-022-04058-3

Langlois T, Goetze J, Bond T. *et al.* (2020) A field and video annotation guide for baited remote underwater stereo-video surveys of demersal fish assemblages. *Methods in Ecology and Evolution*. 11:1401-1409. DOI: 10.1111/2041-210X.13470.

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

Research Group: Ocean and costal systems - MAREFOZ

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

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Contacts and supervisors:

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Dr. Ana Marta Gonçalves (amgoncalves@uc.pt) <http://www.mare-centre.pt/pt/anamartagoncalves> – Universidade de Coimbra

Prof. Dr. João Carlos Marques (jcmimar@ci.uc.pt) <http://www.mare-centre.pt/pt/joaocarlosmarques> – Universidade de Coimbra

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.

. Small-scale fisheries. The implication of gear used, and fish species caught on local economy, environment and society

Research Group: Ocean and costal systems - MAREFOZ

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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 research 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).

Mercury levels in the highly threatened Wandering albatrosses

Research group: EcoTop (Ecology and Conservation of Top Predators)

<https://www.facebook.com/ecotop.mareuc/>

Contact:

José Xavier (jccx@cantab.net)

Paste link to homepage here (<http://cientistapolarjxavier.blogspot.com/>)

Videos of our animal research go to the [WEBSITE](#)

Supervisors

Prof. Dr. José C. Xavier – University of Coimbra

Prof. Dr. Richard Phillips – British Antarctic Survey

Description:

The wandering albatross *Diomedea exulans* is highly threatened, and amongst the seabirds with the highest levels of mercury (Hg) (Tavares et al. 2013, Seco et al. 2021). This study aims to assess the Hg levels in different tissues from wandering albatrosses (E.g. feathers, liver) as well as from guano, in order to understand the accumulation pathways in Hg in this albatross species breeding at South Georgia. This study will provide key information on the increased exposure of wandering albatrosses to Hg in modelling Hg processes.

This project will focus in analysing wandering albatrosses (complete individuals and guano) in laboratorial conditions. This work will be carried out between the University of Coimbra (Coimbra, Portugal) in cooperation with the British Antarctic Survey (Cambridge, United Kingdom), allowing the student to learn methods on analyses of carcasses, Hg extraction and analyses.

The ideal student will be interested in Antarctic marine ecology and be keen to work in the laboratory. The student will also need to be prepared to go to the United Kingdom.

Key bibliography

Seco J, Aparício S, Brierley AS, Bustamante P, Ceia FR, Coelho JP, Philips RA, Saunders RA, Fielding S, Gregory S, Matias R, Pardal MA, Pereira E, Stowasser G, Tarling GA, Xavier JC (2021a) Mercury biomagnification in a Southern Ocean food web. *Environmental Pollution*:116620

Tavares S, Xavier JC, Phillips RP, Pereira ME, Pardal MA (2013) Influence of age, sex and breeding status on mercury accumulation patterns in wandering albatrosses *Diomedea exulans*. *Environmental pollution* 181:315-320

. Microplastics in commercial flatfishes from the Portuguese coast

Research group: Marine Research Lab

<http://cfe.uc.pt/profile/lines/3>

Contact:

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Videos of our animal research go to the [WEBSITE](#)

Supervisors:

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Description:

Microplastic (MPs) pollution is now in the public and scientific domain as an emerging issue of global concern due to their potential effects to nature and the society. There is high evidence that MPs are now present in virtually all aquatic ecosystems and are ingested by several organisms (from zooplankton to top predators), which has been widely reported worldwide.

Recent assessments indicate that only 1% remains floating in surface waters, which suggests that “missing plastics” accumulate in environmental sinks, such as coastal sediments and deep-sea sediments and can interact with several species from the entire marine food web. In addition to their persistence and long-range transportability, microplastics can contain large amounts of chemical additives, such as flame retardants and plasticizers, which can leach from the plastic and pose an added threat to marine biota.

Flatfishes are a valuable component of commercial fisheries worldwide and can be a potential target for MPs accumulation due to their direct contact with marine sediments. In this project, you will identify (colour, size, shape, and polymer type) and quantify MPs in the gastro-intestinal tract of several commercial flatfishes along the Portuguese coast. You will learn and perform laboratory procedures, micro-Fourier transform infrared spectroscopy (μ -FTIR) analyses and advanced statistical methods to analyze the obtained data.

. The Great Cormorants (*Phalacrocorax carbo*) and the problems with aquaculture in the Mondego estuary

Research group: Marefoz Marine Ecosystems Lab; EcoTOP (Ecology and conservation of top Predators <https://www.facebook.com/ecotop.mareuc/>)

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Supervisors

Prof. Sónia Seixas - Universidade Aberta

Prof. Dr. Jaime Ramos – University of Coimbra (MARE – UC)

Description:

Production in aquaculture is a necessity, because we import a large quantity of fish from outside countries. Portugal has a high demand for fish because it is the biggest consumer of fish in the EU.

Like many economic activities aquaculture practices should be balanced with conservation of populations and habitats. The great cormorant (*Phalacrocorax carbo*) has been identified as a source of conflict with fish farming throughout Europe because it may capture large quantities of fish from aquaculture. To solve this problem aquaculture farmers place nets over the tanks, which may kill birds when they attempt to dive. The population of the great cormorant has increased in the last decades, which contributes to increase this conflict between bird conservationists and fish farmers.

The aim of this study is to estimate the population size and assess the diet of Great Cormorant in the Mondego Estuary, and evaluate the number of possible birds dying in aquaculture activities. The methods to achieve the objectives are: a) monthly counts of birds in the Mondego Estuary to estimate the population size and assess the percentage of the population foraging in aquacultures; b) collect regurgitations to assess the diet, particularly seabream and seabass (by otolith identification); c) conduct a survey of aquaculture farmers in the area, to assess their perspective on how to analyse and solve the problem; d) provide an estimate of the potential economic impact of great cormorant to aquaculture in the Mondego estuary. Overall, the project will contribute to propose forms to solve this conflict between aquaculture and bird conservation.

. The nutritional value and beneficial properties of macroalgae collected in Portugal

Research groups: Marine and Coastal Ecosystems (CFE-UC) and ACOI (DCV-UC)

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Description:

After being used for centuries as a predominant food in Asian countries, especially Japan, seaweed dishes are now being explored globally, and Europe is not an exception. Many seaweed species are also associated with the so-called “Mediterranean diet”, which is a plant-based food regime with a wide range of health benefits, such as heart protection, weight regulation, less cognitive decline and cancer reduction. Even though, in Portugal, macroalgae are considered a potentially valuable economic resource, they are still underexploited. Thus, as a contribution to the characterization of the nutritional value and beneficial properties of macroalgae, the present MSc project aims to comprehensively evaluate the content of proteins, fibres, ashes, carbohydrates, total lipids, fatty acids, phenolic compounds and pigments, as well as the antioxidant potential, of around 20 wild macroalgae specimens collected along the Portuguese coast.

Key bibliography:

DOI: 10.1016/j.foodchem.2018.06.145

DOI: 10.3390/app112311261

DOI: 10.3390/toxics9020024

. Portuguese halophytes with potential economic value for the agri-food industry

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Description:

To deal with salty soils, farmers are now starting to explore wild plants that are naturally tolerant to saline water, known as halophytes. In certain geographical locations, these plants have been used as food by local populations for a long time, mainly associated with times of less abundance and economic difficulties. However, the incorporation of novel and healthy food products is currently being promoted worldwide, and the delicacy of halophytes is becoming a global trendy garnish in modern cuisine. It seems that such plants have more distinctive tastes and potentially greater health benefits given the trace minerals found in seawater. Thus, the present MSc project aims to comprehensively determine the nutritional value and beneficial properties of wild halophyte species collected along the Portuguese coast in order to select new food products to be potentially grown in saline agricultural soils.

Key bibliography:

DOI: 10.3390/su11082197

DOI: 10.1016/j.ecss.2021.107733

DOI: 10.3390/plants11212910

DOI: 10.1016/j.jfca.2017.02.003

. The effects of culinary treatments on the nutritional value of fishery products

Research groups: Marine and Coastal Ecosystems (CFE-UC) and ACOI (DCV-UC)

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Description:

A number of health benefits are attributable to fishery products. For instance, seafood is a major source of healthy n-3 long-chain polyunsaturated fatty acids. However, information on the nutritional value and chemical composition of fishery products is often reported with data obtained from raw foods. Although fish is sometimes consumed raw in some preparations, such as sushi and ceviche, it usually undergoes a cooking process before being consumed, which could lead to changes in the nutritional value. Thus, this MSc project aims to determine the effect of cooking processes (boiling and grilling) on the proximate composition, fatty acid profile, and levels of minerals in five widely consumed fishery products: codfish (*Gadus morhua*), hake (*Merluccius merluccius*), octopus (*Octopus vulgaris*), horse mackerel (*Trachurus trachurus*) and sardine (*Sardina pilchardus*).

Key bibliography:

DOI: 10.1016/j.fct.2013.07.050

DOI: 10.1371/journal.pone.0180993

DOI: 10.1016/j.foodchem.2008.12.018

. Marine macroalgae: alternative recipes for a daily nutritional diet

Research groups: Ocean and Coastal Systems

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Description:

Macroalgae are widely diverse in terms of morphology, body structure complexity and size, turning it in a very diverse group of organisms. Seaweeds present a great variety of natural compounds with different properties and benefits to human health. As a way to overcome the lack of food, suppress the nutritional needs of some diets and due to their vast range of essential constituents – minerals (iron and calcium), proteins (with all essential amino acids), vitamins and fibres, absolutely necessary to human primary metabolism, macroalgae arise as a natural food, wild and abundant with a fast growing index with high potential as a source of food nutrition. Marine macroalgae also provide a high nutritional value along with a low caloric value, poor in fat, with the presence of polysaccharides that behave as fibres with no caloric value. Thus, this work aims to collect and cultivated a set of macroalgae defined in preliminary works and determine the biochemical profile (fatty acids, carbohydrates and protein content) to assess the most nutritious macroalgae to pre-cooked dishes.

. Application of marine macroalgae as biofertilizers in agriculture

Research groups: Ocean and Coastal Systems

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Description:

Seaweeds are used in agriculture not only as fertilizers but also as biostimulants as they induce plant growth when used in very small amounts. This property is related to the presence of cytokinins or abscisic acid in seaweed extracts. In addition to this application, aqueous seaweed extracts can be used to promote plant resistance to biotic or abiotic stresses. For example, laminaran, a polysaccharide present in brown seaweed, has the activity of inducing natural defense mechanisms in plants against fungal, bacterial or viral infections. However, the biochemical mechanisms involved in these processes are still not completely known.

In this work, aqueous extracts of different marine algae (green, red and brown) from the Portuguese coast will be obtained. The extracts will be characterized according to their chemical composition, namely carbohydrates, protein, lipids and phenolic compounds. These extracts will be evaluated for stimulating plant growth and their tolerance to biotic (fungi, bacteria, viruses) or abiotic (water, heat and salinity deprivation) stresses. This work will allow the use of marine biomass in the agriculture sector, promoting a new agricultural concept that is less dependent on chemical products, contributing to the production of healthier food.