BIodiv

Annual Meeting

"Know Ourselves, Know Our Past, Know Our Future"

BOOK OF ABSTRACTS

Welcome to the BIODIV Meeting 2021!

Dear colleagues, dear friends,

It is with great pleasure that we welcome you to the second edition of the BIODIV Meeting, this year, due to the limiting conditions that we face, in a virtual format, the BIODIV Meeting 2021, online edition.

First, we would like to thank all of you for your participation at the conference, thank the scientific committee for all the support provided, as well as Dora and Mariana for all the help. We also would like to thank our plenary speakers, Susana Freitas and Adrià López Baucells for accepting our invitation and sharing their knowledge and experience with us.

The second BIODIV Meeting is organized by and for BIODIV PhD students to provide them with the opportunity to discuss their work and establish scientific, academic and social connections. As a reflection of the work developed by the students, we expect a multidisciplinary program on evolution and dynamics of biodiversity at distinct scales of biological organization: from organisms and populations to communities and ecosystems.

In the current edition of the BIODIV meeting, we propose the motto “Know Ourselves, Know Our Past, Know Our Future” as we believe to be essential to make ourselves acquainted not only with the ongoing projects being developed within the scope of the Biodiv doctoral programme, but also to know the work and life experience of those who came before us and those who only now have joined this programme. In that regard, we are proud to have 2 Alumni of the BIODIV programme that will share not only the results of their work but also, some of their life experience inside and outside of the programme. We are also proud of having several 1st year students attending this conference, as this is expected to be a great opportunity for them to introduce themselves and their ideas among peers.

We hope that you enjoy the conference and that you actively participate in the several moments in which you can contribute with questions, doubts or comments.

The organizing committee

PLENARY

Susana Freitas

BIODIV Alumni student from Porto University

14 January 2021 – Thursday

14h30-15h00

Short Bio Susana Freitas

Susana Freitas is a postdoctoral researcher at the University of Lausanne. Her main line of research is on the evolution of asexuality, and more specifically how asexual species originate and persist when in competition with their sexual ancestors. Susana received a mixed PhD grant and did her PhD work jointly at the University of Porto in Portugal and the University of Sheffield in the UK, using *Darevskia* lizards as a model system. After finishing her PhD, Susana moved to the University of Lausanne to continue her research on asexuality using two insect systems, *Timema* stick insects and *Nephus* ladybirds.

SESSION 1

Genetics and Evolution

14 January 2021 – Thursday

15h00-15h45

15h00 – 15h15	**Leili Khalatbari** *How metabacoding can improve conservation measures of Asiatic cheetah?*
15h15 – 15h30	**Mafalda S. Ferreira** *Knowing the past to predict the future: The evolution of seasonal camouflage in white-tailed jackrabbits and its adaptive potential to climate change*
15h30 – 15h45	**Carolina Pacheco** *Demographic history of gray wolves in Far East Russia and Pacific Northwest*

How metabacoding can improve conservation measures of Asiatic cheetah?

Leili Khalatbari

Faculty of Sciences - University of Porto

Knowledge on diet composition can improve conservation measures of large carnivores. Despite being one of the most endangered felids of the word, little is known about ecology of Asiatic cheetah, especially on its overall diet and regional differences in their prey selection. In this study we assesses diet composition of this species along all its current range using metabarcoding. Results show that they are primary predating on mouflon, other prey items were ibex, cape hare and goitered gazelle. Despite having a large population size, small livestock was never observed in analysed samples. Goitered gazelles were only taken in one area, where the habitat type is mainly composed of flat areas. In other areas where the slope is higher, mouflon is more taken; the percentage of taken ibex rises with raise of slope in Yazd areas, but still mouflon is the most consumed item. Higher usage of mouflon in comparison to goitered gazelles, which are known to be primary prey of cheetahs, suggest that human pressure has forced cheetahs to live in suboptimal habitats. This emphasises on importance of higher protection of flat plains and management plans to remove livestock from these habitats to ensure long term survival of Asiatic cheetah. Laboratory and bioinformatics pipelines used in this study can be used for answering similar questions about other threatened carnivores.

Knowing the past to predict the future: The evolution of seasonal camouflage in white-tailed jackrabbits and its adaptive potential to climate change.

Mafalda S. Ferreira

Faculty of Sciences - University of Porto

Preserving genetic diversity is fundamental for conservation since standing adaptive variation is a critical component of evolutionary responses to rapid environmental changes. Here, we study the distribution and evolution of continuous winter coat color variation in the white-tailed jackrabbit (*Lepus townsendii*), a declining North American hare species, to determine the adaptive potential of this species to future changes in snow cover. Using whole-genome data from 74 white-tailed jackrabbits from Colorado, USA, we infer a multigenic genetic architecture determining winter coat color in the species. Using comparative genomic analyses across 10 hare species, we further show that genetic variation underlying winter coat color has been maintained through a combination of secondary gene flow between species and long-term balancing selection. We then modeled the expected color phenotypes in forecasted environmental conditions for 2080 and show that selection will increasingly favor winter brown phenotypes across the majority of the white-tailed jackrabbit distribution. Though adaptation to this rapid shift in environmental conditions will likely rely on the standing genetic variation for winter-brown phenotypes, we show that the majority of the winter brown range overlaps with areas of presumed extirpated or severely declining populations. Future conservation measures should thus focus on protecting areas still harboring adaptive genetic variation underlying winter brown coats. Our work is an example of how the ecology and evolutionary history of an adaptive polymorphism can inform conservation actions targeted at protecting adaptive genetic variation important for evolutionary rescue under climate change.

Demographic history of gray wolves in Far East Russia and Pacific Northwest.

Carolina Pacheco

Faculty of Sciences - University of Porto

Gray wolves (*Canis lupus*) are one of the few extant top predators that survived the climate-induced habitat changes during Pleistocene, and the extreme anthropogenic pressure of the last centuries. A recent study using whole mitochondrial data traced the origin of extant wolves to an expansion from Beringia, dated to the end of the Last Glacial Maximum. This ancestral population ranged from Eastern Siberia (Russia) to Western Yukon (Canada), across the now submerged Beringia Land Bridge. In this study we present a demographic and population genetic analysis of the extant wolf population from the former Beringia region and the contiguous Southeast Alaska population based on genome-wide SNPs. Our goal was to assess patterns of genetic diversity and structure for these populations and to understand the contribution of historical and contemporary processes that shaped their demography over time. Our results show that Russian and Northwest American populations shared a common ancestry until 40,000 years ago when they initiate divergence, and both entered a period of continuous demographic decline. These results suggest that there was genetic structure in the Beringia wolves prior to their population expansion. Furthermore, we observed synchronic demographic trends of Northwest American and Eurasian wolves throughout the Pleistocene which suggests an effect of large-scale climatic fluctuations. In contrast to their continental counterparts, Southeast Alaska wolves represent a distinct evolutionary lineage that likely diverged in a separate glacial refugia. Additionally, this population exhibits reduced genetic diversity and high levels of inbreeding, probably associated with the complex geomorphological history of this region and an increasing human pressure in the last centuries.

SESSION 2

Ecology and Behaviour

14 January 2021 – Thursday

16h00-16h45

16h00 – 16h15	**Rita Fortuna** *Parents and helpers' provisioning rules in relation to brood demand in a cooperatively breeding bird*
16h15 – 16h30	**Martina Panisi** *An endemic-rich island through the eyes of its children: wildlife recognition and conservation preferences*
16h30 – 16h45	**João Gameiro** *Influence of colony traits on ectoparasite infestation in birds breeding in mixed-species colonies*

Parents and helpers' provisioning rules in relation to brood demand in a cooperatively breeding bird.

Rita Fortuna

Faculty of Sciences - University of Porto

Parental care can only remain evolutionarily stable if increasing offspring survival generates more fitness benefits than costs. To optimally distribute energy spent in feeding, breeders should recognize traits that reflect offspring needs. In birds, young exhibit acoustic begging that can contain information on hunger. Parents were seen to adjust feeding rates to these potential signals. In cooperative breeders, the fitness payoffs of providing care may affect parents and helpers. Previous studies show that both parents and helpers feed more when offspring demand increases, suggesting that helpers may equally benefit from adjusting feeding rules to offspring need. However, it is unclear how helpers' response to brood demand varies with their sex and relatedness to the offspring, which is crucial to understand if helping benefits are indirect, through kin associations, and/or direct through effects on group size and dynamics. We studied begging behaviour and feeding responses using as study system a cooperatively breeding bird, the sociable weaver *Philetairus socius*, in which helpers show different levels of relatedness to the offspring and both sexes help. We recorded acoustic begging at each feeding event, allowing us to investigate 1) whether begging behaviour varied in relation to the identity of the bird feeding and 2) if inter-visit intervals were correlated with brood demand for both breeders and helpers that differed in their sex and relatedness to the offspring. This investigation will provide a robust understanding of the provisioning rules in a highly social system and help to identify which benefits can arise from cooperative breeding.

An endemic-rich island through the eyes of its children: wildlife recognition and conservation preferences.

Martina Panisi

Faculty of Sciences - University of Lisboa

Understanding how humans use natural resources and protect certain species while over-exploiting others requires assessing what drives their decisions and what factors might alter perceptions about biodiversity and ecosystems. Childhood is a key period to forge connections with the surrounding environment. Assessing what enhance and affect children's early connections with local wildlife is critical to develop useful strategies that aim to engage them in species conservation. In this study we assessed factors that influence the ability of children to recognize endemic and exotic animal species and explored potential links between this ability and stated conservation preferences in the developing endemic-rich country of São Tomé and Príncipe, in Central Africa. To achieve our objectives, we developed a survey using a game format with 361 students attending rural and urban primary schools. We found that gender, socio-economic status, and school proximity to forested areas are significant factors to influence children's ability to recognize species. Although rural students were better at recognizing endemic species than urban students, the species origin, endemic or exotic, was not a significant factor to explain the student's ability to recognize species. We did not find a significant correlation among conservation preferences and children's ability to recognize species. Instead, preferences seem to be justified by species-specific factors, with a prevalence for species that are visually attractive or profitable.

Influence of colony traits on ectoparasite infestation in birds breeding in mixed-species colonies.

João Gameiro

Faculty of Sciences - University of Lisboa

Coloniality in birds is often associated with an increase in parasite burden, but most studies have focused on mono-specific colonies. In this study, we took advantage of mixed-species colonies formed after the provision of artificial breeding structures for restoring the lesser kestrel population in Portugal. We sampled four groups of ectoparasites (carnid flies, haematophagous mites, louse flies and chewing lice) in the four most common hosts in these colonies: lesser kestrels, European rollers, feral pigeons, and spotless starlings. Our goal was to understand how colony characteristics such as size, species richness, density, and composition influence the presence of ectoparasites and the abundance of the carnid fly *Carnus hemapterus*, the most common ectoparasite in these colonies. Ectoparasites were sampled from all nestlings from more than 250 nests in 43 different sites. Our study revealed that host species was the best predictor for ectoparasite composition, with each host species nest having a distinct infracommunity of ectoparasites, regardless of colony traits such as size, density or host richness. The abundance of *C. hemapterus* was mainly influenced by colony composition – number of nests of each host species – rather than by colony size or density, with its abundance decreasing with increasing numbers of less suitable hosts such as starlings. We highlight that the increased contact between multiple species of hosts in mixed-species colonies may complexify host-parasite interactions and challenge our current knowledge on the ecological relationships between host sociality and parasitism.

PLENARY

Adrià López Baucells

BIODIV Alumni student from Lisbon University

15 January 2021 – Friday

14h00-14h30

Short Bio Adrià López Baucells

Dr. Adrià López-Baucells completed his PhD at the University of Lisbon in 2018. During his doctorate he studied the effects of Amazonian rainforest fragmentation on tropical bats using autonomous ultrasound detectors. He has lately been focused on the 'soundscape' exploration (the landscape of sounds that exist in nature) in order to promote sustainable land use. Nonetheless, his main area of interest has always been bat ecology and conservation worldwide, particularly with the most severely threatened species and habitats.

He started working with bats at the Natural Science Museum of Granollers (Catalonia) in 2005, where he met his first mentors, who rapidly introduced him to the intimate secrets of the bat world. Since then, he has collaborated on numerous international bat conservation projects shaping his scientific knowledge and background. As a bat researcher, he has always been determined to find applied, clear solutions to the current threats that bats are seriously facing all over the world. After 5 years of bat research in Europe, in 2010, he concluded his BSc with a final project on bats in Colombia, his first contact with Neotropical species. Afterwards, he jumped to Sydney (Australia) to carry out his MSc thesis studying competitive behavior between flying foxes. And more recently, he has also joined quite a few bat-related expeditions in North Africa, Kenya and Madagascar, where he has finally become a National Geographic Explorer.

As a National Geographic Explorer he is establishing a new project based in Madagascar, one of the poorest countries in the world, totally dependent of subsistence

rice agriculture, with big problems of harvest loss, and heavily threatened endemic bat populations due to the vast deforestation. Because bats are known to be excellent pest controllers Adrià will work to assess the effectiveness of bats as pest suppressors in rural areas using bat boxes and field experiments while promoting bat conservation amongst local villagers and farmers.

He is now leading a young research group in the Natural Science Museum of Granollers focused on bat research and conservation, the study of habitat connectivity, loss and fragmentation, all under the umbrella of applied ecology, with special emphasis on the use of technology for conservation.

SESSION 3

Ecology and Behaviour

15 January 2021 – Friday

14h30-15h15

14h30 – 14h45	**Filipa Coutinho Soares** *Niche differences reduce competition between native and exotic birds in oceanic islands*
14h45 – 15h00	**Ana Cristina Gomes** *Familiarity, dominance, sex and season shape common waxbill social networks*
15h00 – 15h15	**Fernando Esteves** *Ontogenetic shift in foraging strategy of green turtles (Chelonia mydas) in the Bijagós archipelago, Guinea-Bissau*
15h15 – 15h30	**Patrícia Beltrão** *Plumage colour saturation predicts long-term, cross-seasonal social dominance in a mutually ornamented bird*

Niche differences reduce competition between native and exotic birds in oceanic islands.

Filipa Coutinho Soares

Faculty of Sciences - University of Lisboa

Aim: Few bird extinctions on oceanic island have been attributed to competition with exotic species, even though it might be an overlooked driver of biodiversity loss. We evaluate potential competition between native and exotic island bird species, identifying species and island characteristics that enhance it and may potentiate future extinctions.

Location: Seventy-three (> 100 km2) oceanic islands worldwide.

Methods: We compiled a species list for each island and used single-trait meta-analyses to assess differences between native and exotic species. Then, we used single-trait beta regression models to identify species traits linked to competition. Finally, we used a trait-based approach to calculate the potential competition between native and exotic species on each island and identify island characteristics linked to competition.

Results: Native bird species tended to be smaller forest dwellers, that were either carnivore, frugivore or insectivore, and that foraged in flight, in the canopy or at midheight. In contrast, exotic birds tended to be open habitat granivores, that were either ground or unspecialized foragers. Potential competition tended to be higher for native species with typical exotic traits and forest-dwelling unspecialized exotic species. Potential competition between native and exotic birds was consistently higher in islands that were larger, had more exotics or were drier.

Main conclusions: Niche differentiation of native and exotic species may explain the scarcity of reported competition-driven extinctions since exotics clearly tend to favour and are better adapted to anthropogenic environments. However, the few exotics that occur in native ecosystems may be problematic. The loss of native ecosystems coupled with the introduction of species that might outcompete native species may enhance the relevance of competition in future island extinctions.

Familiarity, dominance, sex and season shape common waxbill social networks.

Ana Gomes

Faculty of Sciences - University of Porto

In gregarious animals, phenotypic differences and past interactions may determine social network position, which, in turn, may influence life-history traits and fitness. To evaluate how phenotypic differences and familiarity influence individuals' social network positions, we monitored a captive flock of the year-round highly gregarious common waxbill (*Estrilda astrild*). We used radio-frequency identifiers in a large mesocosm during the non-breeding and breeding seasons of two consecutive years. We found that individual differences in network centrality were repeatable across seasons and years, suggesting a stable, personality-like social phenotype. Nonetheless, there were seasonal changes in social structure: while in breeding seasons waxbills associated more strongly with opposite-sex individuals, in the non-breeding seasons they associated more strongly with individuals of similar dominance rank. We also found that waxbills entering the mesocosm at the same time associated more strongly, suggesting long-lasting social bonds. Furthermore, waxbills entering the mesocosm later (but before the beginning of this study) had more central positions in the network, especially during the breeding seasons, which perhaps indicates less differentiated social bonds. Most individual differences in various phenotypes (e.g., personality type, cognitive performance, colour ornamentation) did not predict position in the social network. These results point to a role of long-lasting associations among familiar individuals in the social organization of common waxbills and less influence of phenotypic differences.

Ontogenetic shift in foraging strategy of green turtles (*Chelonia mydas*) in the Bijagós archipelago, Guinea-Bissau.

Fernando Esteves

Faculty of Sciences - University of Lisboa

After hatching, juvenile green turtles are oceanic and mostly omnivorous, supposedly shifting to an herbivorous diet when recruiting to coastal areas. The waters around the islands of Unhocomo and Unhocomozinho in the Bijagós archipelago, Guinea-Bissau, are frequented by a significant number of juvenile turtles, being a potentially important recruitment area. In this study we describe juvenile green turtle size distribution and diet at this site through stable isotope analysis. Two main habitat types were sampled, coastal deeper rocky areas with only macroalgae and offshore sandy shallows with macroalgae and seagrass. The isotopic signature of the benthic community of each area type varied significantly, mainly by the presence or absence of seagrass. We captured 89 turtles, from juveniles, 35 to 75.3 cm curved carapace length (CCL) to adults, 78.3 to 97 cm CCL. Smaller individuals (< 40 cm CCL) were isotopically distinct, indicating that these were probably recently recruited. Resident turtle isotopic signatures showed clear differences according to the type of area they were captured, indicating a dichotomy in foraging habitat. The distribution of turtle sizes was also habitat dependent, smaller turtles were more abundant in the sandy shallows and larger turtles and adults in the rocky areas. This segregation is evident in the stable isotope data, with turtle signatures shifting gradually from newly arrived recruits, to sandy areas, to rocky areas. This ontogenetic shift in foraging strategy suggests that, in this area, turtles recruit to sandy shallows, with seagrass, gradually shifting to rocky macroalgae dominated areas as they reach adulthood.

Plumage colour saturation predicts long-term, cross-seasonal social dominance in a mutually ornamented bird.

Patrícia Beltrão

Faculty of Sciences - University of Porto

Dominance hierarchies are known to reduce agonistic interactions between individuals. Social dominance can be conditioned by different phenotypes such as body size, personality or cognition. Additionally, colour ornamentation can act as a badge of status in social dominance, but this role is less understood for the particular case of carotenoid-based colour ornamentation. Here we studied whether various phenotypic differences among individuals, including colour ornamentation, predicted social dominance in the highly social and mutually -ornamented common waxbill (*Estrilda astrild*). We monitored dominance interactions in a large mesocosm where waxbills live in semi-natural conditions, using a radio-frequency identification (RFID) system, in 2 non-breeding seasons and 2 breeding seasons over 2 consecutive years. Waxbills' position in the dominance hierarchy was repeatable across seasons and years. Overall aggressiveness and the steepness of the dominance hierarchy were higher in the breeding seasons, perhaps because of increased competition over mates or breeding resources. Contrary to previous tests with waxbills confined to birdcages, body size did not predict social dominance, perhaps because in our more natural setting aggressive encounters were mostly airborne, where large body size may not confer a fighting advantage and may even reduce manoeuvrability. Reactive-to-proactive personality differences did not predict social dominance either. Our study clearly identifies the carotenoid-based plumage colouration component (i.e., breast saturation and not patch size) that acts as a badge of status. The saturation of carotenoid-based red plumage strongly predicted social dominance, adding to the knowledge that carotenoid-based colouration, as an honest signal, can be important in a social context.

SESSION 4

Genetics and Evolution

15 January 2021 – Friday

15h45-16h130

15h45 – 16h00	**Lara Baptista** *The journey of Phorcus sauciatus (Mollusca: Gastropoda) to the remote Azores Archipelago*
16h00 – 16h15	**Catarina J. Pinho** *Big and small – How do we fit all? An integrative framework for investigating character displacement*
16h15 – 16h30	**Jéssica Teodoro-Paulo** *New Insights into Intraspecific Variation of Defence Suppression in Phytophagous Spider Mites*

The journey of *Phorcus sauciatus* (Mollusca: Gastropoda) to the remote Azores Archipelago.

Lara Baptista

Faculty of Sciences - University of Porto

The marine topshell *Phorcus sauciatus* is currently found along the temperate-subtropical shores of the Northeast Atlantic Ocean, including the Iberian Peninsula, Madeira and Canaries for centuries. Despite this wide distribution, *P. sauciatus* has only recently reached another oceanic volcanic archipelago in this area of the Atlantic Ocean. In 2013, a small population was reported for the first time in Santa Maria Island (Azores Archipelago), soon occupying the intertidal areas around this island and reaching the neighbouring island of São Miguel in a short period of time. Why *P. sauciatus* was so successful in the colonization of the remote archipelago is still not clear. To address this question and clarify the populational dynamics of the top-shell in the NE Atlantic Ocean, we applied a molecular approach based on the mitochondrial COI marker to evaluate the genetic structure of *P. sauciatus*, hoping to determine the potential origin for the first colonizers of the Azores. On the foundations of detailed oceanographic, palaeontological and ecological data, we discuss the role of climate change on prompting colonization of remote oceanic islands and, finally, propose a potential mechanism to explain the long-distance dispersal of the non-planktotrophic gastropod *P. sauciatus* across important biogeographical barriers in the NE Atlantic.

Big and small – How do we fit all? An integrative framework for investigating character displacement.

Catarina J. Pinho

Faculty of Sciences - University of Porto

Oceanic islands are exciting models to study how evolutionary patterns and environmental variables determine speciation and community assembly over time. The Cabo Verde Archipelago is a simplified natural laboratory harbouring three endemic reptile genera that (i) share the same ancestral species, (ii) have species inhabiting the same areas (sympatric) competing for scarce resources and (iii) present wide morphological variation, such as size. This system provides the opportunity to explore how character displacement (CD) acts as an evolutionary force in several sympatric reptile species. Thus, in my PhD project, I aim to investigate dietary and niche preferences of three sympatric reptile species pairs of Cabo Verde to test the possibility of CD driving speciation and subsequent morphological and ecological dissimilarities. For that I am using a multidisciplinary framework integrating DNA-metabarcoding with morphometric and ecological data to better understand the habitat partitioning enabling species coexistence, subsequently providing valuable data for the conservation of threatened species. Due to the pandemic restrictions, I was unable to perform fieldwork, however, during my first year, I was able to analyse preliminary data on the diet and morphology of one reptile species pair *(Tarentola gigas* and *Tarentola raziana*), visiting museums. In addition, I had the opportunity to participate on a project, directly related with mine, on the diet of the house mice introduced to Cabo Verde. Therefore, I have studied the impact of the house mice on native plants and invertebrates and evaluated if there were different diet estimates according to the gastrointestinal tract section(s) analysed.

New Insights into Intraspecific Variation of Defence Suppression in Phytophagous Spider Mites.

Jéssica Filipa Teodoro Paulo

Faculty of Sciences - University of Lisboa

Some herbivorous species suppress plant defences, leading to higher performance of suppressors and the rest of the herbivore community on the plant, as compared to plants with no suppressor herbivores. *Tetranychus* spider mites are important pests of several crops. Within this genus, *T. urticae* tends to induce and *T. evansi* suppress tomato plant (*Solanum lycopersicum*) defences of the jasmonic acid (JA) and salicylic acid (SA) pathways. Defence suppression is beneficial for both species. However, the degree of intraspecific variation for both suppression and induction is as yet unclear. Here, we characterize how two outbred populations of *T. urticae* and *T. evansi*, interact with tomato defences. We also test defence suppression in the 7 populations used to found these outbred populations. To this aim, we infested tomato plants with 25 mites of each population during 4 days, then measured (i) plant defences through differential expression of plant marker genes for JA and SA pathways, and (ii) the consequences of defence suppression for the suppressing mites by recording their fecundity during plant infestation. We found that outbred populations of both species and their founder populations suppressed defences, with similar beneficial effects across populations. These results show that suppression is not uncommon in *T. urticae*. The ecological and evolutionary causes and consequences of within-species variation for defence suppression remain to be elucidated.

Talks

Organizing Committee

David Silva – CIBIO / FCUP

Jéssica Paulo – CE3C / FCUL

João Gameiro – CE3C / FCUL

Luís Seabra – CIBIO / FCUP

Scientific Committee

Nuno Ferrand de Almeida – Director

Jorge Palmeirim

Margarida Matos

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Important Info

14 and 15 of January 2021

Online

Contact us @ biodivannualmeeting@gmail.com

https://www.biodiv.pt/en/phd-programme/annual-meeting-2021/