

PORTUGUESE POLAR PROGRAM ANNUAL REPORT 2020



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ANNUAL REPORT 2020**

March 2021

Portuguese Polar Program - PROPOLAR

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FOREWORD

This Annual Report of the Portuguese Polar Program - PROPOLAR covers the period from August 2019 to December 2020, showing the main activities that were carried out. The PROPOLAR is led by CEG/IGOT - University of Lisbon, under a Coordinating Committee including members of 4 other Portuguese research institutions: CCMAR - University of Algarve, MARE - University of Coimbra, CQE/IST - University of Lisbon, and CIIMAR - University of Oporto. The Program is funded by the Fundação para a Ciência e a Tecnologia (MCTES-FCT) within its Polar Program.

The activities herein disclosed reflect a very busy and demanding year, tinted with impacts of the COVID-19 pandemics. Whereas the Portuguese Antarctic campaign 2019-20 was successful, stringent restrictions linked to the coronavirus have limited Arctic field activities, particularly during summer 2020, with 3 projects in the Western Arctic and Northern Quebec (Canada) and Western coast of Svalbard, postponed to 2021. Researchers accepted the challenge as an opportunity for data analysis. An important consequence of the pandemic was the cancelation of the Antarctic campaign 2020-21, a decision made to ensure that Antarctica remains free from COVID-19 and field teams safe. Overall, 3 field projects were successfully carried out in the Arctic and 9 in Antarctica. Logistics continued to be based on international cooperation and on a Portuguese-funded Antarctic flight open to partner programs. Logistical support in Antarctica was mainly provided by Spain, Chile, and the Republic of Korea, also with strong cooperation in research and facilities, with Brazil, Bulgaria, China, Czech Republic, United Kingdom and the United States of America. Participation in international meetings was maintained online, enabling PROPOLAR to share and stay updated on the latest developments regarding COVID-19 impacted polar logistics. The Portuguese Conference on Polar Science, supported by PROPOLAR, showcased innovative science and technological findings, and policy making, education and capacity building results, helping to enrich this unusual period.

PROPOLAR has found new strategies to cope with COVID-19 impacts and will endeavour to find balanced solutions for the upcoming Polar seasons, in close collaboration with partner programs. Despite the challenges, 2020 reflected the determination of PROPOLAR to continue supporting the very active and motivated community of Portuguese Polar researchers, to help bring polar science and its outcomes into the next generation.

Gonçalo Vieira, Teresa Cabrita and Ana David



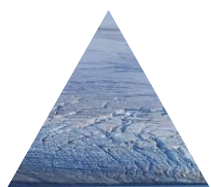
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LIST OF ABBREVIATIONS AND ACRONYMS

AED	Automated External Defibrillator
ALOMAR	Arctic Lidar Observatory for Middle Atmosphere Research
APA	Agência Portuguesa do Ambiente
APECS-Portugal	Association of Polar Early Career Scientists-Portugal
ARICE	Arctic Research Icebreaker Consortium
ASMA	Antarctic Specially Managed Areas
ASPA	Antarctic Specially Protected Areas
ATCM	Antarctic Treaty Consultative Meeting
BAI	Bulgarian Antarctic Institute
BLS	Basic Life Support
CAA-CHINARE	Chinese Arctic and Antarctic Administration
CCMAR	Centro de Ciências do Mar
CEG	Centro de Estudos Geográficos
CEN	Centre d'Études Nordiques
CIIMAR	Centro Interdisciplinar de Investigação Marinha e Ambiental
CMDL	Centro de Medicina Desportiva de Lisboa
COMNAP	Council of Managers of National Antarctic Program
CPE	Comité Polar Espanhol
CPR	Cardiopulmonary Resuscitation
CQE	Centro de Química Estrutural
EPB	European Polar Board
ESA	European Space Agency
FARO	Forum of Arctic Research Operators
FCT	Fundação para a Ciência e a Tecnologia
IAA	Instituto Antártico Argentino
IACS	International Association for Cryospheric Sciences
IASC	International Arctic Science Committee
IGOT	Instituto de Geografia e Ordenamento do Território
INACH	Instituto Antártico Chileno
INRS	L'Institut National de la Recherche Scientifique
IPA	International Permafrost Association
IPDJ	Instituto Português do Desporto e Juventude
IPY	International Polar Year
IST	Instituto Superior Técnico
KOPRI	Korean Polar Research Institute
LoU	Letter of Understanding
MARE	Centro de Ciências do Mar e do Ambiente
MoU	Memorandum of Understanding
NGO	Non-governmental organization
NSF	National Science Foundation
PEI	Polar Educators International
PoReC	ITU Polar Research Center
PROANTAR	Programa Antártico Brasileiro
PROPOLAR	Portuguese Polar Program
RSPB	Royal Society for the Protection of Birds
SCAR	Scientific Committee for Antarctic Research
T-MOSAIC	Terrestrial Multidisciplinary distributed Observatories for the Study of Arctic Connections
U.PORTO	University of Oporto
UAI	Uruguayan Antarctic Institute
UALG	University of Algarve
UBI	University of Beira Interior
UC	University of Coimbra
ULISBOA	University of Lisbon
WWF	World Wildlife Fund





PROPOLAR

THE PORTUGUESE POLAR PROGRAM - PROPOLAR

AN INTRODUCTION

The Portuguese Polar Program - PROPOLAR is funded by the Fundação para a Ciência e a Tecnologia (FCT), based at Instituto de Geografia e Ordenamento do Território (IGOT) of the University of Lisbon (Portugal). The coordination of PROPOLAR is led by the Centro de Estudos Geográficos from Instituto de Geografia e Ordenamento do Território - University of Lisbon (CEG/IGOT-ULISBOA), under a Coordinating Committee that includes members from 4 other research centres, namely the Centro de Ciências do Mar - University of Algarve (CCMAR-UALG), the Centro de Ciências do Mar e do Ambiente - University of Coimbra (MARE-UC), the Centro de Química Estrutural from Instituto Superior Técnico - University of Lisboa (CQE/IST-ULISBOA), and the Centro Interdisciplinar de Investigação Marinha e Ambiental, - University of Oporto (CIIMAR-U.PORTO). Gonçalo Vieira (CEG/IGOT-ULISBOA) is the Head of the program.

The remarkable effort and commitment of the Portuguese Polar scientists, within the framework of the International Polar Year (IPY) 2007-08, were key to promote awareness of the importance of Polar science and research for Portugal. A strategic plan encompassing three main objectives was then set out to: (i) creating a Portuguese Polar Program focused on polar research and innovation and supporting the young generation of Polar scientists, (ii) signing the Antarctic Treaty, and (iii) implementing a national Polar education and outreach program.

With the support of the FCT, PROPOLAR started in 2007.

Portugal ratified the Antarctic Treaty in 2010, and the Madrid Protocol in 2014, and has established liaisons with major international Polar scientific and management organisations and networks. PROPOLAR in close connection with the FCT, has ensured consolidation and sustainability of the development of Portuguese Polar science.

THE PORTUGUESE POLAR PROGRAM - PROPOLAR

MISSION AND OBJECTIVES

The mission of PROPOLAR is to promote and support the development of Portuguese Polar science, by providing access of scientists to the Arctic and the Antarctic, and encouraging multidisciplinary research to enhance knowledge on the Polar regions, and their role on the global system and on how it reacts to ever-increasing human pressures.

PROPOLAR aims at:

- supporting the Portuguese scientific community, by promoting multidisciplinary scientific collaboration and dissemination of scientific knowledge, to develop strategies for the development of Portuguese Polar science towards integration into national and international policies
- providing access to Portuguese scientists to the Polar regions by managing the necessary means to ensure their activities, in coordination with partner Polar programs
- enhancing scientific and logistical cooperation with other countries engaged in Polar research
- supporting young polar scientists by stimulating career development and internationalisation
- increasing awareness within the Portuguese society on the relevance of Polar regions, ecosystems and societies, and the importance of the national and international Polar science, through education and outreach activities
- encouraging the engagement of national stakeholders with a view to supporting innovation and technological development in Polar science
- collaborating with the Portuguese Government to ensure the implementation of standards for research in the Antarctic, under the Antarctic Treaty and the Protocol on Environmental Protection to the Antarctic Treaty
- collaborating with the Portuguese Foundation for Science and Technology (FCT) to implement scientific policy and strategies for Portugal on the Polar sciences

THE PORTUGUESE POLAR PROGRAM - PROPOLAR

COORDINATION COMMITTEE AND EXECUTIVE TEAM

HEAD OF COORDINATING COMMITTEE

Gonçalo Vieira Centro de Estudos Geográficos do Instituto de Geografia e Ordenamento do Território da Universidade de Lisboa (CEG/IGOT-ULISBOA)

COORDINATING COMMITTEE

Adelino Canário Centro de Ciências do Mar da Universidade do Algarve (CCMAR-UALG)

Catarina Magalhães Centro Interdisciplinar de Investigação Marinha e Ambiental da Universidade do Porto (CIIMAR-U.PORTO)

João Canário Centro de Química Estrutural do Instituto Superior Técnico da Universidade de Lisboa (CQE/IST-ULISBOA)

José Xavier Centro de Ciências do Mar e do Ambiente da Universidade de Coimbra (MARE-UC)

EXECUTIVE TEAM

Teresa Cabrita CEG/IGOT-ULISBOA, Executive Director

Ana David CEG/IGOT-ULISBOA, Secretariat, Logistics and Communications Manager



ADELINO CANÁRIO



CATARINA MAGALHÃES



GONÇALO VIEIRA



JOÃO CANÁRIO



JOSÉ XAVIER



TERESA CABRITA



ANA DAVID

THE PORTUGUESE POLAR PROGRAM - PROPOLAR

HOST INSTITUTION

INSTITUTO DE GEOGRAFIA E ORDENAMENTO DO TERRITÓRIO - IGOT INSTITUTE OF GEOGRAPHY AND SPATIAL PLANNING

The Instituto de Geografia e Ordenamento do Território da Universidade de Lisboa (IGOT) is the School of Geography and Spatial Planning of the University of Lisbon. IGOT's mission is to ensure university education, research, dissemination of knowledge and provide technical and specialized scientific studies in the fields of geography, spatial planning and territorial organization, policy development and territorial cohesion, urban planning, environment, resources and risks, and on the socio-spatial dynamics.

IGOT comprises the Centre for Geographical Studies (CEG), the most prestigious national research centre in geography, established in 1943. With a team of 190 researchers, of which, 87 PhD graduates, CEG is a leading institution in the field conducting research at national and international level on cutting-edge subjects of contemporary Human and Physical Geography and Planning.

IGOT coordinates the Portuguese Polar Program with staff providing logistical coordination.

IGOT is located in a separate building at the University of Lisbon campus at Cidade Universitária. It has 1 auditorium, 1 conference room, 6 lecture rooms, 3 GIS rooms, 1 remote sensing laboratory, 1 field support laboratory, 1 library, 1 photo archive, a small meeting room, as well as several offices for its research and support staff. The CEG at IGOT maintains the Laboratory of Geographical Analysis and Modelling (GEOMODLAB) an infrastructure that provides computational and software support to remote sensing and spatial modelling. The GEOMODLAB has several workstations, computers, plotters and large scanners, as well as field equipment.

IGOT is responsible for coordinating the Portuguese Polar Program (PROPOLAR), an interdisciplinary program that promotes Polar science and coordinates the logistics of the Portuguese research teams in the Arctic and Antarctica. Every year, PROPOLAR supports 16-20 research projects in the Arctic and Antarctica. CEG is the leading Portuguese institution on Polar Earth and Cryosphere sciences.



THE PORTUGUESE POLAR PROGRAM - PROPOLAR

THE POLAR PROGRAM - FOUNDATION FOR SCIENCE AND TECHNOLOGY (FCT)

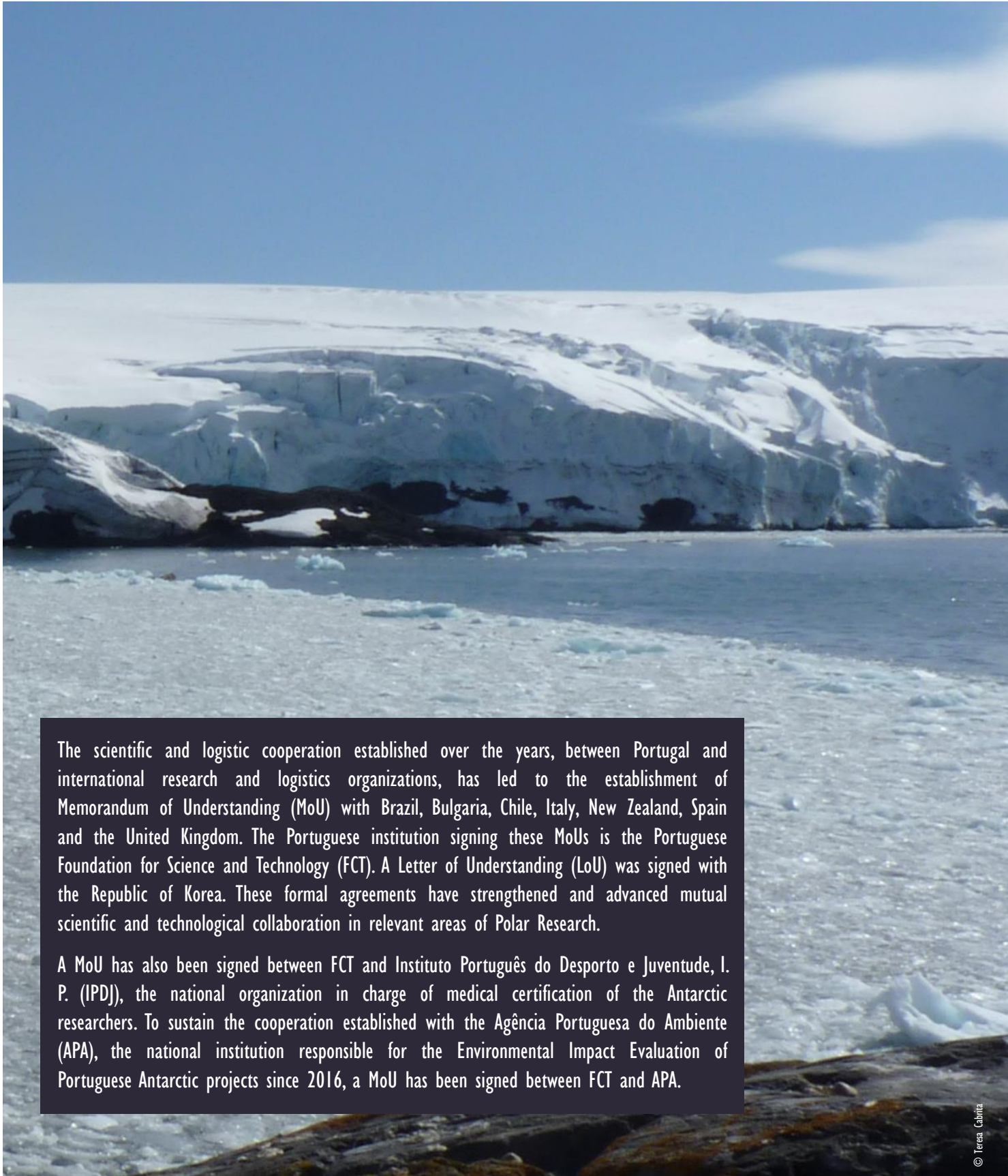


The Polar Program of the FCT (former Polar Office, created on December 2011), provides institutional support and monitoring of national research in the Polar regions. The objectives of the Polar Program of the FCT are to: (i) organize dissemination and communication actions on Portuguese Polar research in Antarctica and in the Arctic; (ii) propose and coordinate logistics supporting Portuguese Polar research needs; (iii) establish practices to be followed by researchers from national institutions, in order to meet the standards for research in Antarctica under the signature of the Antarctic Treaty and the Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol); (iv) propose actions to strengthen international collaboration and protocols in the field of the Polar sciences; (v) serve as liaison between the FCT and the national Polar scientific community; (vi) ensure the connection between the Ministry of Science, Technology and Higher Education and the Ministry of Foreign Affairs to promote Polar science and the correct integration of national scientists within international protocols; (vii) ensure the representation of the Portuguese research community in the major international organizations for Polar science and logistics, such as the European Polar Board (EPB), the Scientific Committee on Antarctic Research (SCAR), the International Arctic Science Committee (IASC), the Forum of Arctic Research Operators (FARO), and the Council of Managers of National Antarctic Program (COMNAP); (viii) support the Directive Board of FCT on matters of Polar science; (ix) organize a national polar database, and make it available to the Antarctic Master Directory, as suggested by SCAR and COMNAP Advisory System under the Antarctic Treaty; and (x) propose and foster partnerships between research institutions and industry in order to promote technological transference and the economical impact of knowledge.

Germana Santos is the coordinator of the Polar Program at the FCT with the support of two science advisors, Gonçalo Vieira (University of Lisbon) and José Xavier (University of Coimbra), in permanent connection with FCT to support Polar research initiatives.

THE PORTUGUESE POLAR PROGRAM - PROPOLAR

MEMORANDA OF UNDERSTANDING (MoU)



The scientific and logistic cooperation established over the years, between Portugal and international research and logistics organizations, has led to the establishment of Memorandum of Understanding (MoU) with Brazil, Bulgaria, Chile, Italy, New Zealand, Spain and the United Kingdom. The Portuguese institution signing these MoUs is the Portuguese Foundation for Science and Technology (FCT). A Letter of Understanding (LoU) was signed with the Republic of Korea. These formal agreements have strengthened and advanced mutual scientific and technological collaboration in relevant areas of Polar Research.

A MoU has also been signed between FCT and Instituto Português do Desporto e Juventude, I. P. (IPDJ), the national organization in charge of medical certification of the Antarctic researchers. To sustain the cooperation established with the Agência Portuguesa do Ambiente (APA), the national institution responsible for the Environmental Impact Evaluation of Portuguese Antarctic projects since 2016, a MoU has been signed between FCT and APA.

THE PORTUGUESE POLAR PROGRAM - PROPOLAR

REPRESENTATION IN INTERNATIONAL ORGANIZATIONS

Antarctic Treaty Consultative Meeting (ATCM)

José Xavier (jxavier@zoo.uc.pt)

Council of Managers of National Antarctic Program (COMNAP)

Teresa Cabrita (tcabrita@campus.ul.pt)

European Polar Board (EPB)

Gonçalo Vieira (vieira@campus.ul.pt)

Forum of Arctic Research Operators (FARO)

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International Association for Cryospheric Sciences (IACS)

Gonçalo Vieira (vieira@campus.ul.pt)

International Permafrost Association (IPA)

Gonçalo Vieira (vieira@campus.ul.pt) as Vice-President

Scientific Committee for Antarctic Research (SCAR)

Adelino Canário (acanario@ualg.pt)

Standing Committee on Geosciences of the Scientific Committee for Antarctic Research (SCAR)

Gonçalo Vieira (vieira@campus.ul.pt)

Standing Committee on Life Sciences of the Scientific Committee for Antarctic Research (SCAR)

José Xavier (jxavier@zoo.uc.pt)

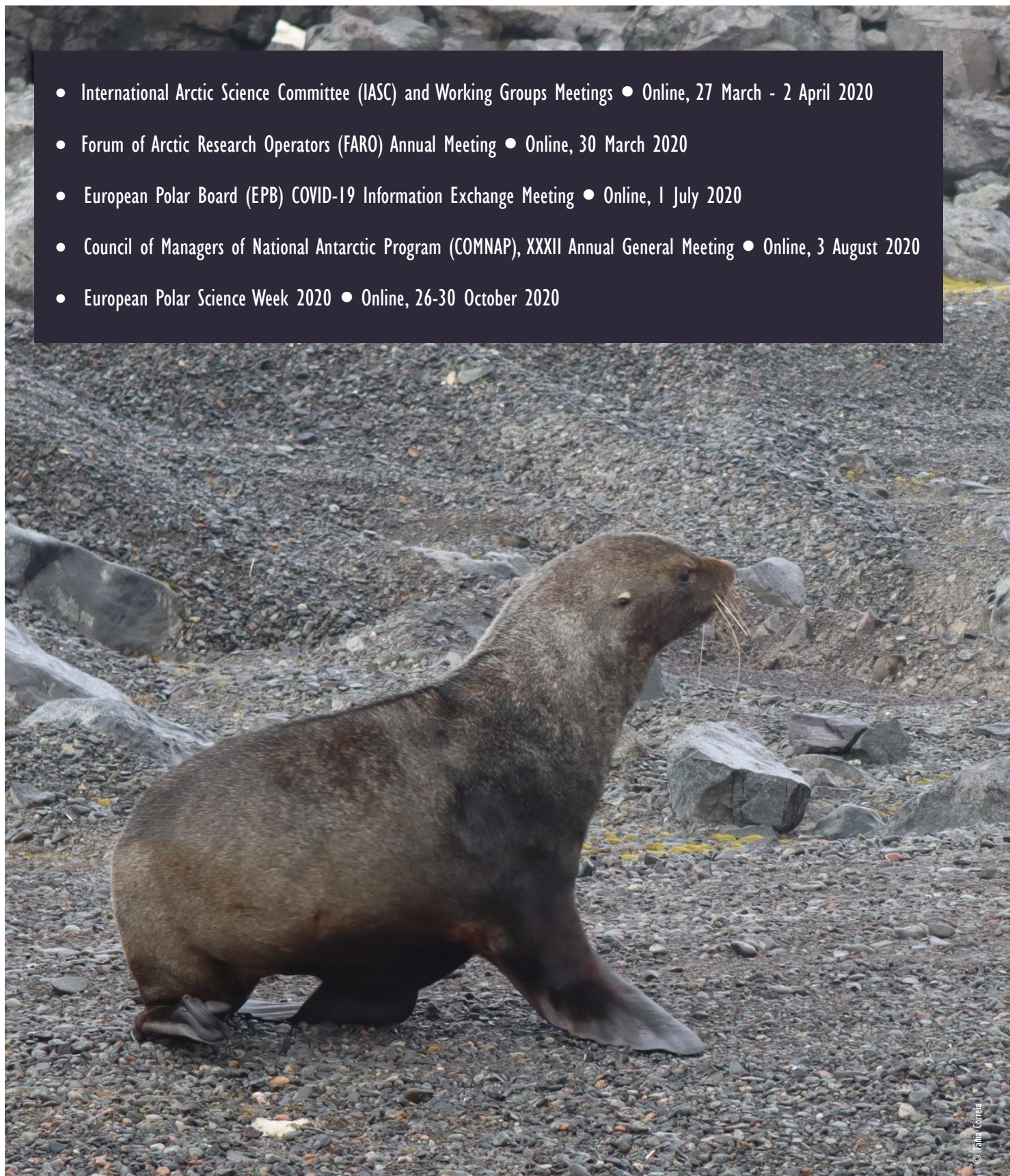
Capacity Building, Education and Training Advisory Group of the Scientific Committee for Antarctic Research (SCAR)

José Xavier (jxavier@zoo.uc.pt)

THE PORTUGUESE POLAR PROGRAM - PROPOLAR

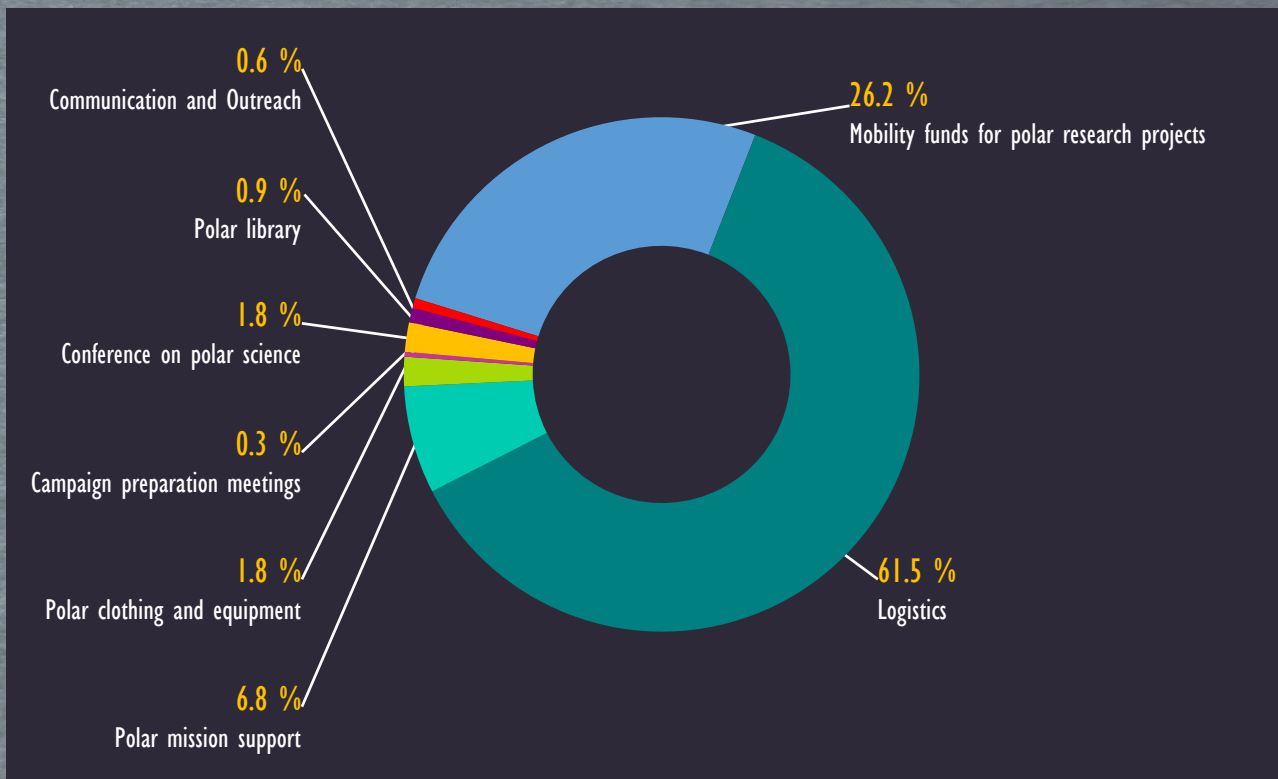
PROPOLAR IN INTERNATIONAL MEETINGS IN 2020

- International Arctic Science Committee (IASC) and Working Groups Meetings • Online, 27 March - 2 April 2020
- Forum of Arctic Research Operators (FARO) Annual Meeting • Online, 30 March 2020
- European Polar Board (EPB) COVID-19 Information Exchange Meeting • Online, 1 July 2020
- Council of Managers of National Antarctic Program (COMNAP), XXXII Annual General Meeting • Online, 3 August 2020
- European Polar Science Week 2020 • Online, 26-30 October 2020



THE PORTUGUESE POLAR PROGRAM - PROPOLAR

BUDGET ALLOCATION



Overheads correspond to 25 % of the eligible costs.



THE PROJECTS

SCIENTIFIC PROJECTS 2019-20

THE PROPOLAR CALLS

The scientific projects funded and supported by PROPOLAR are selected within the framework of annual calls. The Coordinating Committee of the PROPOLAR and the Portuguese Foundation for Science and Technology (FCT) jointly cooperate to announce the Call for Polar Research Projects in all scientific areas. The main objective of these calls is to stimulate innovative and excellent polar research proposals that contribute to advancing scientific and technological knowledge and demonstrate potential impact on the national and international science system or on the development of new technologies.

The calls aim at supporting three types of projects: (i) projects in the Arctic, (ii) projects in the Antarctic, and (iii) projects to be developed in foreign institutions for sample analysis that demonstrably cannot be carried out in Portugal. Eligible applicants are research teams from RD&I institutes/centres from higher education institutions, Associate Laboratories, and state or private laboratories, as long as the projects are coordinated by a PhD researcher.



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SCIENTIFIC PROJECTS 2019-20

THE CALL 2019-20



Within the 2019-20 Call, funding covered transportation for access to the Arctic or Antarctica, and accommodation during the journey and on research stations and vessels. Financial support was given to a maximum of two team researchers, one of whom had to be a young researcher. Participation of young researchers in conferences for presentation of oral or poster communications was also funded.

SCIENTIFIC PROJECTS 2019-20

THE CALL 2019-20



For the polar campaign 2019-20, the call was launched on the 9th of July 2019. Information to support the preparation of the scientific proposals was provided. Twenty two applications were received, 15 to be developed in the Antarctic, 5 in the Arctic, 1 to be developed in foreign institutions and 1 project, already funded by FCT within the scope of its call for scientific research and technological development (SR&TD) project grants, only asking for logistic support for missions in Antarctica. The Portuguese team from project Nunataryuk (funded by Horizon 2020 Programme) asked for field equipment support. Evaluation of the proposals followed logistical and scientific procedures. The logistical evaluation was carried out by the PROPOLAR to ensure that the proposals fell within the scope of the existing logistic possibilities of the program. The scientific evaluation was entrusted to groups of 3 independent experts per proposal, both national and international, who graded the scientific and technical value of the proposals, as well as the researchers' curricula. Twenty proposals received scientific approval, and 11 projects with highest marks were funded. Four scientifically approved Antarctic projects were carried out with self funding. Four projects could not pursue their missions: three Arctic projects due to the COVID-19 pandemic, and 2 Antarctic projects due to logistic issues. Overall, 3 projects were carried out in the Arctic and 9 in the Antarctic.

PROJECT FEATURES

-  Principal investigator
-  Team in the field
-  Project type
-  Funding institution
-  Protected area visited
-  Location



PROJECTS in the ARCTIC

MIGRANT

EFFECTS OF DIET ON LONG DISTANCE MIGRANTS: HOW TO FUEL INCREDIBLE JOURNEYS ON A RAPIDLY CHANGING WORLD?



Pedro Miguel Araújo, Centro de Investigação em Biodiversidade e Recursos Genéticos (CIBIO-InBIO), University of Porto, Portugal



Pedro Miguel Araújo (CIBIO-InBIO), José Alves (CESAM, Portugal), Tómas Gunnarsson (South Iceland Research Centre, Iceland)



Research project in the Arctic



PROPOLAR • South Iceland Research Centre



Iceland, South Iceland Research Centre, University of Iceland



Pedro Araújo



José Alves

Environmental changes can have detrimental consequences for migratory birds when their diet and associated fat accumulation also changes due to habitat alterations. The lipid composition of birds' tissues, which is its primary fuel is mainly influenced by diet, which can be analysed through its fatty acid (FA) profile. The amount and quality of fat stored can then be used to predict the distance a bird can cover. Our aim is to unravel levels of FA composition associated with different diets on the migratory performance of Black-tailed godwits (BTG) and Whimbrels (NP), two species migrating different distances from Iceland. Prior to departure these species use natural wetlands to fuel for migration, but are increasingly using hayfields which have expanded in south Iceland during the last decades as climate patterns have allowed agricultural expansion. We evaluated the role of ongoing habitat changes in the arctic on the migration avian patterns.



© Miguel Araújo

EFFECTS OF DIET ON LONG DISTANCE MIGRANTS: HOW TO FUEL INCREDIBLE JOURNEYS ON A RAPIDLY CHANGING WORLD?

Conversion of natural habitats for agricultural purposes is a primary driver of biodiversity loss. Natural wetlands in particular, have been greatly reduced or modified, to agricultural land, for example, for rice production which tripled since 1960s. Similarly, the recent climatic amelioration expanded agricultural land at high latitudes, namely in Iceland, the most important shorebird breeding area in West Europe. Migratory shorebirds have been termed “global connectors” as their migrations link arctic and sub-arctic habitats (breeding areas) with temperate and tropical (wintering) areas in both hemispheres. Land use changes may have detrimental consequences for migratory shorebirds as it requires species to change their evolved diets whilst accomplishing their migrations. Despite ongoing conservation efforts, many populations are declining, in some cases at alarming rates. As human pressure in the arctic will continue, conservation actions must be identified. Land conversion and associated resource changes means that shorebirds have either to (a) find alternative resources and adapt their physiology and metabolism in order to store fat reserves from different dietary sources, or (b) change their migration routes and schedules, likely undertaking shorter flights and longer stopovers to reach their destiny. We aimed to unravel levels of FA storage associated with different diets. This will allow understanding the capacity of migratory shorebirds in using novel resources to fuel migratory flights. We modelled flight range at the individual level based on fat content and composition on shorebirds that fly different distances non-stop from Iceland (e.g. Black-tailed godwits - *Limosa limosa*, 2000km; Whimbrels - *Numenius phaeopus*, 5500 km). We were able to understand the possible advantages of some migrants shifting their diet and how novel diets can constrain or potentiate energy acquisition to fuel long migratory flights.

This project aimed at (i) understanding the costs and benefits of species foraging on distinct food resources, (ii) determining the migratory capacity in migratory birds that feed on distinct food resources, and (iii) assessing if the ratio of omega-6:omega-3 PUFA in fat stores of birds can predict non-stop flight distances.



PERMARSENIC

ARSENIC SPECIATION AND BIOGEOCHEMISTRY IN PERMAFROST THAW LAKES



João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal



João Canário, Diogo Ferreira (CQE)



Research project in the Arctic



PROPOLAR • CQE • CEN



Kuujujarapik • Umiujaq, Northern Quebec, Canada



João Canário



Diogo Ferreira

Over the last decades, the thawing of ice-rich permafrost has prompted the formation of thermokarst lakes all over northern landscapes, mobilizing not only organic matter, but also a wide range of previously unavailable contaminants. Arsenic (As) displays varying toxicity, bioavailability, behaviour and environmental fate depending on the chemical species (oxidation state); it may also be present as an organic species (resulting from microbial methylation) as well as an inorganic species. As most current thermokarst lake studies have been solely aimed at total concentrations of trace metals, there is a clear general lack of research regarding As speciation and processes in these thermokarst systems, considering the wide range of variables that affects As speciation. The purpose of this work is to address this lack of knowledge regarding As speciation as well as shed some light into biogeochemical factors and specific microorganisms associated with these thermokarst lakes.



© Diogo Ferreira

Public interest in Arctic climate change usually focused upon sea ice retreat and the effects on biota. Yet, the changes observed on permafrost lands are equally pronounced. Several studies have been published about the large quantities of organic carbon stored in permafrost, but less attention has been given to contaminants that are stored in these environments. In a recent paper contaminant studies were identified as key issues to also understand the impact of permafrost degradation. Arsenic (As) is one of the most toxic elements for the environment. In contrast to other trace elements (e.g. Hg) inorganic As species are the most toxic, particularly As(III). Inorganic As species have mostly geogenic origin while the organic species (methyl, dimethyl, trimethyl As; MMAs, DMAs and TMAs) are a result of inorganic As microbial methylation reactions. Studies in permafrost thaw lakes pointed to relatively high concentrations of trace elements, however As studies in these systems are scarce and only focus in total concentrations. Arsenic speciation is, then, important to predict their toxicity and consequently the impact of these aquatic systems into the boreal environment. Arsenic speciation is strongly dependent of other environmental parameters such as pH, redox potential, iron speciation, organic matter composition and the microbial community. These variables, that change considerably among thaw lakes and depths, will likely have a significant role in As speciation, partitioning and fate, processes yet unknown for these freshwater systems. We aimed to address this gap of knowledge by (i) measuring As speciation in several permafrost thaw lakes; (ii) identifying the biogeochemical factors involved in As speciation and fate (e.g. pH); and (iii) identifying microorganisms that could play an important role in the above processes.

This research will provide critical new scientific information on the arsenic speciation, biogeochemistry and fate in permafrost thaw lakes. This information is critical to better understand the impact of permafrost degradation in the arctic (and sub-arctic) freshwater ecosystems. Thus, the objectives for PERMARSENIC are to (i) identify and quantify inorganic and organic As species in different permafrost thaw lakes and their changes with lake depth; (ii) investigate the environmental factors that may contribute to changes of the As species and their relation with their toxicity (speciation) and bioavailability (lability); (iii) identify the microorganisms involved in the As processes and their relative contribution to each one; and (iv) estimate the impact of As permafrost in the adjacent aquatic systems by the consequent changes in As species.



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TROPHIC CHANGE

CAN TROPHIC INTERACTIONS ALLEVIATE ENVIRONMENTAL CHANGE EFFECTS AT HIGH LATITUDES?



José Alves, Centro de Estudos do Ambiente e do Mar (CESAM), University of Aveiro, Portugal



José Alves, Camilo Carneiro (CESAM), Tómas Gunnarsson (South Iceland Research Centre, Iceland)



Research project in the Arctic



PROPOLAR • South Iceland Research Centre



Iceland, South Iceland Research Centre, University of Iceland



Climate has been changing at an unprecedented rate, with species responding in different ways, noticeably by adjusting the timing of annual events, as breeding. When the phenology of food resources advances at a higher pace than consumers, trophic mismatches can occur. This can have population level consequences and migratory birds that do not adjust their timing tend to be declining. While most Iceland breeding waders advanced the spring migration arrival concomitantly with the warming spring temperatures, Icelandic whimbrels show no phenological change over three decades, but the population size is stable. In the breeding areas, arthropods are an important prey and changes in spring temperature suggests this resource might have advanced its phenology. We hypothesised that another food resource — crowberries — is playing a key role in buffering the lack of arthropods, allowing whimbrel chicks to attain optimal growth rates and survive.



CAN TROPHIC INTERACTIONS ALLEVIATE ENVIRONMENTAL CHANGE EFFECTS AT HIGH LATITUDES?

The phenology of many species has been shifting, and this is mostly attributed to changing climatic conditions. In the cases when the rate of phenological change between consumer and resource have been asynchronous, trophic mismatches can occur and ultimately lead to population level consequences. Such mismatches may result in lower food abundance for chick development, but different food resources may respond differently to warming temperatures and chicks might be able to explore alternative prey resources. In order to understand how shifting trophic interactions can drive chick growth, their diet and variation of consumed food resources in terms of absolute abundance and temporal availability must first be established. Although there is descriptive information regarding wader chick feeding on arthropods in Iceland, as elsewhere in the Arctic and sub-Arctic, we gathered direct evidence that crowberries (*Empetrum nigrum*) might have become an important food, by noticing it was seldom absent from chicks' droppings. Crowberries are widely distributed across whimbrel' breeding range in Iceland, but the annual fruiting timing remains undescribed and long-term changes in phenology unknown. This lack of information is similar for arthropods. However, given the observed spring temperature advancement, it is very likely that arthropods have advanced their phenology, e.g. as reported in other arctic regions, but crowberry fruiting has extended its availability, being available earlier and for longer than in previous decades. Contrary to most Icelandic waders, whimbrels have stable spring migration arrival dates, while spring onset has been advancing locally. Interestingly, the population has been stable, suggesting that demographic parameters have not changed. We proposed that whimbrel chicks may have altered their diet towards crowberries, buffering an increasing asynchrony with arthropod prey, allowing normal chick growth rates and survival.

With this project we aimed to understand how alternative food resources may alleviate the phenological responses of migrants to environmental change at high latitudes. Specifically, we have (i) started to describe in detail the phenology and availability of crowberries and arthropods, and whimbrel breeding phenology in relation to that of its food resources; and (ii) investigated the influence of crowberries on whimbrel chick growth rates, controlling for the availability of other food resources and weather conditions.







PROJECTS
in the ANTARCTIC

ADAT

ADAPTATION DYNAMICS IN ANTARCTICA TEAMS



Pedro Marques Quinteiro, William James Center for Research, Instituto Universitário de Ciências Psicológicas, Sociais e da Vida (ISPA), Portugal



Pedro Marques Quinteiro (ISPA), Jan B. Schmutz (ETH Zurich, Northwestern University, Switzerland)



Research project in Antarctica



PROPOLAR • Portuguese Foundation for Science and Technology



King George Island, South Shetland Archipelago, Antarctica



Pedro Quinteiro



Jan B. Schmutz

ADAT aimed to consolidate and extend the research that has been unfolding since PROPOLAR's 2017-18 (ETeA II) campaign. This research sought to identify predictors of team adaptation during Antarctica Summer Campaigns (ASC). Our findings suggested that managing interpersonal relationships between scientists and logistics personnel is one of the main drivers of team adaptation during summer campaigns. We derived these findings from analysis of qualitative interview and observation data obtained almost exclusively from scientists. To further substantiate those findings, and ensure that our data included all stakeholders, this new project aimed to collect additional data from logistics personnel; to gather information on their perspectives regarding team adaptation in Antarctica; and initiate a quantitative study that allowed us to obtain detailed information about how team adaptation to unpredicted events happens during ASC.



© Jan B. Schmutz

Unpredictable events due to human, environment, and equipment factors challenge work effectiveness during ASC. Few studies explore how teams adapt to these events, particularly, when and how team members modify their behaviors to respond to triggers that threaten performance. Without knowledge of critical factors that enable or hinder adaptation, we cannot support the conditions that bolster adaptation. To resolve this limitation, our ongoing research has used principles of grounded theory methodology and rapid ethnography to collect and analyse qualitative data from individuals enrolled in the 2016-17 and 2017-18 PROPOLAR ASC. Our preliminary findings map the most relevant stressors (e.g., abrupt weather changes; equipment breakdown). Additionally, our findings show that team adaptation in Antarctica is driven by an interplay of factors before trigger events (e.g., managing relationships) and factors during trigger events (e.g., managing resources). Further, team adaptation requires collaboration between multiple teams that relies on the evolution of social interactions throughout the campaign. Our ongoing analysis suggests that how scientists manage relationships with both fellow team members and colleagues as well as with logistics personnel determines the likelihood of experiencing positive supportive behaviors that enable team adaptation to unexpected events. This finding aligns with prior research and team adaptation theory. Given difficult access to Antarctica teams, most studies, including our own, relied on qualitative data. To complement our qualitative data set and advance the knowledge about how effective teams function, we required quantitative empirical evidence to strengthen our argument. Therefore, ADAT built on our prior findings using a mix-methods approach combining qualitative and quantitative methods to consolidate our evolving theory of team adaptation during ASC.



Building on our previous findings, one fundamental research question drove ADAT: How do teams dynamically change their processes in order to anticipate or respond to a trigger (campaign stressors) for adaptation. To address this research question, ADAT pursued two goals, namely to: (i) gather new qualitative data that introduces new sources of information by including new external actors with their own points of view that complement our view on the adaptive processes (e.g., logistics personnel working at research stations and research ships), and (ii) fine grading the adaptive process with multilevel (different organizational and hierarchy levels) and intensive longitudinal measurements, studying trajectories and discontinuities in team processes during campaigns. Achieving these goals not only consolidated our ongoing research, but will also support scientists and policy makers' decision-making regarding human collaboration in Antarctica.



ANTERMON

ANTARCTIC ELECTRICAL RESISTIVITY MONITORING NETWORK



Mohammad Farzamian, Instituto Dom Luiz (IDL), University of Lisbon, Portugal



Mohammad Farzamian, Miguel Esteves (IDL), John Triantafyllis (University of New South Wales - UNSW, Australia)



Research project in Antarctica



PROPOLAR



Deception Island • Livingston Island, South Shetland Archipelago, Antarctica



Mohammad Farzamian



Miguel Esteves



John Triantafyllis

In spite of the air temperature increase in the Antarctic Peninsula (AP), the northwest of the AP has shown a cooling trend between 1999 and 2015 indicating that the climate signal is more complex than previously accounted. ANTERMON aimed to establish an observation network based on the soil electrical resistivity monitoring to improve the spatiotemporal understanding of the active layer and permafrost dynamics and water availability with minimal environmental disturbance. It allowed detecting high-temporal resolution changes on freezing and thawing in a larger spatial scale, providing new insight into the site-specific reactions of active layer and permafrost to climate change. In the scope of this project and in 2020, we installed a new Automated Electrical Resistivity Tomography (A-ERT) system and performed geophysical surveys in Livingston and Deception islands, as well as maintained and upgraded existing A-ERT and borehole temperatures at Deception Island.



© Mohammad Farzamian

The last overview of the thermal state in the Western Antarctic Peninsula (WAP) shows that permafrost is close to 0 °C in the region, suggesting that it is near its climatic boundary. In addition, the region is still far from well-understood and the impacts of climate change have not been well studied. This fact reinforces the importance of studying the evolution of permafrost and active layer in the region. So far, monitoring of the active layer and permafrost dynamics in Antarctica was conducted using only ID borehole and meteorological data, which restricted the analysis to point information that often lacks representativeness at the field scale. In addition, being an invasive technique, the drilling of boreholes disturbs the subsurface and is not feasible to conduct over large areas, especially in environmentally sensitive ecosystems such as the Antarctic. In this context, we installed an A-ERT system for the first time in Antarctica at Deception Island associated to the existing GTN-P and CALM site at Crater Lake and demonstrated how this method could be used to monitor subsurface freezing and thawing processes on a daily and seasonal basis with high-spatiotemporal resolution. We also investigated the impact of short-lived extreme meteorological events on active layer dynamics. ANTERMON aimed at extending the A-ERT monitoring systems and developing a network to provide non-invasive and high temporal observations in the WAP to better study climate change impacts on the active layer and permafrost dynamics in the monitoring site. In a broader application, this observational data, as well as borehole data, were also used by IDL team to evaluate simulations of soil temperature and active layer dynamics of the land-surface model HTESSEL to understand limitations of this model in representing permafrost active layer, which is fundamental for climate monitoring (reanalysis) and climate change projections.

ANTERMON was the continuation of the first successful attempt of the group at Deception Island and proposed a long-term strategy to monitor active layer and permafrost dynamics using a noninvasive and high-resolution geophysical method in WAP. ANTERMON aimed at answering how permafrost, the active layer, and water availability changed in a warming climate and what were the impacts of short-lived extreme meteorological events on the active layer and permafrost dynamics. The long-term observation of ANTERMON in Antarctica allowed a more detailed analysis of permafrost and active layer evolution, which could be also used to evaluate climate models simulation of permafrost conditions. In the season of 2019-20 ANTERMON: (i) installed a new A-ERT system in Livingston Island, (ii) upgraded and maintained existing A-ERT system at Deception Island, and (iii) performed geophysical surveys in Livingston and Deception Islands.



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CEPH 2019-20

CEPHALOPOD ECOLOGY OF THE SOUTHERN OCEAN



José Xavier, Marine Environmental Sciences Centre (MARE), University of Coimbra, Portugal



José Xavier, Ricardo Matias (MARE, University of Coimbra)



Research project in Antarctica



PROPOLAR • British Antarctic Survey (BAS), Cambridge, United Kingdom



Scotia Sea, Antarctica



José Xavier

Ricardo Matias

Pelagic invertebrates play a key role in the Antarctic marine ecosystem and might be affected by climate change. Squid are among the few Antarctic fisheries with potential to be exploited. However, our understanding of the role of Antarctic pelagic organisms needs to be urgently addressed. CEPH 2019-20 was a novel multi-disciplinary and international project aiming to understand the role of the squid in the Antarctic marine food web, supporting our long-term monitoring programme. A first time early career scientist in a research cruise and a senior scientist will participate in a research cruise of the British Antarctic Survey to characterize the invertebrate fauna in the Scotia Sea. We used scientific nets to obtain information about the distribution, abundance and collect samples to obtain genomics and transcriptomics information on squid. These data will be incorporated into the Southern Ocean programs/programs ICED, SCAR Ant-ERA and EGBAMM, and educational activities..



CEPH 2019-20 was a multi-disciplinary and international project proposal aiming to better understand the role of pelagic organisms within the Antarctic marine ecosystem, under a Letter of Understanding (LoU) with the British Antarctic Survey for long-term monitoring of Antarctic cephalopods. Squid are pelagic invertebrates with an important role in marine ecosystems. They are the link between phyto- and zooplankton and the higher trophic levels. The life cycle of squid is influenced by environmental factors, and consequently by climate change. However, genomic and transcriptomic data of Antarctic squid is literally absent whose information could serve as the basis to predict the plasticity of these animals to climate change. Moreover, knowledge on the pelagic region in the Antarctic ecosystem is surprisingly poor and needs to be urgently addressed. Within CEPH 2019-20, we participated in a research cruise of the British Antarctic Survey (BAS), where it was planned to capture Antarctic pelagic squid, among others (e.g. fish, crustaceans), using our previous applied methodologies by our experienced team (Collins et al. 2012). The project had various advantages, whose timing was ideal. Firstly, this was a new collaboration between Portugal and UK (under an LoU) focused in squid ecology, genomics and transcriptomics. Secondly, CEPH 2019-20 asked from PROPOLAR only travel support for two scientists to the Falkland Islands (UK), as BAS provided all the logistics necessary to collect the samples during the cruise. Thirdly, this work provided essential preliminary data for a future PhD proposal of the young scientist Ricardo Matias, following his excellent work (Matias et al. 2019, <https://doi.org/10.1016/j.marenvres.2019.104757>).

CEPH 2019-20 aimed to characterize the Antarctic squid fauna around the Scotia Sea before, across and after the Antarctic Polar Front, an ecological hotspot in the Atlantic sector of the Southern Ocean, obtaining a unique dataset to test two hypotheses. Firstly, we wanted to critically evaluate differences in diversity of squid across 3 regions of the Southern Ocean pelagic ecosystem. And secondly, we sought to describe the genomics and transcriptomics of Antarctic squid from these different regions. The data and information collected under CEPH 2019-20 was used to publish at least one paper on peer reviewed journal, and will be the base for one PhD project proposal.



FACT

LINKS BETWEEN PHYTOPLANKTON DYNAMICS AND CLIMATE FORCING IN NW ANTARCTICA



Ana Brito, Marine Environmental Sciences Centre (MARE), University of Coimbra, Portugal



Afonso Ferreira (MARE, University of Lisbon)



Research project in Antarctica



PROPOLAR • Programa Antártico Brasileiro (PROANTAR, Brazil)



Bransfield Strait, Gerlache Strait and Weddell Sea, Southern Ocean, Antarctica



Afonso Ferreira

The North Antarctic Peninsula and the South Orkney Islands are key-regions in terms of primary production and CO₂ sinking in the Southern Ocean. Assessing the biomass production and the response of distinct species/groups of phytoplankton to ongoing climate-driven ocean warming and ice melting in these regions is crucial to gain insights on how climate change will affect the entire marine trophic web and the biogeochemical cycles that they contribute to. FACT, greatly benefited from the larger multidisciplinary project EcoPelagos, provided a unique opportunity to understand these links, by investigating changes in phytoplankton communities potentially linked to ongoing ocean warming, including the biogeochemically important coccolithophores. Long-term biological data from *in situ* and remote sensing observations were combined to assess the seasonal and interannual variability of phytoplankton communities in these climatically-sensitive Antarctic regions.



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LINKS BETWEEN PHYTOPLANKTON DYNAMICS AND CLIMATE FORCING IN NW ANTARCTICA

The North Antarctic Peninsula (NAP) and the South Orkney Islands (SOI) are key-regions in terms of phytoplankton production and CO₂ sinking in the Southern Ocean (SO), while also highly sensitive to climate-driven ocean warming and ice melting. Increasing primary productivity due to intense nutrient trapping south of 60°S is projected for the future, driven by the poleward shift of the westerly winds, warming surface waters, and sea ice loss. However, increased surface stratification due to ice melting in the NAP appears to be locally favoring the development of cryptophytes (nanoflagellates) in detriment of diatoms. As diatoms are the main primary producers and responsible for ~40% of the organic carbon export in the SO, such changes in phytoplankton communities may negatively impact the pelagic trophic web and reduce the efficiency of the biological carbon pump. At the same time, while coccolithophores are not an abundant group off Antarctica, their poleward expansion from low-mid-latitude regions in the Atlantic has been reported, consistent with ocean-warming gyre expansion. As coccolithophores are responsible for most of the suspended oceanic CaCO₃, their expansion towards higher latitudes may increase the release of CO₂ via calcification, but also enhance the oceans' albedo and provide ballast to drive the biological pump. Yet, it is virtually unknown whether their abundance and biogeochemistry are being affected by climatic change in the NAP and SOI. FACT contributed to disclose the linkages of phytoplankton ecological dynamics to climatic forcing off NW Antarctica, while exploring the potential of coccolithophores as indicators of ongoing ocean warming. Multidisciplinary research in the region within the ongoing project "EcoPelagos" offered an excellent context for FACT. Our findings provided baseline information of modern ecological analogues for predicting productivity in an increasingly warmer ocean.

Understanding the response of phytoplankton to climate forcing in the SO is crucial to gain insights on how climate change will affect the marine trophic web and the biogeochemical cycles that they contribute to. FACT will contribute to expand this topic, by investigating the phytoplankton dynamics in the NAP and SOI on a multidisciplinary basis. The following research objectives were proposed: (i) assessing the seasonal and interannual variability of phytoplankton productivity, to gain insights on their response to long-term climate trends; (ii) disclosing the abundance and community structure of coccolithophores, to explore both their potential as proxies of, and their response to, ongoing ocean warming in the Atlantic sector of the SO; (iii) validating models to derive phytoplankton community size-structure and composition from satellite remote sensing in the NAP, to produce a consistent database on the regional distribution and long-term variability of phytoplankton communities.



LICHEN EARLY METER 2

DEVELOPMENT OF AN ECOLOGICAL INDICATORS TO MONITOR THE EFFECTS OF CLIMATE CHANGE IN POLAR REGIONS BASED ON LICHEN FUNCTIONAL TRAITS



Paula Matos, Centre for Ecology, Evolution and Environmental Changes (cE3c), University of Lisbon, Portugal



Paula Matos, Bernardo Rocha (cE3c)



Research project in Antarctica



PROPOLAR, Personal Funds



Livingston Island - South Shetland Archipelago, Antarctica



Lichens traits have been used as indicators of climate change with potential to be applied globally. In Antarctica, climate has been changing in a very dynamic way, impacting local ecosystems, and with feedbacks that have a global impact extension. In the Antarctic Peninsula and adjacent islands, lichens and bryophytes dominate the vegetation and showed high potential as indicators of this dynamic climate fluctuations. Our objective was to consolidate Lichen Yearly Meter I campaign, combining previous knowledge from team members to develop a trait-based lichen ecological indicator capable of anticipating sudden changes in Antarctica climate. For that, lichen trait diversity and ecosystem multifunctionality was sampled and modelled with spatial climate variation; patterns of change were upscaled for larger regions with high-resolution imagery and for future climate projections. The resulting ecological indicator anticipated sudden climatic changes and signal risk areas.



LICHEN EARLY METER 2

DEVELOPMENT OF AN ECOLOGICAL INDICATORS TO MONITOR THE EFFECTS OF CLIMATE CHANGE IN POLAR REGIONS BASED ON LICHEN FUNCTIONAL TRAITS

The Antarctic Peninsula has been experiencing fast and dynamic fluctuations in climate since the 1950s. These changes contributed, for instance, to changes in permafrost (permanently frozen ground) properties and dynamics and impacts on local ecosystems, expected to extend globally. Due to the local and global implications of climate change in Antarctica, it's crucial to develop new approaches capable of detecting early warning signals of change at the ecosystem level. In the Antarctic Peninsula and adjacent islands, lichens and bryophytes dominate the vegetation. Recent works suggest they can be excellent indicators of climate change in Antarctica, and a lichen trait-based ecological indicator was developed to track climate change effects at the global scale. Simultaneously, aerial high-resolution imagery of lichen species patterns was used to track snow cover in the region, showing the potential these methods can have to upscale to larger spatial areas. This proposal was the follow up of LICHEN EARLY METER project in 2018 and intended to continue the development of a trait-based lichen ecological indicator of climate change for Antarctica. We sampled lichen trait diversity and modelled it with spatial climate variation. Ecosystem multifunctionality, i.e. ecosystem capacity to perform multiple functions simultaneously, was also measured. Lichen trait patterns was calibrated with patterns obtained from aerial high-resolution imagery available from previous, current and forthcoming seasons and modelled using climate scenarios. We expected the ecological indicator to (i) anticipate sudden climatic changes in the future, (ii) show the type of relationship between the dominant vegetation biodiversity (lichens and bryophytes) with ecosystem multifunctionality; and (iii) signal risk areas (both more prone to ecosystems shifts and to loss of ecosystem multifunctionality).

Our goal was to continue to develop an ecological indicator of the effects of climate change in Antarctica, combining approaches from other world regions, previous knowledge from Antarctica, lichen trait patterns' relationship with climate, and integrating ecosystem multifunctionality. We used previous regional knowledge on lichens, high-resolution imagery from previous, current and future seasons in Livingston and Nelson Islands for upscaling and new lichen trait data. Work was divided in four specific objectives: (i) model lichen trait diversity along a spatial gradient of climate to identify trait patterns relationship with climate and key climate variables driving them, (ii) relate lichen trait climate relationship with ecosystem multifunctionality, (iii) calibrate trait patterns with high resolution imagery and identify them in other regional areas (upscale - space and time), and (iv) anticipate from (i) and (ii) sudden climatic changes and areas more susceptible to them in the future.



PERMANTAR 2019-20

PERMAFROST AND CLIMATE CHANGE IN WESTERN ANTARCTIC PENINSULA



Gonçalo Vieira, Centro de Estudos Geográficos (CEG), Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon,



Portugal
Gonçalo Vieira and Joana Baptista (CEG/IGOT)



Research project in Antarctica



PROPOLAR



Barton Peninsula, King George Island • Deception Island, South Shetland Archipelago, Antarctica



Gonçalo Vieira



Joana Baptista

The Antarctic Peninsula is one of the Earth's regions with strongest warming since the 1950's. However, the climate signal is complex. A slight cooling trend took place in the northwest Antarctic Peninsula from 1999 to 2014 and the warming trend seems to be in place again. To evaluate the consequences of climate change in the terrestrial environments dominated by the presence of permafrost, monitoring and modelling are essential. This project aims at increasing the understanding on the changes in the ice-free terrestrial environments of Western Antarctic Peninsula (WAP) and on their linkages to permafrost. Besides maintaining and upgrading the permafrost observatories of the Global Terrestrial Network for Permafrost across c. 450 km in the WAP, in 2019-20 ice-free areas of King George Island, but where up to now, knowledge on permafrost was almost completely lacking.



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Several studies have been taking place on periglacial processes and their relation to permafrost in the Western Antarctic Peninsula and the last overviews of the thermal state shows that permafrost is close to 0 °C in the region, and as far south as the Palmer archipelago, permafrost is absent near sea-level. Our previous work showed that despite no increase in MAAT in Deception Island, there was a thinning of the active layer associated with increased snow cover, a trend that is seemingly reversing. It is becoming clear that the ground is very sensitive to minor climate changes, showing impacts on the terrestrial ecosystems. The active layer depth is very variable interannually and largely dependent on snow cover, a key variable needing further research as we have shown from bioindicators using remote sensing. The last decade of research in the WAP shows that the region is far from well-understood and that impacts of climate change are more complex than expected. These facts add up to increase the interest in this ecologically sensitive region and support the continuation of our investigations, which are based on the long-term PERMANTAR observatories that we have been installing and maintaining since 2000 (<http://permantar.weebly.com>).

The 2019-20 field season took place in different areas of the WAP, with the main activities in Barton Peninsula, where G. Vieira and J. Baptista collected the 1st year of data from the King Sejong Station borehole and from the network of ground surface temperature data loggers. The first results show an average permafrost temperature at 13 m depth of -1.5 °C for 2019-20. The team also conducted observations on snow properties for validating Sentinel-1 SAR imagery and conducted a detailed geomorphological survey the area surrounding the King Sejong Station borehole. In the other PERMANTAR observatories, the data collection and maintenance was conducted by G. Goyanes (Livingston Isl), M.A. de Pablo and M. Esteves (Deception Isl.) and C. Matko (Cierva Cove). The NSF/USAP and the Palmer station staff are thanked for the maintenance and data collection at Amsler Island. The first results of the studies conducted in Barton Peninsula have been successfully presented in January 2021 by J. Baptista in her masters thesis, with two papers in preparation.

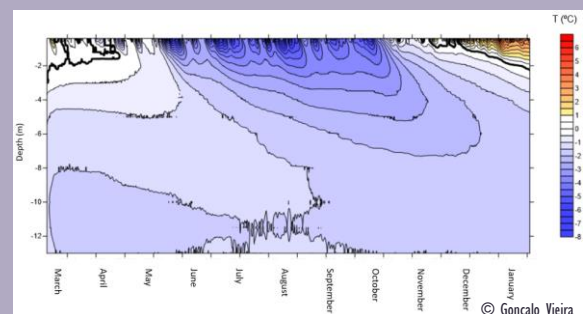


PERMANTAR is essential for the maintenance of the data-series from observatories contributing to the Global Terrestrial Network for Permafrost (IPA/WMO) in the Western Antarctic Peninsula. PERMANTAR targets mainly at the SCAR key science priority 42: How will permafrost, the active layer and water availability in Antarctic soils and marine sediments change in a warming climate, and what are the effects on ecosystems and biogeochemical cycles?

Some recent papers by the PERMANTAR team:

Ramos, M.; Vieira, G.; de Pablo, M.A.; Molina, A.; Jimenez, J.J. (2020). Transition from a Subaerial to a Subnival Permafrost Temperature Regime Following Increased Snow Cover (Livingston Island, Maritime Antarctic). *Atmosphere*, 11, 1332, doi: 10.3390/atmos11121332.

Obu, J., Westermann, S., Vieira, G., Abramov, A., Balks, M., Bartsch, A., Hrbacek, F., Kaab, A., & Ramos, M. (2020). Pan-Antarctic map of near-surface permafrost temperatures at 1 km² scale, *The Cryosphere*, 14 (2): 497-519. doi.org/10.5194/tc-14-497-2020.



POLAR LODGE 2019-20

PERFORMANCE EVALUATION OF A RESILIENT SHELTER FOR RESEARCH DEVELOPMENT IN THE ANTARCTIC



Manuel Guedes, Instituto Superior Técnico (IST), University of Lisbon, Portugal



Manuel Guedes, Susan Roaf (Heriot-Watt University, UK), João Pinelo (University of Bahrain, Kingdom of Bahrain)



Research project in Antarctica



PROPOLAR • Heriot-Watt University



King George Island, South Shetland Archipelago, Antarctica



Manuel Guedes



Gonçalo Roque Araújo



Susan Roaf

The 2018-19 Polar Lodge2 (PL2) field work centered around the design and building of a sustainable, low-impact, optimized, modular lodge, to facilitate scientific studies in the Antarctic. This was achieved in the 2019 project when the PROPOLAR team of three erected PL2, an innovative three skin, yurt like structure at Collins Bay. The progress of the erection and monitoring of the structure is shown in detail on the project blog (www.extremelodge.org/home/app/). Since then considerable analysis, reflection and new thinking were developed, on improving not only the Polar Lodge structure but also ways in which buildings are conceived and designed in a heating world. In addition, research at a range of bases along the Antarctic Peninsula will be aimed to assess environmental and comfort performance of the indoor environment, and review the temporary shelters of these other bases either for remote research sites or as on-base emergency shelters, e.g. in case of fire.



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The original rationale of the PL2 project was as follows: “A vast body of knowledge has been produced on the problem of global warming over the last few decades. There are numerous publications on low-energy, sustainable, building design strategies, resulting in an increasing awareness of the building sector that a change in paradigm is necessary”. Concerns have now centered on the definition of, and design for, resilience on our building stock during this last decade in the face of the ever more extreme weather events being experienced globally in recent years. What we found as three experienced climatic designers was that in the field we were often working beyond the limits of our knowledge, but also beyond the limits of our imagination. The results of have been not only six published conference papers to date but also a proposal for a new design process that is much more based on empirical development through laboratory, bench and field testing. This process is now being disseminated in a new book on “How to Design a Comfortable Building”, but also through the medium of an international student design competition being run by the PL2 team for the academic year 2019-20 to promote and explore new design thinking for buildings in extreme climates and teach student the PL2 design process that is heavily based on practical testing of ideas rather than relying solely on simulated solutions. This was an unforeseen and very useful output from season I of the PL2 project. In addition, so much headway has been made in developing more resilient extreme cold structures we hope to be able to explore the potential for this PROPOLAR project to benefit other teams at other stations along the Antarctic peninsula by understanding their extreme shelter needs and provision gaps in them to see if our learning may help others in the region build safe and durable temporary shelters in Antarctica.

The second season of the PL2 project aimed at: (i) assessing and reporting on the condition of the tent after 12 months in the field; (ii) implementing a series of tent and system upgrades to improve the guying, flooring heating and lighting of the tent; (iii) instigate a 2/3 week performance logging programme as monitoring equipment was upgraded and opportunities for annual monitoring were explored; (iv) visiting other bases in Antarctica to assess indoor environmental and comfort performance, and review their temporary shelter needs, provision gaps in their supply, and explore opportunities for the PROPOLAR PL2 project to benefit other teams in the area.



VEGETANTAR 2

MULTITEMPORAL VEGETATION MAPPING IN THE ANTARCTIC PENINSULA THROUGH MULTISCALE REMOTE SENSING, PART II



Pedro Pina, Centro de Recursos Naturais e Ambiente (CERENA), Instituto Superior Técnico, University of Lisbon, Portugal



Vasco Miranda and Gabriel Goyanes (CERENA, University of Lisbon)



Research project in Antarctica



PROPOLAR • CERENA



Barton Peninsula, King George Island, South Shetland Archipelago, Antarctica



Vasco Miranda



Gabriel Goyanes

The main objective of VEGETANTAR2 was to continue making the multitemporal mapping of the vegetation in the Antarctic Peninsula (AP) through remote sensing. VEGETANTAR2 reinforced the proposed methodology to adequately classify Landsat images through the integration of multiscale imagery of Sentinel2 (10m), WorldView or similar (1-2m) and UAV (0.5-5cm). After the successful campaign in 2019 in Barton Peninsula (King George Island), it was intended to capture the diversity of the vegetation in the Antarctica Peninsula as well as to accurately quantify its representativeness in several other terrestrial areas. The tasks developed in 2020 consisted mainly in surveys with a UAV (Unmanned Aerial Vehicle) using colour and multispectral cameras in other geographic areas, namely in Hurd and Byers Peninsulas (Livingston Island) and Cierva Cove in the Western Antarctica Peninsula.



© Gabriel Goyanes

This project is a follow-up of VEGETANTAR. The warming and absence of warming (and the exposure of the landscape in the AP due to ice retreat) is allowing ecosystems to experience an accelerated dynamics, namely through the variations in the active layer, the spreading of the vegetation or the modification of the water cycle, among others. The field monitoring of these ice-free surfaces is a difficult task for climatic and logistics reasons, but that can be advantageously performed through remote sensing imagery due to the repeatable and extended coverage of the surfaces with multispectral imaging. Nevertheless, current procedures are mainly validated with data from specific sites with oriented purposes, preventing robust and integrated extrapolations in space but also in time. In particular, the monitoring of the vegetation abundance and biodiversity, which is crucial for establishing plant growth rates together with associated meteorological and micro-climate data, could be much better performed if more than extreme scales of observation (field and satellite imagery) are used. In addition, the nature of the vegetation covers, mainly constituted by relatively small and sparse patches of lichens and mosses, leads to observations in satellite imagery where their degree of spectral mixing with other covers (soils, rocks, water, snow, ice) is being established with low levels of certitude. This is verified in approaches based, for instance, on vegetation indexes or object-based approaches that only perform well when the spectral mixing is low. This incertitude is obliging algorithms to be very conservative and, consequently, by incorrectly indicating many vegetated areas to be un-vegetated. To overcome this issue and consequently produce more reliable thematic maps, it is necessary to incorporate intermediate scales of observation in the procedure.

The main objective of VEGETANTAR2 was to continue advancing in the multitemporal mapping of the vegetation in the Antarctic Peninsula (AP) through remote sensing since the late 1970s, when the availability of satellite images became common. There were expected advancements at methodological level together with the enlargement of the datasets (in number but also in the diversity of the areas covered) with more recent imagery (UAV and satellite) of higher spatial resolution imagery from terrestrial regions in the AP. The previously identified 4 tactic objectives continue to be the same: (i) development and validation with current contemporary multiscale imagery (UAV-WV-Sentinel2-Landsat) and ground-truthing; (ii) extrapolation to historic Landsat datasets; (iii) detection and quantification of vegetation changes in space and time, and (iv) creation of an accurate baseline for future scenarios simulation.



WHY ANTARCTICA

WASTEWATERS FOR HYDROPONICS IN ANTARCTICA



Sandra Gonçalves da Saúde, Instituto Politécnico de Beja (IPBeja), Portugal



Tânia Correia and Luís Madeira (IPBeja)



Research project in Antarctica



PROPOLAR



King George Island - South Shetland Archipelago, Antarctica



Tânia Correia



Luís Madeira

The project aimed to implement on a station in Antarctica a system of plant cultivation in hydroponics using pretreated domestic wastewater as nutrient solution. This was the upgrade of a prototype already tested and validated, in the 2019 campaign, in which lettuce were cultivated. This campaign aimed to: (i) increase the size of the system to improve the statistical significance of results; (ii) test the treatment applied to the water in a station which, due to its size, will have residual waters with specific characteristics; (iii) increase the number of parameters monitored during the experiment; (iv) collect water and lettuce samples at the end of the campaign to assess the efficiency of the system and the quality of the plants. This campaign made an important contribution to ongoing research as it allowed for testing a larger system, perform functional tests under more favorable conditions, and obtain important information regarding lettuce growth.



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WHY ANTARCTICA

WASTEWATERS FOR HYDROPONICS IN ANTARCTICA

Wastewater treatment and disposal is recognized as a practical, human health and environmental concern for countries managing Antarctic research stations but of the 44 permanently manned stations, 37% do not have any kind of wastewater treatment. Also, Antarctic expeditioners are frequently faced with months of isolation, with no new supplies, and thus no fresh food arriving. With the implementation of the Antarctic Treaty and subsequently the Madrid Protocol, the growth of plants at Antarctic stations requires adherence to strict requirements aimed at preventing the introduction of non-native species, limiting waste production, as well as greater monitoring and reporting requirements, leaving hydroponic cultivation the only alternative for fresh food production. In addition to access to fresh products, it is known that the presence of plants within such remote environments can provide psychological benefit. The proposed project had two important positive consequences: (i) treating wastewaters decreases the environmental impact of the Antarctica Stations, and (ii) reusing the pre-treated domestic wastewaters to the hydroponic system decreases the necessity of using commercial nutrient solutions thus of importing chemicals. Both contribute to decrease the Human presence footprint in Antarctica. The proposed system has the potential to scale up, and be adapted by several stations, already using hydroponics vegetable growth. The project contributed to improve the overall design of the tested system (water treatment, and monitoring system), and was one step further in achieving a sustainable, and eco-friendly hydroponics vegetable growth solution for Antarctica.

The project implemented during the 2019 campaign was intended to assess the viability of chemical domestic wastewater treatment mixed by hand for hydroponic plant growth in Antarctica. The success of the project suggested several improvements. In this campaign our objectives were to expand the scope and breadth of our research, as well as verify the results obtained by: (i) increasing the size of the hydroponic system, allowing a minimum of 30 lettuce, and (ii) increasing the number of collected data (wastewater and environmental parameters); (iii) replicating and validating the chemical pretreatment applied as well as improving its efficiency at a different Antarctic station (larger and with a more varied wastewater load); (iv) upgrading the hydroponic monitoring system, adding new sensors for environmental and wastewater parameters (DO, CO₂, EC, NO₃); (v) increasing the number of collected samples of wastewater and plants (≥ 30) for further laboratory analysis after the end of the campaign.



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PREVIOUS PROJECTS
SUPPORTED BY PROPOLAR




PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2011-2012

COOPANTAR - DYNAMICS OF INTERNATIONAL COOPERATION IN ANTARCTICA

-  Carlos Manuel Mendes, Academia Militar, Lisboa, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

CONTANTARC - TRACE ELEMENT FATE, TRANSPORT AND SPECIATION IN ENVIRONMENTAL COMPARTMENTS IN DECEPTION ISLAND (ANTARCTICA)

-  João Canário, Instituto de Investigação das Pescas e do Mar (IPIMAR), Instituto Nacional de Recursos Biológicos (INRB), Lisboa, Portugal
-  Research project in Antarctica
-  Deception Island, South Shetland Archipelago, Antarctica

FISHWARM - ADAPTATIVE RESPONSES OF FISH TO ENVIRONMENTAL CHANGE

-  Adelino Canário, Centre of Marine Sciences (CCMAR), University of Algarve, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica



HOLOANTAR - LATE HOLOCENE EVOLUTION OF THE SOUTH SHETLANDS PERMAFROST ENVIRONMENT - MARITIME ANTARCTIC

-  Marc Oliva, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

PENGUIN - INTER-SPECIFIC DIETARY COMPETITION BETWEEN THREE PENGUIN SPECIES: DO THEY COMPETE FOR THE SAME PREY?

-  José Xavier, Instituto do Mar (IMAR), University of Coimbra, Portugal
-  Research project in Antarctica
-  Livingston Island, South Shetland Archipelago, Antarctica

PERMANTAR-2 - PERMAFROST AND CLIMATE CHANGE IN THE MARITIME ANTARCTIC




-  Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Deception Island • King George Island • Livingston Island (South Shetland Archipelago) • Cierva Point (Antarctic Peninsula), Antarctica

SNOWCHANGE - SNOWPATCH DYNAMICS AND THE CHANGING PERMAFROST ENVIRONMENT

-  Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

2012-2013

ANATOCU - ANTHROPOLOGY OF ANTARCTIC TOURISM CULTURE: PROPOSAL FOR A PRELIMINARY STUDY

-  David Picard, Centro em Rede de Investigação em Antropologia (CRIA), Faculdade de Ciências Sociais e Humanas (FCSH), NOVA University of Lisbon, Portugal
-  Research project in Antarctica
-  Ushuaia, Argentina




CEPH 2013 - CEPHALOPOD FAUNA OF THE SOUTHERN OCEAN

-  José Xavier, Instituto do Mar (IMAR), University of Coimbra, Portugal • British Antarctic Survey (UK)
-  Research project developed in foreign institutions
-  Wellington, New Zealand




PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2012-2013 (continuation)

CONTANTARC 2 - TRACE ELEMENTS SPECIATION, PARTITION AND TRANSPORT IN AQUATIC SYSTEMS OF KING GEORGE ISLAND (ANTARCTICA)

-  João Canário, Instituto Português do Mar e da Atmosfera (IPMA) Lisboa, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

FISHWARM - PHYSIOLOGICAL AND MOLECULAR PLASTICITY TO THERMAL AND OSMOREGULATORY CHALLENGE IN ANTARCTIC FISHES

-  Adelino Canário, Centre of Marine Sciences (CCMAR), University of Algarve, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

HISURF - VERY HIGH RESOLUTION IMAGING FOR DETAILED SURFACE MAPPING IN ICE-FREE AREAS OF MARITIME ANTARCTICA

-  Pedro Pina, Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica




HOLOANTAR - HOLOCENE ENVIRONMENTAL CHANGE IN THE MARITIME ANTARCTIC. INTERACTIONS BETWEEN PERMAFROST AND THE LACUSTRINE ENVIRONMENT

-  Marc Oliva, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Livingston Island, South Shetland Archipelago, Antarctica




MATAGRO - MONITORING OF ATMOSPHERIC TRACERS IN ANTARCTICA WITH GROUND-BASED OBSERVATIONS

-  Daniele Bortoli, Geophysics Centre of Évora (CGE), University of Évora, Portugal
-  Research project in Antarctica
-  Terra Nova Bay, Antarctica

NITROEXTREM - NITROGEN CYCLE IN EXTREME ANTARCTIC TERRESTRIAL ENVIRONMENTS: PROCESSES, COMMUNITIES AND ENVIRONMENTAL CONSTRAINTS


-  Catarina Magalhães, Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR), University of Oporto, Portugal
-  Research project in Antarctica
-  McMurdo Dry Valleys, Victoria Land, Antarctica

PERMACHANGE - PERMAFROST MONITORING AND MAPPING IN THE SOUTH SHETLANDS

-  Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Deception Island • Livingston Island (South Shetland Archipelago), Antarctica

2013-2014

ADAPT - ARCTIC DEVELOPMENT AND ADAPTATION TO PERMAFROST IN TRANSITION - PORTUGUESE BRANCH

-  João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in the Arctic
-  Kuujuarapik, Quebec, Canada



CEPH 2013 - CEPHALOPOD FAUNA OF THE SOUTHERN OCEAN

-  José Xavier, Instituto do Mar (IMAR), University of Coimbra, Portugal • British Antarctic Survey (UK)
-  Research project developed in foreign institutions
-  Wellington, New Zealand

PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2013-2014 (continuation)

CONTANTARC 3 - CONTAMINANT (BIO)AVAILABILITY IN SOILS AND SEDIMENTS OF FILDES BAY (KING GEORGE ISLAND, ANTÁRTIDA)

-  João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

HISURF 2 - VERY HIGH RESOLUTION IMAGING FOR DETAILED SURFACE MAPPING IN ICE-FREE AREAS OF MARITIME ANTARCTICA - PART 2

-  Pedro Pina, Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica




HOLOANTAR - HOLOCENE ENVIRONMENTAL CHANGE IN THE MARITIME ANTARCTIC. INTERACTIONS BETWEEN PERMAFROST AND THE LACUSTRINE ENVIRONMENT

-  Marc Oliva, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Livingston Island, South Shetland Archipelago, Antarctica




MATAGRO - MONITORING OF ATMOSPHERIC TRACERS IN ANTARCTICA WITH GROUND-BASED OBSERVATIONS

-  Daniele Bortoli, Geophysics Centre of Évora (CGE), University of Évora, Portugal
-  Research project in Antarctica
-  Terra Nova Bay, Antarctica

NITROEXTREM - NITROGEN CYCLE IN EXTREME ANTARCTIC TERRESTRIAL ENVIRONMENTS: PROCESSES, COMMUNITIES AND ENVIRONMENTAL CONSTRAINTS


-  Catarina Magalhães, Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR), University of Oporto, Portugal
-  Research project developed in foreign institutions
-  Waikato University, Hamilton, New Zealand

PERMANTAR-3 - PERMAFROST AND CLIMATE CHANGE IN THE ANTARCTIC PENINSULA

-  Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Deception Island • Livingston Island (South Shetland Archipelago), Antarctica

2014-2015

ADAPT 2 - ARCTIC DEVELOPMENT AND ADAPTATION TO PERMAFROST IN TRANSITION - PORTUGUESE BRANCH

-  João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in the Arctic
-  Kuujuarapik, Quebec, Canada

CEPH 2014 - CEPHALOPOD FAUNA OF THE SOUTHERN OCEAN

-  José Xavier, Instituto do Mar (IMAR), University of Coimbra, Portugal • British Antarctic Survey (UK)
-  Research project developed in foreign institutions
-  Alfred Wegener Institute (AWI), Bremen, and University of Hamburg, Germany

PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2014-2015 (continuation)




CONTANTARC 4 - (BIO)AVAILABILITY OF MERCURY AND METHYLMERCURY IN A NATURAL CONTAMINATED ECOSYSTEM (DECEPTION ISLAND, ANTARCTICA)

-  João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in Antarctica
-  Deception Island, South Shetland Archipelago, Antarctica

COSMOANTAR - HOLOCENE DEGLACIATION OF ICE-FREE AREAS IN THE SOUTH SHETLAND ISLANDS

-  Marc Oliva, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Livingston Island • King George Island (South Shetland Archipelago), Antarctica

EAIS-MARGINS - VULNERABILITY OF EAST ANTARCTIC ICE SHEET MARGINS

-  Caroline Lavoie, Centro de Estudos do Ambiente e do Mar (CESAM), University of Aveiro, Portugal
-  Research project in Antarctica
-  Eastern Antarctic continental shelf, Antarctica

GEOPERM - INTEGRATED GEOLOGICAL, GEOCHEMICAL AND PERMAFROST STUDIES IN FILDES PENINSULA, KING GEORGE ISLAND, ANTARCTICA

-  Pedro Ferreira, Laboratório Nacional de Energia e Geologia (LNEG), Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica




HISURF 3 - VERY HIGH RESOLUTION IMAGING FOR DETAILED SURFACE MAPPING IN ICE-FREE AREAS OF MARITIME ANTARCTICA - PART 3

-  Pedro Pina, Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica




MATAGRO - MONITORING OF ATMOSPHERIC TRACERS IN ANTARCTICA WITH GROUND-BASED OBSERVATIONS

-  Daniele Bortoli, Geophysics Centre of Évora (CGE), University of Évora, Portugal
-  Research project in Antarctica
-  Terra Nova Bay, Antarctica

NITROEXTREM 3 - NITROGEN CYCLE IN EXTREME ANTARCTIC TERRESTRIAL ENVIRONMENTS: PROCESSES, COMMUNITIES AND ENVIRONMENTAL CONSTRAINTS

-  Catarina Magalhães, Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR), University of Oporto, Portugal
-  Research project developed in foreign institutions
-  Waikato University, Hamilton, New Zealand




PERMANTAR-3 - PERMAFROST AND CLIMATE CHANGE IN THE ANTARCTIC PENINSULA

-  Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Deception Island • Livingston Island (South Shetland Archipelago) • Doumer Island (Palmer Archipelago), Antarctica

POLAR LODGE - A SUSTAINABLE MODULAR BUILDING FOR RESEARCH DEVELOPMENT IN THE ANTARCTIC

-  Manuel Guedes, Instituto Superior Técnico (IST), University of Lisbon, Portugal
-  Research project in Antarctica
-  South Shetland Archipelago • Palmer Archipelago • Antarctic Peninsula, Antarctica

SICANTAR - SIC IN ANTARCTICA WITH THE PORTUGUESE RESEARCHERS

-  Carla Castelo and Filipe Ferreira, SIC - Sociedade Independente de Comunicação (Portuguese television network and media company), Lisbon, Portugal
-  Television and media project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica




PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2015-2016

AMS - UNRAVELLING THE STRENGTH OF CARRY-OVER EFFECTS IN A ARTIC MIGRATORY SHOREBIRD

-  Pedro Miguel Mendes Araújo, Marine Environmental Sciences Centre (MARE), University of Coimbra, Portugal
-  Research project in the Arctic
-  Iceland, Reykjavik Iceland South Iceland Research Centre, Iceland University

ANTUAV - DETAILED SURFACE MAPPING OF THE ICE-FREE AREAS OF MARITIME ANTARCTICA USING UAVs

-  Lourenço Bandeira, Centro de Recursos Naturais e Ambiente (CERENA), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in Antarctica
-  Livingston Island, South Shetland Archipelago, Antarctica

FISHWARM III - PHYSIOLOGICAL AND MOLECULAR PLASTICITY TO THERMAL AND OSMOREGULATORY CHALLENGE IN ANTARCTIC FISHES

-  Adelino Canário, Centre of Marine Sciences (CCMAR), University of Algarve, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica




GEOPERM II - INTEGRATED GEOLOGICAL, GEOCHEMICAL AND PERMAFROST STUDIES IN FILDES AND BARTON PENINSULAS, KING GEORGE ISLAND, ANTARCTICA

-  Pedro Ferreira, Laboratório Nacional de Energia e Geologia (LNEG), Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

GEOWHIMBREL - EFFECTS OF LONG-DISTANCE MIGRATION ON INDIVIDUAL FITNESS

-  José Alves, Centro de Estudos do Ambiente e do Mar (CESAM), University of Aveiro, Portugal
-  Research project in the Arctic
-  Iceland, Reykjavik Iceland South Iceland Research Centre, Iceland University

LATA - LOADINGS AND TECTONICS OF ANTARCTICA

-  Rui Fernandes, Space & Earth Geodetic Analysis Laboratory (SEGAL), University of Beira Interior (UBI), Portugal
-  Research project in Antarctica
-  Cierva Point, Antarctic Peninsula, Antarctica

MERCANTAR - MERCURY METHYLATION AND DEMETHYLATION RATES IN DECEPTION ISLAND WATERS IMPACTED BY VOLCANIC-MERCURY

-  João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in Antarctica
-  Deception Island, South Shetland Archipelago, Antarctica



PELAGIC - CEPHALOPOD FAUNA OF THE SOUTHERN OCEAN

-  José Xavier, Instituto do Mar (IMAR), University of Coimbra, Portugal • British Antarctic Survey (UK)
-  Research project in Antarctica
-  South Orkney Islands, Southern Ocean

PERMACHEM-WINTER - BIOGEOCHEMISTRY OF CARBON, SULPHUR AND CONTAMINANTS IN THERMOKARST LAKES UNDER WINTER CONDITIONS

-  João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in the Arctic
-  Kuujjuarapik, Quebec, Canada

PERMANTAR 2015-16 - PERMAFROST AND CLIMATE CHANGE IN THE ANTARCTIC PENINSULA 2015-16

-  Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Deception Island • King George Island (South Shetland Archipelago) • Doumer Island (Palmer Archipelago), Antarctica

PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2015-2016 (continuation)

POLAR LODGE - A SUSTAINABLE MODULAR BUILDING FOR RESEARCH DEVELOPMENT IN THE ANTARCTIC

-  Manuel Guedes, Instituto Superior Técnico (IST), University of Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica




PHRUBI - INDIVIDUAL PARTICLE ANALYSIS OF ATMOSPHERIC AEROSOLS AT A REMOTE SITE, IN THE NORTH OF THE ARCTIC CIRCLE

-  Sandra Mogo, University of Beira Interior (UBI), Portugal
-  Research project in the Arctic
-  Norway, Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR), Andøya Space Center (ASC)

SHRUBIFLY - REMOTE SENSING ANALYSIS OF TERRAIN AND VEGETATION CHANGES IN THAW LAKE CATCHMENTS (WHAPMAGOOSTUI-KUJJUARAPIK)

-  Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in the Arctic
-  Whapmagoostui - Kuujuarapik, Hudson Bay, Quebec, Canada

ZOOPWARM - ZOOPLANKTON IN A WARMING ARCTIC OCEAN: INTEGRATING TRANSCRIPTIONAL AND PHYSIOLOGICAL RESPONSES TO THERMAL STRESS

-  Ana Ramos, Centre of Marine Sciences (CCMAR), University of Algarve, Portugal
-  Research project in the Arctic
-  Norwegian Sea (Norway), Arctic Ocean, Arctic

2016-2017

ANTIMUNE - EVOLUTION AND CONSTRAINTS OF IMMUNE RESPONSE IN NOTOTHENIROID FISHES

-  Adelino Canário, Centre of Marine Sciences (CCMAR), University of Algarve, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica




ARTICISED - DEVELOPMENT OF REMEDIATION STRATEGIES FOR OIL CONTAMINATED ARCTIC SOIL

-  Paula Guedes, Faculdade de Ciências e Tecnologia (FCT), NOVA University of Lisbon (UNL), Portugal
-  Research project developed in foreign institutions
-  University of Tromsø and Akvaplan-niva, Norway


CEPH 2017 - CEPHALOPOD COMPONENT OF DIET OF TOP PREDATORS IN THE SOUTHERN OCEAN

-  José Xavier, Instituto do Mar (IMAR), University of Coimbra, Portugal • British Antarctic Survey (UK)
-  Research project developed in foreign institutions
-  National Institute of Water and Atmospheric Research (NIWA), New Zealand

CIRCLAR - MAPPING AND MONITORING SORTED STONE CIRCLE FIELDS WITH ULTRA-HIGH RESOLUTION IMAGERY IN MARITIME ANTARCTICA

-  Pedro Pina, Centro de Recursos Naturais e Ambiente (CERENA), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

CRONOBYERS - HOLOCENE DEGLACIATION OF ICE-FREE AREAS IN LIVINGSTON ISLAND (SOUTH SHETLAND ISLANDS, ANTARCTICA)

-  Marc Oliva, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Livingston Island, South Shetland Archipelago, Antarctica

PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2016-2017 (continuation)

EXPAR - EXTREME PRECIPITATION EVENTS IN ANTARCTICA: INVESTIGATING THE ROLE OF ATMOSPHERIC RIVERS



Irina Gorodetskaya, Centro de Estudos do Ambiente e do Mar (CESAM), University of Aveiro, Portugal



Research project developed in foreign institutions



Institute for Snow and Avalanche Research (SLF), Davos, Switzerland

GEOPERM III - INTEGRATED GEOLOGICAL, GEOCHEMICAL AND PERMAFROST STUDIES IN FILDES AND BARTON PENINSULAS, KING GEORGE ISLAND, ANTARCTICA



Pedro Ferreira, Laboratório Nacional de Energia e Geologia (LNEG), Lisbon, Portugal



Research project in Antarctica



King George Island, South Shetland Archipelago, Antarctica

GEOWHIMBREL II - EFFECTS OF LONG-DISTANCE MIGRATION ON INDIVIDUAL FITNESS



José Alves, Centro de Estudos do Ambiente e do Mar (CESAM), University of Aveiro, Portugal



Research project in the Arctic



Iceland, Reykjavik Iceland South Iceland Research Centre, Iceland University • Ireland

Hg-PLANKTARCTIC - UNRAVELLING INTERACTIONS BETWEEN PHYTO- AND ZOOPLANKTON AND MERCURY CYCLING IN DECEPTION ISLAND WATERS IMPACTED BY VOLCANIC-MERCURY



Carla Gameiro, Centro de Ciências do Mar e do Ambiente (MARE), University of Lisbon, Portugal



Research project in Antarctica



Deception Island, South Shetland Archipelago, Antarctica

NITROEXTREM 2016-17 - NITROGEN CYCLE IN EXTREME ANTARCTIC TERRESTRIAL ENVIRONMENTS: A CASE STUDY OF CAPE ADARE PENGUIN COLONY



Catarina Magalhães, Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR), University of Oporto, Portugal



Research project developed in foreign institutions



Waikato University, Hamilton, New Zealand

NITROnice - BIOGEOCHEMISTRY OF NITROGEN IN THE ARCTIC OCEAN: PROCESSES AND COMMUNITIES



Catarina Magalhães, Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR), University of Oporto, Portugal



Research project in the Arctic



LongYearByen, Svalbard Archipelago, Norway

PERMACHEM II - BIOGEOCHEMISTRY OF CARBON, SULPHUR AND CONTAMINANTS IN THERMOKARST LAKES UNDER WINTER CONDITIONS



João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal



Research project in the Arctic



Umiujaq, Quebec, Canada

PERMANTAR 2016-17 - PERMAFROST AND CLIMATE CHANGE IN WESTERN ANTARCTIC PENINSULA



Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal



Research project in Antarctica



Livingston Island, South Shetland Archipelago • Amsler Island, Palmer Archipelago • Cierva Cove, Antarctic Peninsula, Antarctica

PERMATOMO - GEOELECTRICAL STUDY OF PERMAFROST EVOLUTION IN THE CALM AND PAPAGAL SITES NEAR THE BULGARIAN ANTARCTIC STATION (LIVINGSTON ISLAND) AND NEAR THE KOREAN ANTARCTIC STATION (KING GEORGE ISLAND) ANTARCTICA



António Correia, Instituto de Ciências da Terra (ICT), University of Évora, Portugal



Research project in Antarctica



King George Island • Livingston Island, South Shetland Archipelago, Antarctica

PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2016-2017 (continuation)

POLARUBI 2016-17 - INDIVIDUAL PARTICLE ANALYSIS OF ATMOSPHERIC AEROSOLS AT THE NORTH OF THE ARCTIC CIRCLE



Sandra Mogo, University of Beira Interior (UBI), Portugal



Research project in the Arctic



Norway, Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR), Andøya Space Center (ASC)

SHRUBFLY - REMOTE SENSING ANALYSIS OF TERRAIN AND VEGETATION CHANGES IN THAW LAKE CATCHMENTS (WHAPMAGOOSTUI-KUJJUARAPIK)



Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal



Research project in the Arctic



Whapmagoostui - Kuujuarapik, Hudson Bay, Quebec, Canada

2017-2018

AMS II - UNRAVELLING THE STRENGTH OF CARRY-OVER EFFECTS IN A ARCTIC MIGRATORY SHOREBIRD



Pedro Miguel Mendes Araújo, Marine Environmental Sciences Centre (MARE), University of Coimbra, Portugal



Research project in the Arctic



Iceland, Reykjavik Iceland South Iceland Research Centre, Iceland University

CEPH 2017 - CEPHALOPOD COMPONENT OF DIET OF TOP PREDATORS IN THE SOUTHERN OCEAN



José Xavier, Instituto do Mar (IMAR), University of Coimbra, Portugal • British Antarctic Survey (UK)



Research project developed in foreign institutions



National Institute of Water and Atmospheric Research (NIWA), New Zealand

CIRCLAR 2 - MAPPING AND MONITORING SORTED STONE CIRCLE FIELDS WITH ULTRA-HIGH RESOLUTION IMAGERY IN MARITIME ANTARCTICA, PART 2



Pedro Pina, Centro de Recursos Naturais e Ambiente (CERENA), Instituto Superior Técnico, University of Lisbon, Portugal



Research project in Antarctica



Barton Peninsula, King George Island, South Shetland Archipelago, Antarctica

ETeA II - ENSURING TEAMWORK EFFECTIVENESS ON ANTARCTICA II



Pedro Quinteiro, William James Center for Research (WJCR), Instituto Universitário (ISPA, Portugal)



Research project in Antarctica



King George Island • Ardley Island - South Shetland Archipelago, Antarctica

GEOWHIMBREL III - EFFECTS OF LONG-DISTANCE MIGRATION ON INDIVIDUAL FITNESS



José Alves, Centro de Estudos do Ambiente e do Mar (CESAM), University of Aveiro, Portugal



Research project in the Arctic



Iceland, Reykjavik Iceland South Iceland Research Centre, Iceland University • Ireland

HYDROTOMO - GEOELECTRICAL SURVEY TO STUDY PERMAFROST HYDROLOGY AND ITS POSSIBLE INFLUENCE IN ECOSYSTEM EVOLUTION IN SITES NEAR THE KOREAN ANTARCTIC STATION AND THE AQUIFER OF THE PERUVIAN ANTARCTIC STATION, KING GEORGE ISLAND, MARITIME ANTARCTICA



António Correia, Instituto de Ciências da Terra (ICT), University of Évora, Portugal



Research project in Antarctica



King George Island, South Shetland Archipelago, Antarctica

LATA 2017-18 - LOADING AND TECTONICS OF ANTARCTICA PENINSULA 2017-18



Rui Fernandes, Space & Earth Geodetic Analysis Laboratory (SEGAL), University of Beira Interior (UBI), Portugal



Research project in Antarctica






Cierva Point, Antarctic Peninsula, Antarctica




PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2017-2018 (continuation)

NITRO_{nice} II - BIOGEOCHEMISTRY OF NITROGEN IN THE ARCTIC OCEAN: PROCESSES AND COMMUNITIES

-  Catarina Magalhães, Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR), University of Oporto, Portugal
-  Research project in the Arctic
-  LongYearByen, Svalbard Archipelago, Arctic




PERMAMERC - MERCURY METHYLATION AND MMHg DEMETHYLATION IN PERMAFROST THAW LAKES

-  João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in the Arctic
-  Kuujjuarapik, Quebec, Canada




PERMANTAR 2017-18 - PERMAFROST AND CLIMATE CHANGE IN WESTERN ANTARCTIC PENINSULA

-  Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Livingston Island, South Shetland Archipelago • Cierva Point, Antarctic Peninsula, Antarctica

POLARUBI 2017-18 - ELEMENTAL AND INDIVIDUAL PARTICLE ANALYSIS OF ATMOSPHERIC AEROSOLS FROM THE ARCTIC CIRCLE




-  Sandra Mogo, University of Beira Interior (UBI), Portugal
-  Research project in the Arctic
-  Norway, Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR), Andøya Space Center (ASC)

ReACT - RISK ASSESSMENT IN FILDES PENINSULA: IMPROVING KNOWLEDGE TOWARDS ENVIRONMENTAL PROTECTION ACTIONS IN THE ANTARCTICA

-  Joana Pereira, Centro de Estudos do Ambiente e do Mar (CESAM), University of Aveiro, Portugal
-  Research project in Antarctica
-  Barton Ardley Island • King George Island • Nelson Island - South Shetland Archipelago, Antarctica

2018-2019




CEPH-BAS 2018-19 - UNRAVELLING THE STRENGTH OF CARRY-OVER EFFECTS IN A ARCTIC MIGRATORY SHOREBIRD

-  José Xavier, Marine Environmental Sciences Centre (MARE), University of Coimbra, Portugal
-  Research project developed in foreign institutions
-  British Antarctic Survey (BAS), Cambridge, United Kingdom




EESTEEM ANTARCTICA - CEPHALOPOD COMPONENT OF DIET OF TOP PREDATORS IN THE SOUTHERN OCEAN

-  Sandra Gonçalves da Saúde, Instituto Politécnico de Beja (IPBeja), Portugal
-  Research project in Antarctica
-  Livingston Island - South Shetland Archipelago, Antarctica

GEOWHIMBREL IV - EFFECTS OF LONG-DISTANCE MIGRATION ON INDIVIDUAL FITNESS

-  José Alves, Centro de Estudos do Ambiente e do Mar (CESAM), University of Aveiro, Portugal
-  Research project in the Arctic
-  Iceland, South Iceland Research Centre, Iceland University

HYDROPERMA - GEOELECTRICAL SURVEY TO STUDY PERMAFROST AND HYDROLOGY REGIME OF THE AQUIFER THAT PROVIDES WATER TO THE PERUVIAN ANTARCTIC STATION, KING GEORGE ISLAND, AND GEOELECTRICAL SURVEY TO STUDY PERMAFROST EVOLUTION IN THE BULGARIAN ANTARCTIC STATION, LIVINGSTON ISLAND, MARITIME ANTARCTICA

-  António Correia, Instituto de Ciências da Terra (ICT), University of Évora, Portugal
-  Research project in Antarctica
-  King George Island • Livingston Island, South Shetland Archipelago, Antarctica

PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2018-2019 (continuation)




LATA 2018-19 - LOADING AND TECTONICS OF ANTARCTICA PENINSULA - 2018-19

-  Machiel Bos, Space & Earth Geodetic Analysis Laboratory (SEGAL), University of Beira Interior (UBI), Portugal
-  Research project in Antarctica
-  Cierva Point, Antarctic Peninsula, Antarctica

LICHEN EARLY METER - DEVELOPMENT OF AN ECOLOGICAL INDICATORS TO MONITOR THE EFFECTS OF CLIMATE CHANGE IN POLAR REGIONS BASED ON LICHEN FUNCTIONAL TRAITS

-  Paula Matos, Centre for Ecology, Evolution and Environmental Changes (cE3c), University of Lisbon, Portugal
-  Research project in Antarctica
-  Livingston Island - South Shetland Archipelago, Antarctica

NITROPENGUIN - HOW DOES THE LOCATION OF PENGUIN COLONIES IN ANTARCTIC COASTAL ENVIRONMENTS DICTATE NITROGEN EXTENT OF DISPERSION IN TERRESTRIAL ENVIRONMENTS?

-  Ana Mafalda Baptista, Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR), University of Oporto, Portugal
-  Research project developed in foreign institutions
-  University of Waikato, New Zealand

NUNATARYUK - THE PORTUGUESE RESEARCH CONTRIBUTION - PERMAFROST THAW AND THE CHANGING ARCTIC COAST, SCIENCE FOR SOCIOECONOMIC ADAPTATION

-  José Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in the Arctic
-  Western Arctic, Canada

PERMAMERC - MERCURY METHYLATION AND MMHG DEMETHYLATION IN PERMAFROST THAW LAKES

-  João Canário, Centro de Química Estrutural (CQE), Instituto Superior Técnico, University of Lisbon, Portugal
-  Research project in the Arctic
-  Whapmagoostui-Kuujuuarapik, Northern Quebec, Canada

PERMANTAR 2018-19 - PERMAFROST AND CLIMATE CHANGE IN WESTERN ANTARCTIC PENINSULA

-  Gonçalo Vieira, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal
-  Research project in Antarctica
-  Barton Peninsula, King George Island • Deception Island, South Shetland Archipelago, Antarctica

PHYTO-NAP - PHYTOPLANKTON RESPONSE TO CLIMATE TRENDS IN THE NORTHERN ANTARCTIC PENINSULA

-  Vanda Brotas Gonçalves, Marine Environmental Sciences Centre (MARE), University of Coimbra, Portugal
-  Research project in Antarctica
-  Marine area off the Antarctic Peninsula (from the Bransfield and Gerlache Straits to the Weddell Sea), Antarctica

POLAR LODGE - POLAR LODGE: A SUSTAINABLE MODULAR BUILDING FOR RESEARCH DEVELOPMENT IN THE ANTARCTICA

-  Manuel Guedes, Instituto Superior Técnico (IST), University of Lisbon, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

REIMUNE - RENAL AND IMMUNE RESPONSES IN ANTARCTIC FISH

-  Adelino Canário, Centre of Marine Sciences (CCMAR), University of Algarve, Portugal
-  Research project in Antarctica
-  King George Island, South Shetland Archipelago, Antarctica

PREVIOUS PROJECTS SUPPORTED BY PROPOLAR

2018-2019 (continuation)

**THAWPOND - REMOTE SENSING ANALYSIS OF VEGETATION AND THAW POND COLOUR DYNAMICS AT THE TUNDRAFOREST ZONE: FROM LOCAL TO REGIONAL SCALE
(WHAPMAGOOSTUI - KUJUUARAPIK, HUDSON BAY, SUB-ARCTIC CANADA)**



Carla Mora, Centro de Estudos Geográficos, Instituto de Geografia e Ordenamento do Território (IGOT), University of Lisbon, Portugal



Research project in the Arctic



Whapmagoostui-Kujuarapik (Nunavik) • Umiujaq (Nunavut), sub-Arctic Quebec (Canada)

VEGETANTAR - MULTITEMPORAL VEGETATION MAPPING IN THE ANTARCTIC PENINSULA THROUGH MULTISCALE REMOTE SENSING



Pedro Pina, Centro de Recursos Naturais e Ambiente (CERENA), Instituto Superior Técnico, University of Lisbon, Portugal



Research project in Antarctica



Barton Peninsula, King George Island, South Shetland Archipelago, Antarctica



FUNDING FOR PARTICIPATION IN CONFERENCES

PROJECTS 2019-20

FUNDING FOR PARTICIPATION IN SCIENTIFIC CONFERENCES

The annual Call for Polar Research Projects 2019-20 provided funding for the young researcher in each project, to participate in scientific conferences outside Portugal. The young researcher had to be the first author of the oral or poster communication. However, due to the COVID-19 pandemic, participation in international conferences was cancelled.

PREVIOUS PROJECTS BENEFITING FROM FUNDING FOR PARTICIPATION IN SCIENTIFIC CONFERENCES

HYDROPERMA - GEOELECTRICAL SURVEY TO STUDY PERMAFROST AND HYDROLOGY REGIME OF THE AQUIFER THAT PROVIDES WATER TO THE PERUVIAN ANTARCTIC STATION, KING GEORGE ISLAND, AND GEOELECTRICAL SURVEY TO STUDY PERMAFROST EVOLUTION IN THE BULGARIAN ANTARCTIC STATION, LIVINGSTON ISLAND, MARITIME ANTARCTICA

Young researcher: Pedro Mendes • VII Conference of the Iberian Section of the International Permafrost Association 2019, Jaca, Spain

NITROPENGUIN - HOW DOES THE LOCATION OF PENGUIN COLONIES IN ANTARCTIC COASTAL ENVIRONMENTS DICTATE NITROGEN EXTENT OF DISPERSION IN TERRESTRIAL ENVIRONMENTS?

Young researcher: Adriana Rego • International Conference on Polar and Alpine Microbiology 2019, Waikato, Hamilton, New Zealand

PHYTO-NAP - PHYTOPLANKTON RESPONSE TO CLIMATE TRENDS IN THE NORTHERN ANTARCTIC PENINSULA

Young researcher: Afonso Ferreira • 54th European Marine Biology Symposium, Dublin, Ireland

VEGETANTAR - MULTITEMPORAL VEGETATION MAPPING IN THE ANTARCTIC PENINSULA THROUGH MULTISCALE REMOTE SENSING

Young researcher: Vasco Miranda • International Geoscience and Remote Sensing Symposium 2019 - IGARSS'2019, Yokohama, Japan

CEPH-BAS 2017 - LONG-TERM PELAGIC FAUNA ANALYSES OF THE SOUTHERN OCEAN

Young researcher: José Abreu • SCAR/IASC Open Science Conference 2018, Davos, Switzerland

GEOWHIMBREL III - EFFECTS OF LONG-DISTANCE MIGRATION ON INDIVIDUAL FITNESS

Young researcher: Camilo Carneiro • Internacional Wader Study Group 2018, Workum, The Netherlands

PREVIOUS PROJECTS BENEFITING FROM FUNDING FOR PARTICIPATION IN SCIENTIFIC CONFERENCES (continuation)

NITROnice II - BIOGEOCHEMISTRY OF NITROGEN IN THE ARCTIC OCEAN: PROCESSES AND COMMUNITIES

Young researcher: António Sousa • SCAR/IASC Open Science Conference 2018, Davos, Switzerland

PERMANTAR 2017-18 - PERMAFROST AND CLIMATE CHANGE IN WESTERN ANTARCTIC PENINSULA

Young researcher: Sara Ramos • 5th European Conference on Permafrost - EUCOP 2018, Chamonix-Mont Blanc, France

POLARUBI 2017-18 - ELEMENTAL AND INDIVIDUAL PARTICLE ANALYSIS OF ATMOSPHERIC AEROSOLS FROM THE ARCTIC REGION

Young researcher: Edgar Conceição • EGU General Assembly 2018, Vienna, Austria





CAMPAIGN PREPARATION

ENVIRONMENTAL CERTIFICATION OF ANTARCTIC PROJECTS

The Environmental Impact Assessment of Antarctic projects was carried out by the Portuguese Environment Agency (APA), in close collaboration with the PROPOLAR. The Environmental Impact Evaluation was performed in accordance with the requirements of the Protocol on Environmental Protection to the Antarctic Treaty. All projects developed within the PROPOLAR Antarctic campaign 2019-20, received environmental certification, with activities foreseen in the projects considered as having a minor or transitory impact.



MEDICAL CERTIFICATION OF ANTARCTIC RESEARCHERS

Medical certification was implemented through the agreement established with the Centro de Medicina Desportiva de Lisboa - Instituto Português do Desporto e Juventude (CMDL-IPDJ), in collaboration with the PROPOLAR. All researchers underwent medical exams and clinical evaluations. Medical certification is mandatory for the Portuguese Antarctic scientists and was carried out between November 2019 and January 2020.



POLAR RESEARCHERS' PREPARATION • THE PROPOLAR CAMPAIGN PREPARATION MEETINGS

Before starting their mission in the polar regions, researchers go through a training program, during the Polar Campaign Preparation Meetings, organized annually by PROPOLAR.

For the PROPOLAR campaign 2019-20, the meeting took place on the 5th of November 2019, gathering polar researchers with projects to be carried out in the Arctic and the Antarctic. Researchers received information on fundamental aspects of the Antarctic Treaty and of the Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol), since presence in this region has to respect the rules of these agreements to which Portugal has joined in 2010 and 2014, respectively.



Specific information and training on polar safety and survival both on land and sea, fire prevention and control, as well as guidelines for the use of communication devices, were provided in the scope of the meeting. Researchers became acquainted with protection, safety and rescue technical equipment. These topics were covered with the support of the Portuguese Navy as far as safety at sea was concerned, and of the National Republican Guard for land safety and VHF communications.

Because working in the Polar Regions is a unique experience that encompasses its own particular demands and challenges for those in the field, the PROPOLAR also covered other specific topics. For this meeting, Polar bear safety was given particular attention, to ensure that Arctic researchers are aware of procedures to keep them safe in case of an encounter with a bear. Hannah Mevenkamp (University of Alaska-Fairbanks, USA) was invited to talk about this topic, showing how people and bears can safely and respectfully coexist.

POLAR RESEARCHERS' PREPARATION • THE PROPOLAR POLAR CAMPAIGN PREPARATION MEETINGS

Researchers received materials and information on ways to disseminate the PROPOLAR and its activities during the campaign, and on how to engage in Education & Outreach activities while in mission in the polar regions.



Still within the framework of the Polar Campaign Preparation Meeting, polar equipment and clothing, as well as rules and procedures regarding clothing maintenance and cleaning, for avoiding introduction of non-native species, were presented.

The PROPOLAR provides, on a loan basis, clothes and other equipment to support field work. As a rule, two separate sets of clothing are available, one for the Arctic and the other for the Antarctic.



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POLAR RESEARCHERS' TRAINING

Researchers took a 6-hour training course on Basic Life Support (BLS) that included training in cardiopulmonary resuscitation (CPR) and use of automated external defibrillator (AED). The course was provided by a certified medical and paramedical team, and researchers obtained certification for Basic Life Support (BLS) Providers by the European Resuscitation Council. This practical training prepared researchers for accidents or emergency situations that might occur during their mission on the Polar regions.



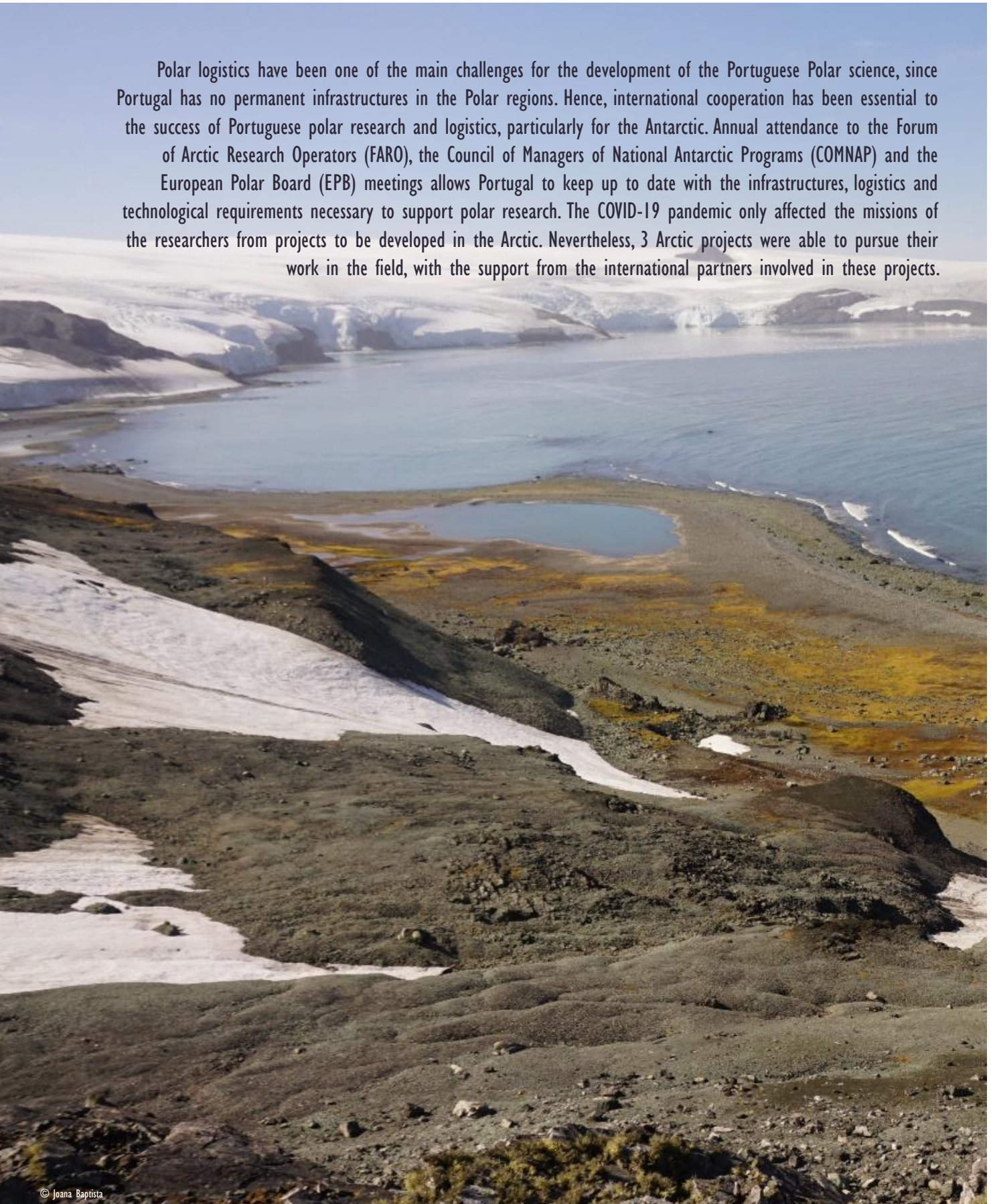
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LOGISTICS

POLAR LOGISTICS

Polar logistics have been one of the main challenges for the development of the Portuguese Polar science, since Portugal has no permanent infrastructures in the Polar regions. Hence, international cooperation has been essential to the success of Portuguese polar research and logistics, particularly for the Antarctic. Annual attendance to the Forum of Arctic Research Operators (FARO), the Council of Managers of National Antarctic Programs (COMNAP) and the European Polar Board (EPB) meetings allows Portugal to keep up to date with the infrastructures, logistics and technological requirements necessary to support polar research. The COVID-19 pandemic only affected the missions of the researchers from projects to be developed in the Arctic. Nevertheless, 3 Arctic projects were able to pursue their work in the field, with the support from the international partners involved in these projects.



ARCTIC LOGISTICS


PROPOLAR supports travelling of researchers to the Arctic. The organisation of the field logistics lies with the research teams, such as transport to field sites requiring aircraft or helicopter chartering.



During the PROPOLAR campaign 2019-20, contacts made by Arctic research teams, with the South Iceland Research Centre (Iceland University), and the Centre d'Études Nordiques (CEN, Canada), were key to the implementation of the work on the ground for three Arctic projects (MIGRANT, PERMARSENIC and TROPHICHANGE; see section THE PROJECTS), particularly under the restrictions to fight the spread of COVID-19.

ANTARCTIC LOGISTICS

With no infrastructure on the Antarctic region, Portugal relies on international cooperation with the national Antarctic programs from Argentina (Instituto Antártico Argentino, IAA), Brazil (Programa Antártico Brasileiro, PROANTAR), British Antarctic Survey (BAS), Bulgaria (Bulgarian Antarctic Institute, BAI), Chile (Instituto Antártico Chileno, INACH), China (Chinese Arctic and Antarctic Administration, CAA-CHINARE), Peru (Dirección de Asuntos Antárticos), Republic of Korea (Korean Polar Research Institute, KOPRI), Spain (Comité Polar Español, CPE), Turkey (ITU Polar Research Center, PolReC), United States of America (National Science Foundation, NSF) and Uruguay (Uruguayan Antarctic Institute, UAI). Many of these collaborations are sustained by Memoranda of Understanding (MoU). Support is provided for the transport of Portuguese researchers and equipment to and from Antarctica, as well as for stay in Antarctic research stations, remote field camps and vessels.



Logistics included the shipping of the projects' equipment and materials to Antarctica. This task was carried out with the support of the Comité Polar Español (CPE). The cargo was sent by PROPOLAR to Spain, for boarding on the Spanish vessels BIO Hespérides or Sarmiento de Gamboa, which then sailed to Antarctica. Once there, the cargo was distributed between the locations where the Portuguese teams were working, involving coordination and collaboration effort between CPE, the PROPOLAR logistics team in Portugal, the Antarctic station managers and the researchers already in Antarctica.

Some research teams travelled all the way from Punta Arenas (Chile) or Ushuaia (Argentina) to Antarctica, on board of research vessels from partner countries. The voyage takes not less than 3 days across the Drake Passage between South America's Cape Horn and the South Shetland Islands in Antarctica. During the 2019-20 campaign, Portugal has received support from the vessels BIO Hespérides from the Spanish Navy (managed by Unidad de Tecnología Marina - UTM), NPo Almirante Maximiano (H-41) from the Brazilian Navy, and the RRS James Clark Ross from the British Antarctic Survey (BAS).

© Miguel Esteves

ANTARCTIC LOGISTICS



Short-distance transportation in zodiacs, was ensured by Antarctic programs from Bulgaria, China, Spain and Republic of Korea.

© Mohammad Farzaman

On the scope of the PROPOLAR campaign 2019-20, support was provided for accommodation of researchers in: (i) the Spanish Gabriel de Castilla station in Deception Island; (ii) the Korean King Sejong, Chinese Great Wall and the Chilean Professor Julio Escudero stations, in King George Island; and (ii) the Bulgarian St. Kliment Ohridski and Spanish Juan Carlos I stations, and Byers camp at Livingston Island. Researchers also stayed in the Czech CzechoNelson station, located in Nelson Island.



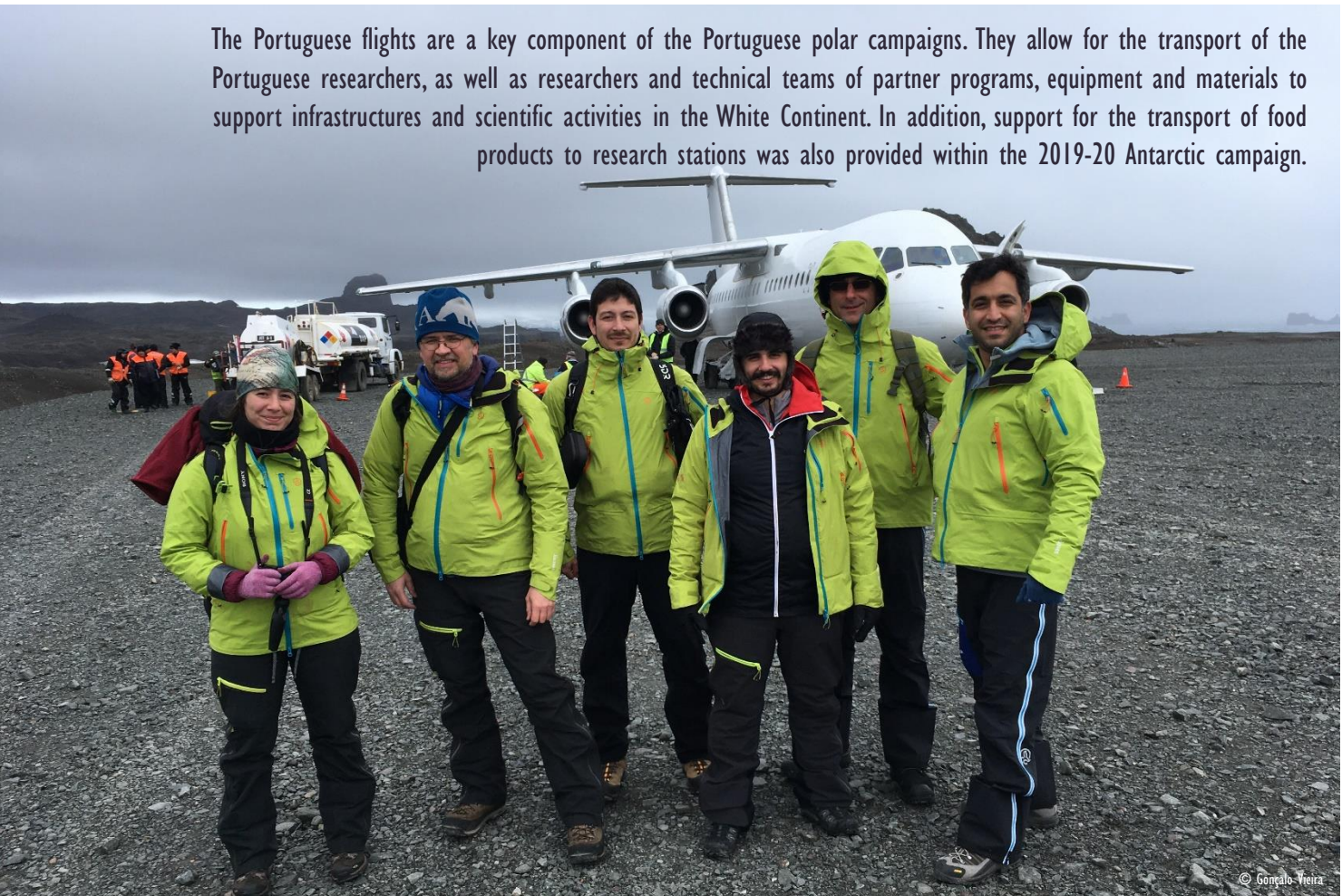
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ANTARCTIC LOGISTICS

The Portuguese contribution to international polar logistics is an annual flight between Punta Arenas (Chile) and the airfield Teniente R. Marsh in King George Island, South Shetlands Islands Archipelago, Antarctica. For this purpose, a BAe 146 airplane is chartered to the airline company DAP.

So far, the Portuguese Polar Programme has managed 9 Antarctic flights, supporting the international effort to logistics in Antarctica since 2012.

The Portuguese flights are a key component of the Portuguese polar campaigns. They allow for the transport of the Portuguese researchers, as well as researchers and technical teams of partner programs, equipment and materials to support infrastructures and scientific activities in the White Continent. In addition, support for the transport of food products to research stations was also provided within the 2019-20 Antarctic campaign.



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During the PROPOLAR campaign 2019-20, the Portuguese flights were carried out on the 13th of February 2020. The inbound and outbound flights carried a total of 66 passengers, respectively, from Argentina, Australia, Bulgaria, Chile, Colombia, Czech Republic, New Zealand, Portugal, South Africa, Spain, Switzerland, and United Kingdom. A total of 1 ton of additional cargo was transported. Portugal provided support to partner polar programs, such as the Bulgarian Antarctic Institute (BAI), the Chinese Arctic and Antarctic Administration (CAA-CHINARE), the Comité Polar Español (CPE), the Instituto Antártico Chileno (INACH), and the Korean Polar Research Institute (KOPRI).

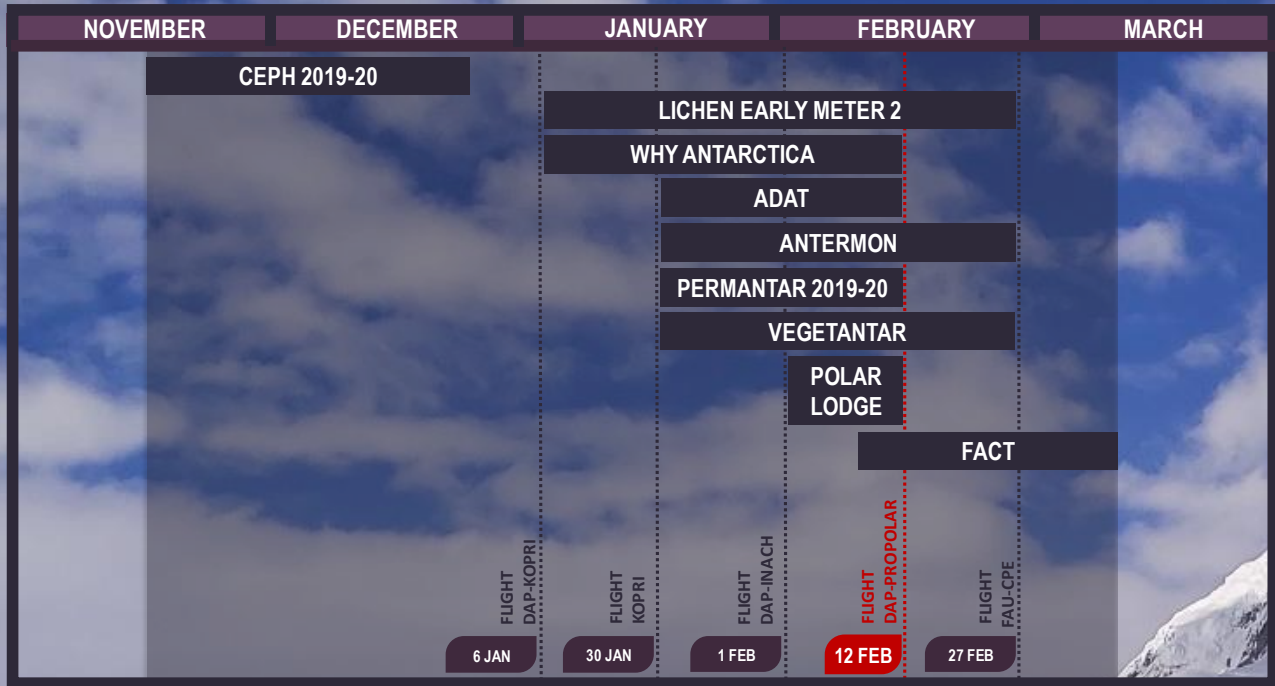
ANTARCTIC LOGISTICS

Besides the Portuguese flight, some Portuguese scientists travelled to King George Island on flights of other national Antarctic programmes. During the PROPOLAR campaign 2019-20, Portuguese researchers have benefited from flights managed by CPE, INACH and KOPRI. Once at King George Island, researchers were accommodated in research stations, or travelled by ship to other islands in the South Shetlands Archipelago, such as, Deception, Livingston and Nelson Islands, located on the Antarctic Peninsula.




ANTARCTIC LOGISTICS

The logistical support received by PROPOLAR, allowed the implementation of 9 projects in Antarctica (ADAT, ANTERMON, CEPH 2019-20, FACT, LICHEN EARLY METER 2, PERMANTAR 2019-20, POLAR LODGE, VEGETANTAR 2 and WHY ANTARCTICA; see section THE PROJECTS). The planning of the campaign was elaborated following the schedules of flights, vessels and research station time availability provided by partner national Antarctic programs.



INTERNATIONAL
UNIVERSITY
UNIVERSITY

Permafrost is -1.3°C at 13 m depth in
new borehole in Barton Peninsula
(King George Island, Antarctica)



ABSTRACT
The first permafrost borehole was drilled in 1968 at the site of the first Antarctic research station, the British Antarctic Survey (BAS) station, on King George Island, Antarctica. The borehole was drilled to a depth of 13 m and the temperature was found to be -1.3°C at this depth. This is the first time that permafrost has been found in the region.

KEY WORDS
1. Permafrost
2. Barton Peninsula
3. King George Island
4. Antarctica

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OTHER ACTIVITIES

PORTUGUESE CONFERENCE ON POLAR SCIENCES

The Portuguese Conferences on Polar Sciences are annual events promoted by PROPOLAR. These conferences aim at disseminating national research on Polar regions and are the forum where the recent advances in Portuguese polar projects are presented. New strategies for national and international cooperation are also outlined. The conferences are targeted to the national polar scientific community, researchers and students focused on understanding the role of the Arctic and Antarctica on the functioning of the Earth system, and particularly on how these regions respond to ever-increasing human pressure. International experts on diverse polar topics are invited for key-note lectures and address relevant questions on which new and emerging perspectives are welcomed. The conferences are hosted by national institutes and research centres integrating polar research teams. During the PROPOLAR 2019-20, the 11th PORTUGUESE POLAR SCIENCE CONFERENCE was hosted by the University of Coimbra (UC), at Coimbra (Portugal), on the 24th and 25th of October 2019.



© José Xavier

The conference started with the Opening Session with the presence of Cláudia Cavadas (Vice-rector of the University of Coimbra), Germana Santos (Coordinator of the Polar Program of the Portuguese Foundation for Science and Technology), Jorge Canhoto (Director of Department of Life Sciences of the University of Coimbra), João Carlos Marques (Director of the Marine and Environmental Sciences Centre - MARE), Helena Freitas (Director of the Centre of Functional Ecology - CFE), and José Xavier, Hugo Guimarães, Patrícia Fialho and Joana Fragão (Heads of the Conference Organizing Committee). An introduction to the PROPOLAR was presented by Teresa Cabrita (PROPOLAR).

PORTUGUESE CONFERENCE ON POLAR SCIENCES

The invited keynote speakers of the conference were Kevin Hughes (British Antarctic Survey - BAS, UK), Yves Cherel (Centre d'Etudes Biologiques de Chizé-Centre National de la Recherche Scientifique - CEBC-CNRS, France) and Allen Pope (Executive Director of the International Arctic Science Committee - IASC, Akureyri, Iceland; and National Snow and Ice Data Center - NSIDC, USA).

The newest results obtained from the work developed in the Arctic and Antarctica under the scope of the research projects, were shared and discussed. The range of topics was wide, covering atmospheric, cryosphere, marine, earth and biological sciences.



PORTUGUESE CONFERENCE ON POLAR SCIENCES



The conference also hosted the X Workshop APECS Portugal, which took place on the 25th October 2019. The topic of the workshop was “A Scientist is born”, to celebrate the first decade of the APECS Portugal workshops. The objective of the Workshop was focused on the value of early career researchers (ECRs) to Science, as well as the value of ECRs within a scientific team and in an organization such as APECS. The workshop invited speakers were the keynote speakers from the conference (Kevin Hughes, Yves Cherel and Allen Pope) and the PhD student José Seco. A debate covering the topic “Scientists in the classroom: how and why” was moderated by Patrícia Azinhaga (a high school teacher) and members of APECS Portugal, and took place in the Botanical Garden of the University of Coimbra, where the importance of sharing science with young students in schools and the benefits of these activities for the community was discussed.

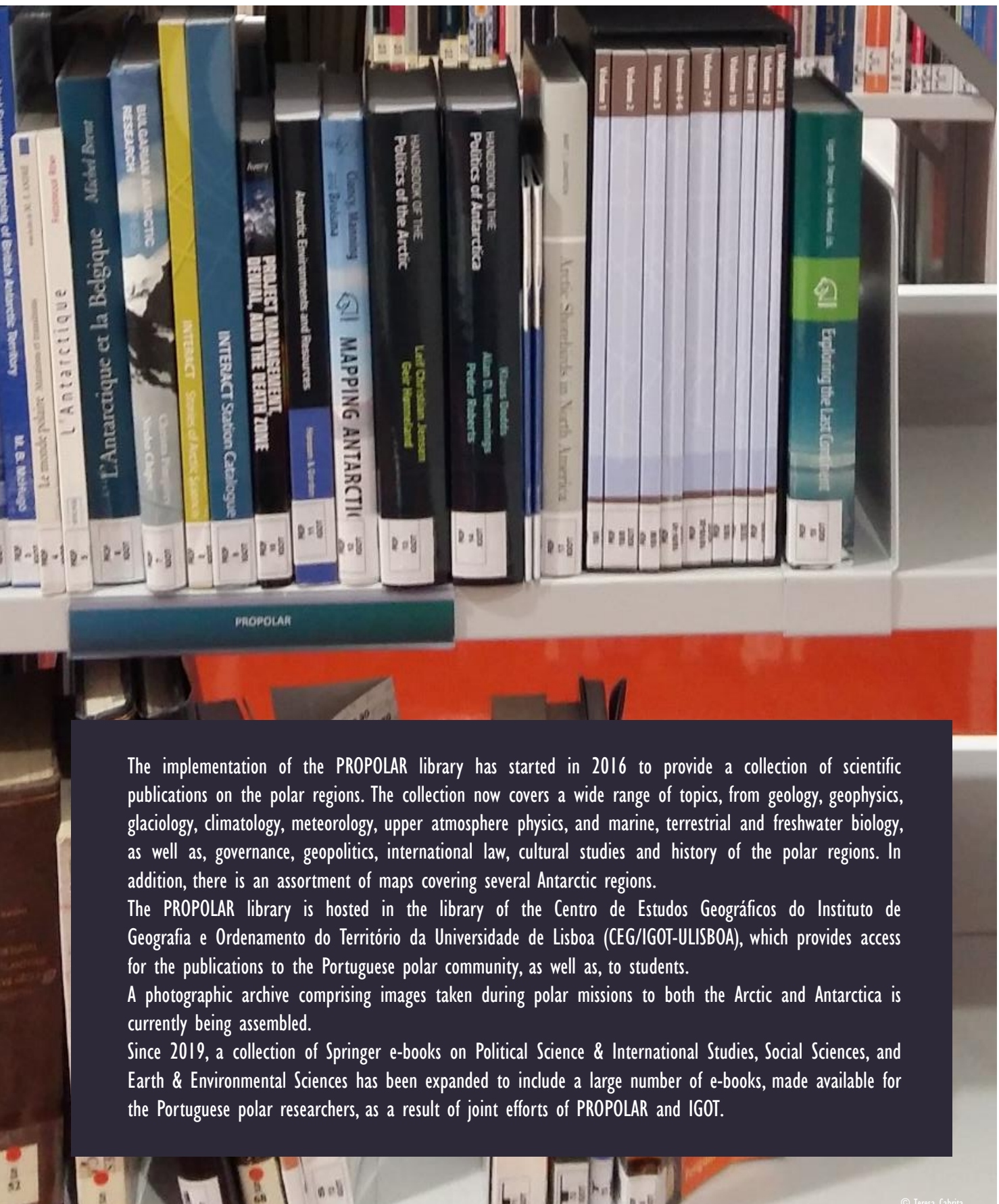
EDUCATION & OUTREACH

Since the International Polar Year (IPY) 2007-2008, education and outreach has been a strategic priority for the Portuguese Polar Program as a way to inform and motivate society and the young generations towards a behavioural change contributing to a sustainable future. During the IPY 2007-2008, the LATITUDE60!, educational programme, funded by the national agency for scientific and technological culture “Ciência Viva” provided an exceptional opportunity for teachers, students and the general public to have access to relevant and valuable information on polar regions, provided at first hand by Portuguese polar scientists. More than 40 educational activities were organised, involving more than 50 Portuguese nursery, primary and secondary schools and universities. After that, a national program on education and outreach - EDUCAÇÃO PROPOLAR - was implemented in the early stages of the PROPOLAR, set out to engage the young generations in active polar science endeavours on a national scale. The program is implemented jointly by PROPOLAR, APECS Portugal and Polar Educators International (PEI). The Portuguese polar scientific community, young scientists and teachers, have been deeply involved and committed to this initiative, participating in various educational activities, from school talks, to the development of the projects “PROFESSION: POLAR SCIENTIST” and “POLAR WEEKS”. These educational projects offer a wide range of communication tools, for instance, school talks, workshops, presentations, exhibitions, films, games, skype contacts with polar scientists on mission in the Arctic and Antarctica, and practical demonstrations of scientific equipment used for field work in the polar regions. During the PROPOLAR 2019-20, several of these activities were carried out throughout the country, and as via online live streaming when the restrictions associated to COVID-19 pandemic started. The Education & Outreach efforts activities have been very successful, with Portugal being internationally recognized for the excellence of its polar educational and outreach program.



© José Xavier

PROPOLAR LIBRARY



The implementation of the PROPOLAR library has started in 2016 to provide a collection of scientific publications on the polar regions. The collection now covers a wide range of topics, from geology, geophysics, glaciology, climatology, meteorology, upper atmosphere physics, and marine, terrestrial and freshwater biology, as well as, governance, geopolitics, international law, cultural studies and history of the polar regions. In addition, there is an assortment of maps covering several Antarctic regions.

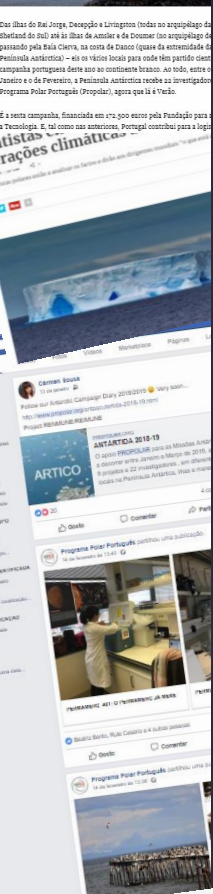
The PROPOLAR library is hosted in the library of the Centro de Estudos Geográficos do Instituto de Geografia e Ordenamento do Território da Universidade de Lisboa (CEG/IGOT-ULISBOA), which provides access for the publications to the Portuguese polar community, as well as, to students.

A photographic archive comprising images taken during polar missions to both the Arctic and Antarctica is currently being assembled.

Since 2019, a collection of Springer e-books on Political Science & International Studies, Social Sciences, and Earth & Environmental Sciences has been expanded to include a large number of e-books, made available for the Portuguese polar researchers, as a result of joint efforts of PROPOLAR and IGOT.

PROMOTING POLAR SCIENCE AND THE IMPORTANCE OF POLAR REGIONS

...eles, indo eles a caminho... da Antártida

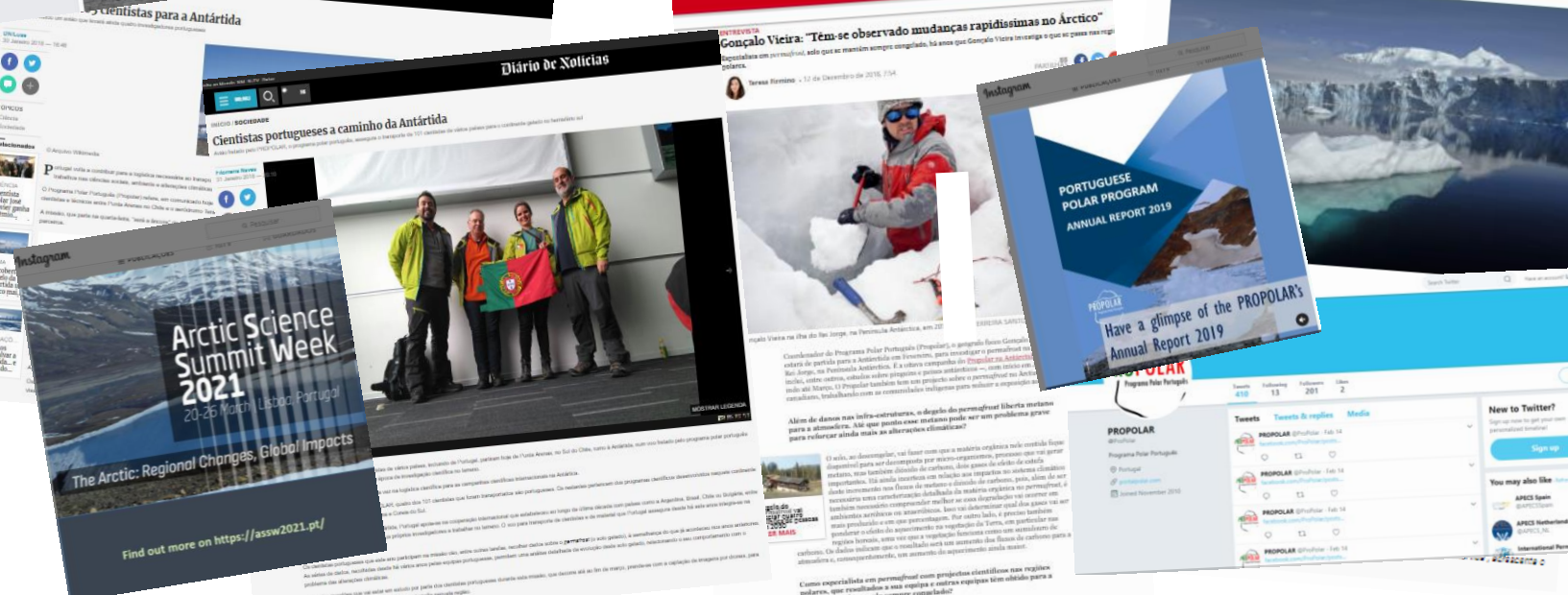


Raising awareness about the importance of polar regions and disseminating polar science and research, aimed at all types of audiences, are key to the Portuguese Polar Program. In order to disseminate and promote the PROPOLAR polar campaign 2019-20 the Portuguese flight to Antarctica and other important events, **PRESS RELEASES** were issued with the support of the Instituto de Geografia e Ordenamento do Território and the University of Lisbon dissemination channels.

INTERVIEWS were also given to the Portuguese media, generating articles mostly published in online journals, magazines and newspapers.

In addition, **POLAR MISSION DIARIES** were published on the PROPOLAR site, almost on a daily basis, during the duration of the polar missions, enabling the polar research community, and the public in general, to discover about the missions and scientific adventures of the Portuguese scientists in the Arctic and Antarctica. Amazing photos illustrate the everyday life of the Portuguese scientists during their stay in the polar regions, available on <http://www.propolar.org/blog-2017-2018>.

The **PROPOLAR website** (<http://www.propolar.org/>) provides updated content, and the "PORTAL POLAR" site (<https://comitepolarpt.weebly.com/>), **INSTAGRAM** (<https://www.instagram.com/programapolarportugues/>), and **FACEBOOK** (https://www.facebook.com/search/str/programa+polar+portugu%C3%AAs/keywords_search?epa=SEARCH_BOX) and **TWITTER** (<https://twitter.com/propolar?lang=en>) accounts and a **NEWSLETTER**, all kept by PROPOLAR, display the activities, events and news related to the Portuguese polar research.







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