

PORTUGUESE POLAR PROGRAM ANNUAL REPORT 2019



**PORTUGUESE POLAR PROGRAM
ANNUAL REPORT 2019**

November 2020

Portuguese Polar Program - PROPOLAR

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FOREWORD

This Annual Report of the Portuguese Polar Program, - PROPOLAR reports the main activities conducted between August 2018 and December 2019.

The PROPOLAR is led by the CEG/IGOT - University of Lisbon, under a Coordinating Committee that includes members of other 4 Portuguese research institutions: CCMAR - University of the Algarve, MARE - University of Coimbra, CQE - University of Lisbon, and CIIMAR - University of Oporto. The Program is funded by the Fundação para a Ciência e a Tecnologia (MCTES-FCT) as a development of its former Polar Office.

The activities herein disclosed reflect a very busy and inspiring year. The PROPOLAR supported fifteen projects that were successfully carried out in the Arctic and 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 Argentina, Brazil, Bulgaria, China, Peru, Turkey, United States of America and Uruguay. Participation in international meetings and workshops, as well as the organisation of a symposium and an international meeting, and the support provided to the Portuguese Conference on Polar Science, fulfilled and enriched this very active period, also helping to reinforce the credibility and relevance of the program in the international polar arena.

Bringing together all these efforts and resources will surely attract and mobilise more young researchers into a Polar scientific career, thus ensuring the future of the Portuguese Polar science, and that the program will continue to blossom.

We are confident that the successes that PROPOLAR has had in 2019 will serve as an impetus for our very dynamic and committed community of polar researchers to move forward in investing in the future of the Portuguese Polar science and preparing to seize new opportunities.

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 |
| PolReC | 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 |






THE 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 Coordinator 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 the 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 Antarctica, 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 is devoted to:

- encouraging 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 of Portuguese scientists to Polar regions by managing necessary means to ensure their activities, with the support of international cooperation with other 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 and ecosystems, and the importance of the national and international Polar science, through education and outreach activities
- encouraging the engagement of national industry on Polar science with a view to supporting innovation and technological development
- collaborating with the Portuguese government to ensure the implementation of standards for research in Antarctica, under the Antarctic Treaty, the Protocol on Environmental Protection to the Antarctic Treaty and other regulations
- collaborating with the Portuguese Foundation for Science and Technology (FCT) to implement scientific strategies and action plans 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)

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

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



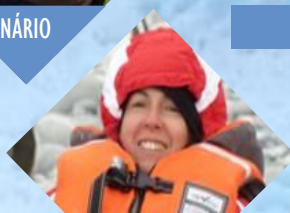
GONÇALO VIEIRA



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)

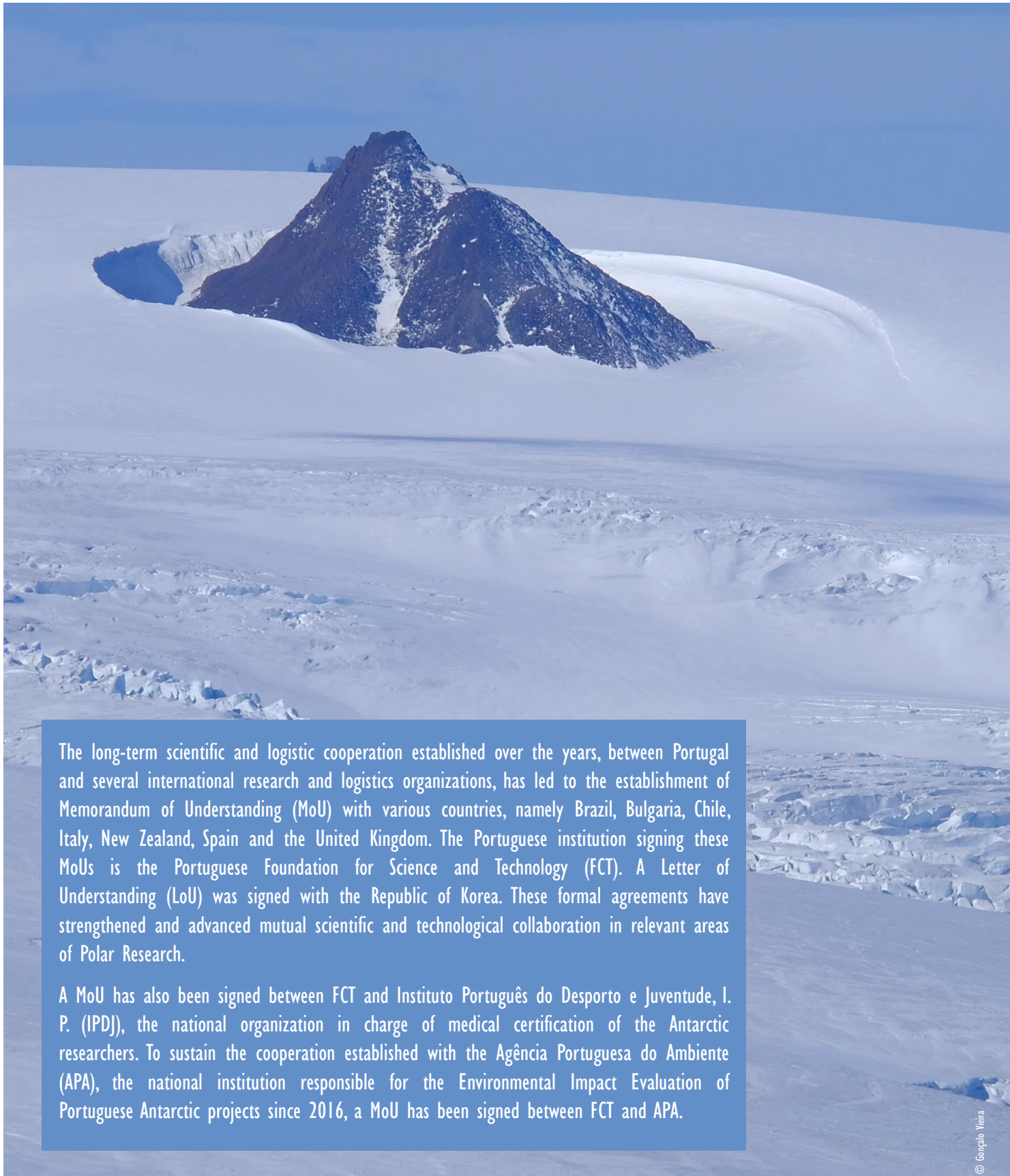


The Polar Program of the FCT (former Polar Office, created on December 2011), provides institutional support and monitoring of national research in the Polar regions. The objectives of the Polar Program of the FCT are to: (i) organize dissemination and communication actions on Portuguese Polar research 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 of the FCT, liaising with PROPOLAR on matters related to Portuguese Polar research. The Polar Program has 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 long-term scientific and logistic cooperation established over the years, between Portugal and several international research and logistics organizations, has led to the establishment of Memorandum of Understanding (MoU) with various countries, namely 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)

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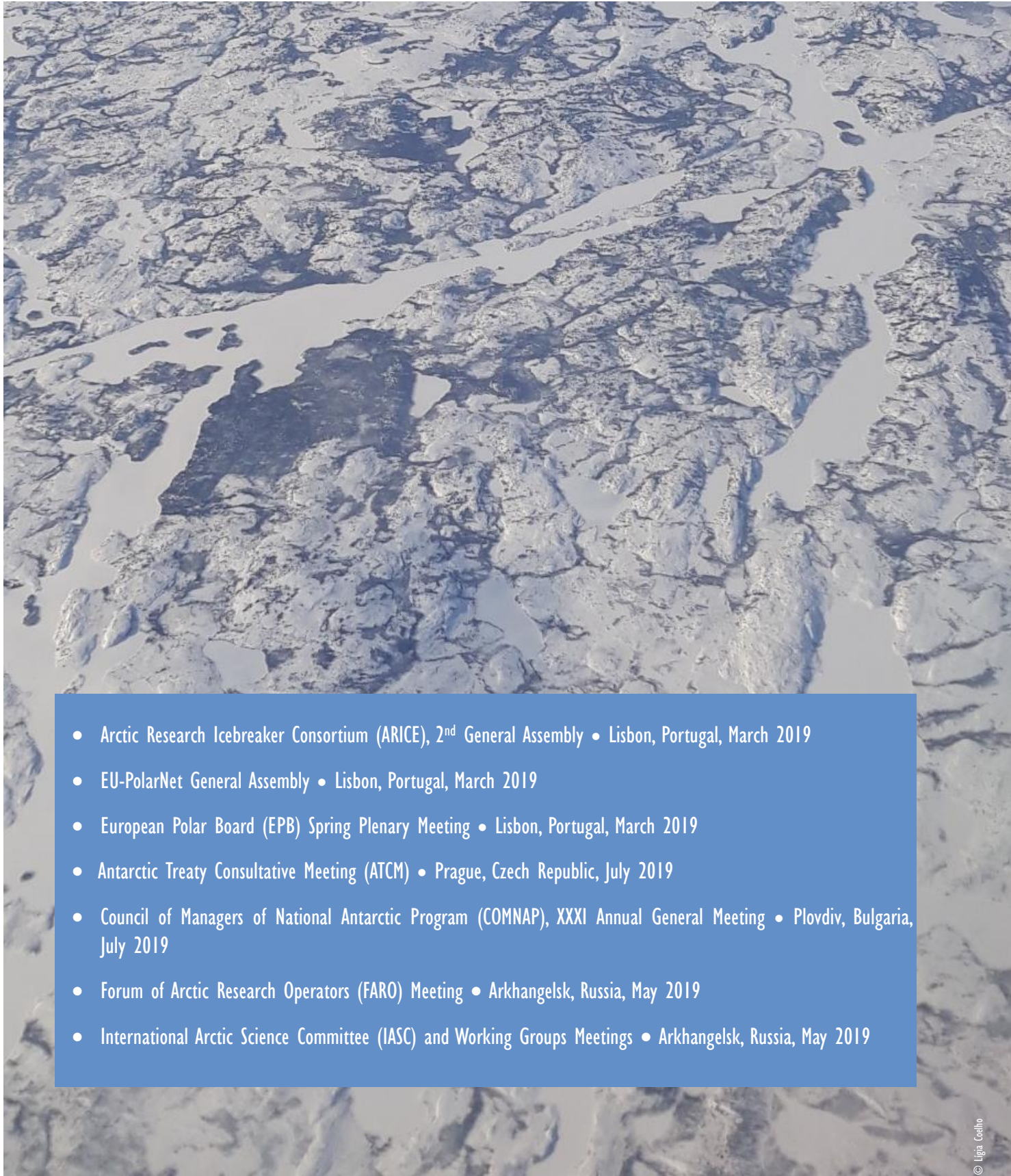
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THE PORTUGUESE POLAR PROGRAM - PROPOLAR

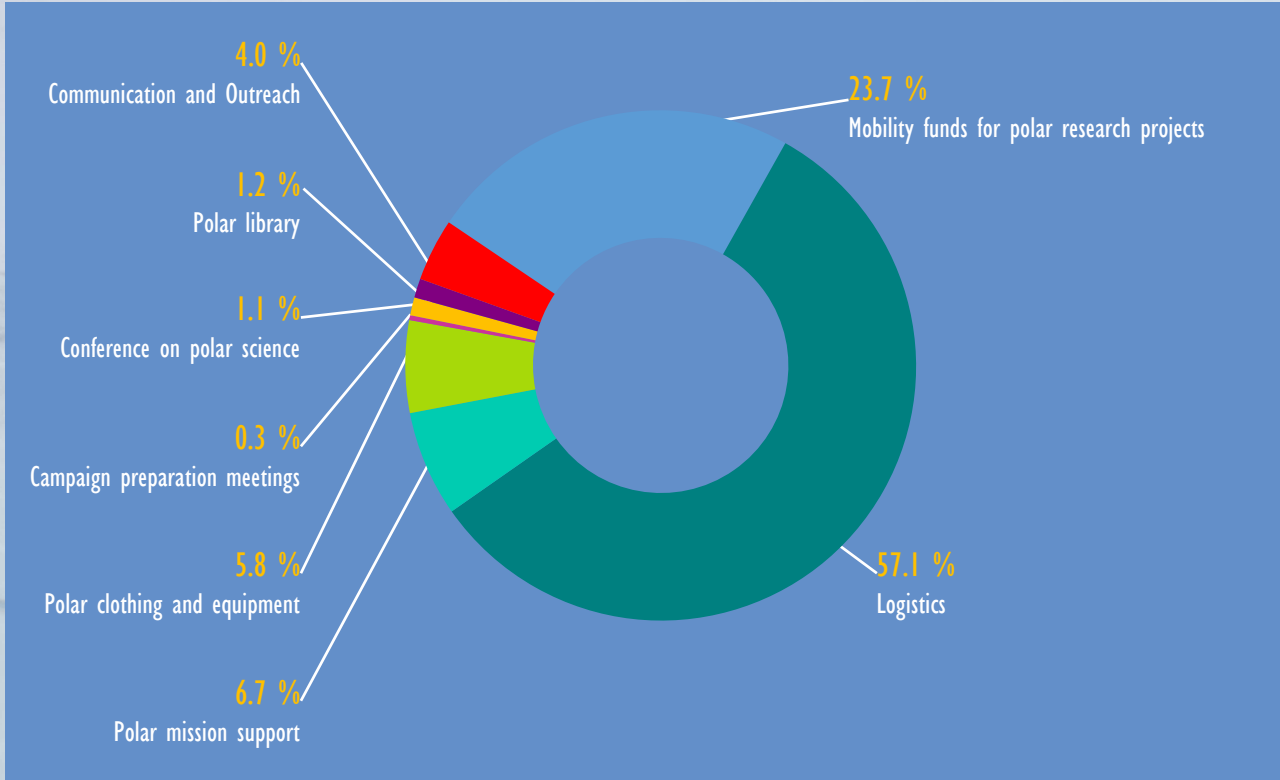
PROPOLAR IN INTERNATIONAL MEETINGS IN 2019



- Arctic Research Icebreaker Consortium (ARICE), 2nd General Assembly • Lisbon, Portugal, March 2019
- EU-PolarNet General Assembly • Lisbon, Portugal, March 2019
- European Polar Board (EPB) Spring Plenary Meeting • Lisbon, Portugal, March 2019
- Antarctic Treaty Consultative Meeting (ATCM) • Prague, Czech Republic, July 2019
- Council of Managers of National Antarctic Program (COMNAP), XXXI Annual General Meeting • Plovdiv, Bulgaria, July 2019
- Forum of Arctic Research Operators (FARO) Meeting • Arkhangelsk, Russia, May 2019
- International Arctic Science Committee (IASC) and Working Groups Meetings • Arkhangelsk, Russia, May 2019

THE PORTUGUESE POLAR PROGRAM - PROPOLAR

BUDGET ALLOCATION



Over-heads correspond to 25 % of the eligible costs



THE PROJECTS

SCIENTIFIC PROJECTS 2018-19

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.

SCIENTIFIC PROJECTS 2018-19

THE CALL 2018-19



Within the 2018-19 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, and 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.

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SCIENTIFIC PROJECTS 2018-19

THE CALL 2018-19

For the polar campaign 2018-19, the call was launched on the 4th of May 2018, in close collaboration between the PROPOLAR and the Polar Office (FCT). Information sessions to support the preparation of the scientific proposals were made available. Eighteen applications were received, 12 to be developed in the Antarctic, 3 in the Arctic, 2 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. 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 were asked to grade the scientific and technical value of the proposals submitted, as well as the suitability of the researchers' curricula. Fourteen proposals received scientific approval, and 11 projects with highest marks were funded. The Portuguese team from project Nunataryuk (funded by Horizon 2020 Programme) asked for support regarding outreach of the project activities. Overall, four projects were carried out in the Arctic, 9 in Antarctica, and 2 developed in a foreign institution.

LEGEND FOR PROJECT FEATURES

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



PROJECTS in the ARCTIC

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



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, Iceland University



One of the most widely reported responses to environmental change in recent years are changes in migratory phenology of bird species. Arctic and sub-arctic breeding shorebirds face several of the most preminent impacts of global environmental change. Arctic habitats currently experience the highest rates of warming temperatures potentially leading to mismatches on resource availability in nesting sites and/or food for these species. Upon leaving the arctic, shorebirds migrate to coastal areas in the temperate and tropical zones where they spend the non-breeding season. These areas are currently under intense anthropogenic pressure with many being converted into recreational or industrial areas. Indeed, many migratory bird populations are currently declining and such declines are particularly apparent in the Afro-Palearctic system. Understanding these species' and individuals' ability in responding to changing environment is likely to be key in altering their demographic trends.



EFFECTS OF LONG-DISTANCE MIGRATION ON INDIVIDUAL FITNESS

Polar and sub-arctic regions are experiencing particularly rapid rates of climate change and the majority of animals using these habitats are migratory. Changes to migratory behaviour are amongst the most widely reported responses to environmental change throughout the world, but the individual and population-level consequences of these changes are largely unknown. Within migratory populations, early arrival to the breeding grounds can potentially confer fitness benefits through processes such as acquiring better territories, earlier laying dates and increased numbers of nesting attempts. At higher latitudes current changes in climatic conditions, such as earlier spring warming that facilitate earlier nesting may therefore disproportionately improve the breeding success of early arriving individuals, if they occupy territories earlier in the season. Consequences of such changes for population size and distribution will depend on the factors determining individual migratory strategy, as well, as the strength of carry-over effects from the previous wintering season. Iceland supports internationally important populations of many avian migrants and due to its geographical location, land-birds must undertake a sea crossing in excess of 800 km to the breeding areas. Costs associated with this may be considerable, given the absence of stop-over sites in which to shelter if unfavourable weather conditions are encountered *en route*. However, we have recently identified a novel migration strategy in which Icelandic whimbrels (*Numenius phaeopus islandicus*) reach their wintering locations in West Africa and return to their Icelandic breeding areas in two single flights, covering ca. 11000 Km over oceanic waters. Such strategy is unique in land-birds for which an alternative coastal route is available and likely involves considerable trade-offs between early arrival and the acquisition of good breeding conditions, which will ultimately influence individual fitness.

Studies on long distance migrants rarely investigate individual fitness consequences resulting from differences in wintering area, migration strategy and breeding conditions. We have quantified those parameters and linked them to individual fitness, using remote tracking techniques combined with field measurements, in line with the objectives set out: (i) quantify individual variation in migration strategies (arrival timings, distance, winter site, stopover period, flight costs), (ii) determine individual (arrival and laying timing, reproductive investment) and site-based (breeding density, food availability, successful breeders proportion) variation in demographic drivers on breeding grounds, (iii) establish strength and fitness consequences of carry-over effects in this system by linking the previous aims and determine its population effects by scaling up individual effects according to breeding and migration strategy.



NUNATARYUK – THE PORTUGUESE RESEARCH CONTRIBUTION

PERMAFROST THAW AND THE CHANGING ARCTIC COAST, SCIENCE FOR SOCIOECONOMIC ADAPTATION



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



Gonçalo Vieira, Pedro Freitas (IGOT, University of Lisbon), Pedro Pina, Daniel Pinheiro (CERENA, University of Lisbon)



Research project in the Arctic



PROPOLAR • Horizon 2020 Programme



Northwest Territories, Canada



Gonçalo Vieira



Pedro Pina



Daniel Pinheiro



Pedro Freitas

The main goal of Nunataryuk (<https://www.nunataryuk.org/>) was to determine the impacts of thawing land, coast and subsea permafrost on the global climate and on humans in the Arctic and to develop targeted and co-designed adaptation and mitigation strategies. The project, funded by the European Commission through the Horizon 2020 Programme, brings together world-leading specialists (26 partners from 11 countries) in natural science and socio-economics and is being implemented since 2017 until 2022. The Instituto de Geografia e Ordenamento do Território (IGOT) is the Portuguese partner of the project. The Portuguese team is led by Gonçalo Vieira, with the participation of Carla Mora, Pedro Freitas (IGOT), Pedro Pina, Daniel Pinheiro (CERENA/IST) and João Canário (CEQ/IST), and is responsible for 2 deliverables, within the Work Package 2 of the project, regarding: (i) updated survey of archive data on Arctic coasts and coastal erosion, and (ii) report on new advances on Arctic coastal retreat rates.



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NUNATARYUK – THE PORTUGUESE RESEARCH CONTRIBUTION

PERMAFROST THAW AND THE CHANGING ARCTIC COAST, SCIENCE FOR SOCIOECONOMIC ADAPTATION

The rapid warming in the Arctic is causing drastic changes in the cryosphere and ecosystems, significantly affecting areas of perennially frozen ground or permafrost, as one of the most striking impacts. Permafrost areas occupy around 20% of the continental surface of the Northern Hemisphere and are particularly important to the global climate due to their high organic matter content. With warming and permafrost thaw, trapped organic matter in the permafrost becomes exposed to microbial decomposition which results in the abrupt release of greenhouse gases, such as carbon dioxide and methane to the atmosphere. The resulting positive feedback has tremendous impact to the global climate system, as higher temperature generates increasing permafrost thawing and consequently enhanced release of greenhouse gases. However, the degradation of permafrost also triggers other impacts such as hydrology, geomorphology and vegetation changes that lead to alterations in the ecosystems. Furthermore, there are enormous problems associated with terrain stability in built-up areas, affecting diverse types of infrastructures and cultural heritage. As most areas of human activity in the Arctic occur along permafrost coasts and these coasts have become one of the most dynamic ecosystems on Earth, quantifying coastal erosion retreat rates, as well as quantifying lateral fluxes of carbon, nutrients and contaminants from coastal erosion and watersheds, is of the utmost importance.

The contribution of the Portuguese team to NUNATARYUK is focused on the monitoring of the coast line dynamics, particularly in the Beaufort Sea, using field techniques and high-resolution remotely-sensed products at target regions. It contributes to the permafrost biochemistry component, particularly in what concerns carbon and mercury. During the 2019 mission, field work covered the coastal area of Tuktoyaktuk and Paulatuk villages from the Northwest Territories (Canada) in collaboration with Natural Resources Canada (Canada Geological Survey). The main goal of this mission was to carry out field surveys of both villages and surrounding areas, to produce digital surface models and orthophotomaps, which allowed to generate erosion and inundation risk cartography. To achieve this, autonomous unmanned vehicles (drones), D-GPS systems and field observation were carried out.



PERMAMERC

MERCURY METHYLATION AND MMHG DEMETHYLATION IN PERMAFROST THAW LAKES



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



João Canário, Martin Jusek (CQE), Lúcia Coelho (CQE, MIT Portugal)



Research project in the Arctic



PROPOLAR • CQE • CEN



Whapmagoostui-Kuujuarapik, Northern Quebec, Canada



João Canário



Martin Jusek



Lúcia Coelho

Mercury (Hg) is a global pollutant, considered by UNEP to be of highest concern due to its effect on humans and wildlife. Among several Hg compounds, monomethylmercury (MMHg) is the most toxic since it is a potent neurotoxin. Although many studies have been conducted on Hg biogeochemistry in the Arctic, information for permafrost soils is scarce. A recent paper pointed to degrading permafrost as one of the most important pools of mercury in the Arctic, corresponding to a new threat to the northern hemisphere. In this project, one of the most important biogeochemical processes of the mercury cycle was accessed. Hg methylation and MMHg demethylation rates were estimated and the abiotic and biotic factors controlling both reactions were investigated. To the best of our knowledge, this was the first time that these processes were examined in these environments and the results contribute to better predicting the impact of thawing permafrost in the northern ecosystems.



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MERCURY METHYLATION AND MMHG DEMETHYLATION IN PERMAFROST THAW LAKES

Public interest in the Arctic climate change has been focused on sea ice retreat and associated effects on biota. Yet, changes observed on permafrost lands are equally pronounced. Several studies have been published about the large quantities of organic carbon in permafrost and how warming climate accelerates its microbial breakdown and the release of greenhouse gases, but less attention has been given to contaminants stored in these environments. In a recent paper, contaminant studies were identified as key to also understand permafrost degradation impacts. A recent study showed that permafrost holds a much greater cache of mercury (Hg) that potentially can be released into the ecosystem. Hg was recognized as one of the most dangerous chemicals to the environment strongly pointing to its regulation. Among toxic mercury forms, monomethylmercury (MMHg) is of greatest concern since it is a potent neurotoxin. MMHg is produced in the environment by Hg methylating bacteria under suboxic/anoxic conditions, particularly by iron and sulphate reducing bacteria as well as methanogens. Studies on permafrost thaw lakes pointed to relatively high levels of trace elements including Hg. Information on MMHg levels is scarce. MacMillan et al. reported MMHg data on thaw lakes, and more recently the PI team analysed MMHg in sub-arctic thaw lakes. Results showed that the proportion of MMHg to total Hg was higher than in other environments pointing to extremely favourable conditions for Hg methylation.

However, the biogeochemical factors contributing to these conditions are currently unknown.

This research provided critical new scientific information on the Hg methylation and MMHg demethylation rates in permafrost thaw lakes and the biogeochemical factors involved. This information was critical to better understand impacts of permafrost degradation in the Arctic (and sub-Arctic) freshwater ecosystems. The field work met the aims of PermaMerc: (i) estimate Hg methylation and MMHg demethylation rates in permafrost thaw lakes and compare with those from other comparable ecosystems, (ii) investigate environmental factors that contribute to changes of Hg and MeHg production, and (iii) identify microorganisms involved in Hg methylation and MMHg demethylation processes and their relative contribution to each process.



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THAWPOND

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



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



Carla Mora, Gonçalo Vieira, Pedro Freitas (IGOT, University of Lisbon)



Research project in the Arctic



PROPOLAR



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



Thaw lakes and ponds are frequent in degrading ice-rich permafrost and show strong biogeochemical dynamics, significant for the Global carbon cycle. Arctic warming is accelerating thaw, affecting the landscape and influencing hydrology and soils, hence generating new conditions for ecosystems. At the southern limit of permafrost, the tundra-taiga boundary is changing, with a marked increase in shrubification and terrestrialization, and a still poorly understood dynamics in thaw lakes and ponds. However, the latter, due to their small size have been frequently neglected in remote sensing analysis. THAWPOND took place at Northern Quebec and aimed at tackling this issue by synergistically using different remote sensing platforms, from UAS to satellites to characterize lake and pond colour, CDOM and DOC and upscale the information from local to regional scale. The spatial and temporal variability of pond characteristics were analysed and the controlling factors identified.

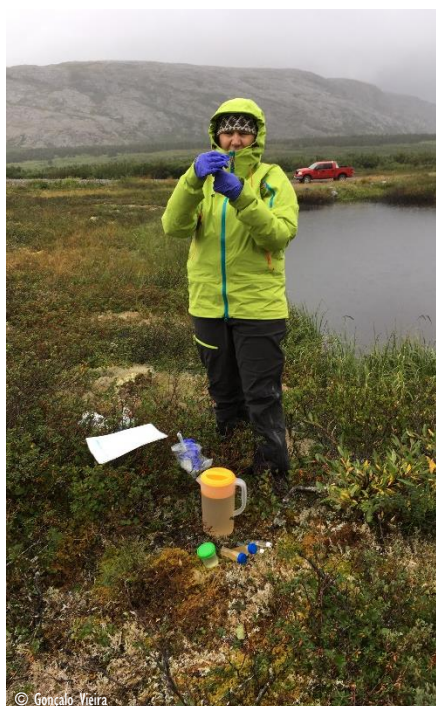


REMOTE SENSING ANALYSIS OF VEGETATION AND THAW POND COLOUR DYNAMICS AT THE TUNDRAFOREST ZONE: FROM LOCAL TO REGIONAL SCALE (WHAPMAGOOSTUI - KUUJJUARAPIK, HUDSON BAY, SUB-ARCTIC CANADA)

Climate warming has induced fast and significant changes in the terrestrial ecosystems of the Arctic and Sub-Arctic. Permafrost degradation, terrestrialization and shrubification are occurring at a fast pace at the tundra-forest boundary, where permafrost is sporadic or discontinuous and thaw lakes and ponds are widespread. These changes have profound implications for local and regional hydrology and the biogeochemical cycle of carbon and are key for improving the understanding of the Global climate system (GCS). Canada has a 4 million km² area underlain by permafrost, from which about 5% are thaw lakes, but small lakes and ponds, which occupy large areas are poorly constrained in regional remote sensing approaches. Lake colour has been shown to correlate with lake chemistry and can be analysed by remote sensing, including variables such as DOC, CDOM or suspended sediment load. Satellites such as Sentinel-2 with spatial resolution of 10 m and a revisit period of up to 3 days, allow for free unprecedented monitoring possibilities of very large areas. For ground truthing, UAS with multispectral sensors, and LiDAR allow for the detailed mapping of lake morphometry, colour, as well as lake catchment vegetation (species and structure) and topography. Comparison of new aerial orthomosaics with earlier ones, satellite imagery and archive aerial photos, allows the identification of ecosystem changes. Sampling of soils, lake sediments and water in lake catchments allows for result calibration and interpretation of the controls on lake chemistry. In THAWPOND we built on the experience and data from previous seasons and on the synergistic use of these techniques, for upscaling from local surveys to the regional scale, contributing to a better understanding of thaw lake dynamics and their implications to the GCS THAWPOND was a collaboration with PERMAMERC and a contribution to www.t-mosaic.com.



THAWPOND provided new advances in the understanding of the spatial and temporal dynamics of thaw pond chemistry by using new multi-scale remote sensing data supported by unprecedented resolution ground truthing. The research was driven by the testing of the following hypotheses: (i) multispectral ultra-high-resolution UAV imagery of thaw ponds allows to estimate CDOM and DOC, allowing to monitor their temporal and spatial changes and ground truth satellite imagery, (ii) new high-resolution satellite imagery such as Sentinel-2 allows for monitoring small lake and pond dynamics and hence assess lake carbon chemistry at the regional scale (e.g. CDOM and DOC), and (iii) pond colour is controlled by catchment characteristics and history, such as soils and geomorphology, vegetation and pond age. These hypotheses were the starting point of a multi-year project, which resulted in a PhD dissertation targeting the regionalization of results to northern Quebec.



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PROJECTS
in ANTARCTICA

CEPHALOPOD FAUNA OF THE SOUTHERN OCEAN

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



Pelagic invertebrates play a key role in the Antarctic marine ecosystem. CEPH-BAS 2018-19 is a novel multi-disciplinary and international project aiming to better understand the role of the squid within the Antarctic marine food web. The project allowed research work at the British Antarctic Survey (Cambridge, United Kingdom) to characterize the invertebrate fauna around South Georgia, through particularly the diet of Patagonian toothfish in comparison with the diet of other 6 top predators (2 species of penguins, 1 seal and 3 species of albatrosses). After the characterization of the diets, stable isotopic analyses allowed to obtain information about their distribution, habitat, diet and trophic level. These data were incorporated into food web models of the Southern Ocean that are being developed under ICED, SCAR Ant-ERA and EGBAMM. Educational and science communication activities took place in collaboration within EDUCAÇÃO PROPOLAR.



CEPHALOPOD FAUNA OF THE SOUTHERN OCEAN

CEPH-BAS 2018-19 was a project proposal aiming to better understand the role of pelagic organisms within the Antarctic marine ecosystem, essential for an ecosystem approach of the sustainable use of Southern Ocean (SO) resources, as emphasized by organizations that we are working with, and within major international programs (SCAR Antarctic Thresholds - Ecosystem Resilience and Adaptation, AnT-ERA), in which we are highly involved. Pelagic squid (hereafter squid) are pelagic invertebrates with an important role in marine ecosystems. Squid are the link between phyto- and zooplankton and the higher trophic levels, and they have the potential to be exploited commercially. Our understanding of the function of the squid in the Antarctic ecosystem is surprisingly poor and needs to be urgently addressed to identify the role of these in the pelagic food web. Within CEPH-BAS, we participated in laboratory research trip to Cambridge, to the headquarters of the British Antarctic Survey (BAS), where analysing squid, among others, was planned. The samples collected were used to study the distribution, habitat and trophic level of these organisms to understand their function in the pelagic food web. The project had various advantages, and whose timing was ideal. Firstly, this is a long-term collaboration between Portugal, UK and France. Secondly, CEPH-BAS 2018-19 asked from PROPOLAR only travel support for two scientists to the UK, as BAS provided all the logistics necessary to collect the samples during this year. Thirdly, this work allowed our Portuguese team to have a strong contribution to this field, following the work previously developed and addressing a gap of knowledge identified at the SCAR Horizon Scan.

CEPH-BAS 2018-19 aimed to characterize the cephalopod fauna around South Georgia, an ecological hotspot in the Atlantic sector of the Southern Ocean, obtaining a unique dataset to fit and improve the food web dynamics models being developed for this area and to test two hypotheses. Firstly, squid is important to the Southern Ocean pelagic ecosystem, by assessing it through the diet of key top predators in the region. And secondly, squid habitat and trophic levels change according to their size (and their maturity stage), as obtained by their predators (e.g. penguins are thought to feed on juvenile squid, Antarctic fur seals and smaller albatrosses on sub-adults and Patagonian toothfish and wandering albatrosses on adult squid) around South Georgia. This year, we focused on the diet of Patagonian toothfish, one of the exploited Antarctic fish species, whose results will be relevant to their management. This work was also complement to our work on education.



© José Queirós



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ESTEEM ANTARCTICA

EDUCATION IN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS IN ANTARCTICA



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



Nuno Pereira, Tânia Correia (IPBeja)



Research project in Antarctica



PROPOLAR



Livingston Island - South Shetland Archipelago, Antarctica

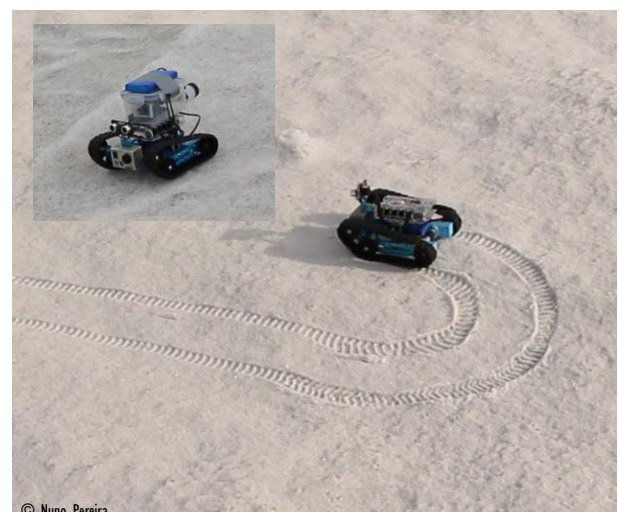


Nuno Pereira



Tânia Correia

In the 2018-19 campaign three projects were implemented: ViRAL (Virtual Reality Antarctica Laboratory), Antartuino (Physical Computing in Antarctica with the Arduino), and ARC (Antarctica Robotics Challenge). The main objectives were the promotion of science, technology, engineering, and mathematics education, engaging students and educators in teaching-learning activities using the project based learning methodology and, using virtual reality, to increase the awareness of society for topics related to Antarctica, namely, the conservation of wildlife, pollution, and the impact of Human activity at a global scale. These are topics of the utmost priority and importance, for the future educational framework (digital literacy, in particular coding skills), and for the engagement of society (in particular the new generations) in the discussion of solutions and pathways for a sustainable development.

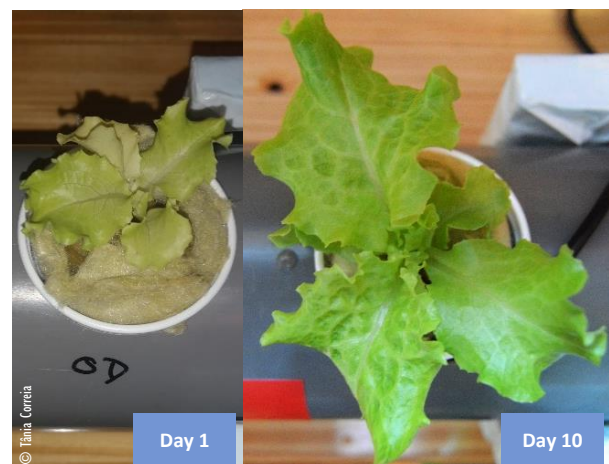


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EDUCATION IN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS IN ANTARCTICA

The viability of the proposed projects was validated in a previous campaign (2017-18) at the Bulgarian Antarctic Base, in collaboration with the Bulgarian Antarctic Institute, in terms of concept, methodology, equipment, and conditions on site. For this purpose, and for the STEM activities (Robotics and Physical Computing), four schools were selected as partners, two in Portugal, and two in Bulgaria. The tests performed at the base were very successful: the five robots showed a very good performance, and the four systems build with the Arduino board (an open source hardware platform) worked as expected, under outdoor conditions. The results from the tests (photos and videos) are available on the Facebook page of the project (@AntarcticaEducation) and measurement data is available for download. The VR project was the first edition of ViRAL (Virtual Reality Antarctica Laboratory). The idea of this project was already presented at the APEX Online Conference 2017, and was awarded the first place in the 'Outside the Box' category. The project aimed to use VR technology, in its most affordable configuration (using a smart phone and inexpensive VR devices), to science outreach activities in schools, and to provide on-line VR resources that can be used by students and educators in teaching-learning activities. We were able to capture 360° pictures of wildlife, ongoing projects, and landscape, all made available at the project's page. After the campaign, and according to planning, we have been involved in science outreach sessions in schools (in Bulgaria, and in Portugal), and in the Sofia Science Festival with the support of the British Council in Sofia, and the Camões – Instituto da Cooperação e da Língua, of Sofia. This first campaign was essential as a proof of concept that allowed us, not only to validate the projects, but to define their upgrades, and how to expand the participation of the schools in the 2018-19 campaign.

The campaign had two levels of objectives: educational, and technical. We wanted to promote the participation of students in the development of the electronic systems that were tested. This allowed a first contact with applied research within the scope of a curricular unit of an Informatics course. We wanted to extend the Antarctuino project, and the robotics challenge to more schools in Portugal, and in Bulgaria. For that purpose, we were in contact with the Municipality of Beja to support the participation of schools and, in Bulgaria, we had the collaboration of the Bulgarian Antarctic Institute, and the Camões Institute - Sofia, to promote the project in the institute network of schools. From the technical side, we implemented three experiments of Physical Computing, expanded the virtual reality image survey, implemented the robotics challenge and, as in the previous campaign, tested sensors and electronic boards to evaluate the viability of its use in future projects.



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



António Correia, Pedro Mendes (ICT, University of Lisbon)



Research project in Antarctica



PROPOLAR



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



António Correia



Pedro Mendes

With this project we aimed at: 1. Continuing geophysical surveys using electrical resistivity tomographies (ERTs) near the Peruvian Antarctic Station with the objective of delineating and characterizing, in geoelectrical terms, the aquifer that provides water to the station, and create 2D and 3D models of the aquifer which will allow improving its exploration in the future. Start geoelectrical and temperature monitoring of the permafrost layer detected in 2018 beneath the base. Thickness decrease and temperature increase of the ground beneath the base can increase the risk of structural failure of the base buildings in an air temperature increase scenario. 2. Carrying out new (ERTs) in the CALM and PAPAGAL sites near the Bulgarian Antarctic Station. ERTs were performed there for the first time in 2009; the main objective was to continue monitoring the space and time evolution of permafrost and so correlate its evolution with climatic change.



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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

The proposed project was divided in two parts corresponding to two different geographical areas: the one near the Peruvian Antarctic Station (PAS) and the other near the Bulgarian Antarctic Station (BAS). For both the interest was related with permafrost space and time evolution and, in particular, for the (PAS) it was related with permafrost hydrology and aquifer delineation and characterization. The method used in both areas was electrical resistivity tomography (ERT) which has been very successful in delineating permafrost and active layer in other areas of the South Shetland Islands. For the PAS a new line of research was proposed which has to do with permafrost monitoring beneath the station; as a matter of fact, permafrost was found in the last campaign under the facilities of the station which, in case temperature increase and/or thawing, can put at risk the stability of station structures.

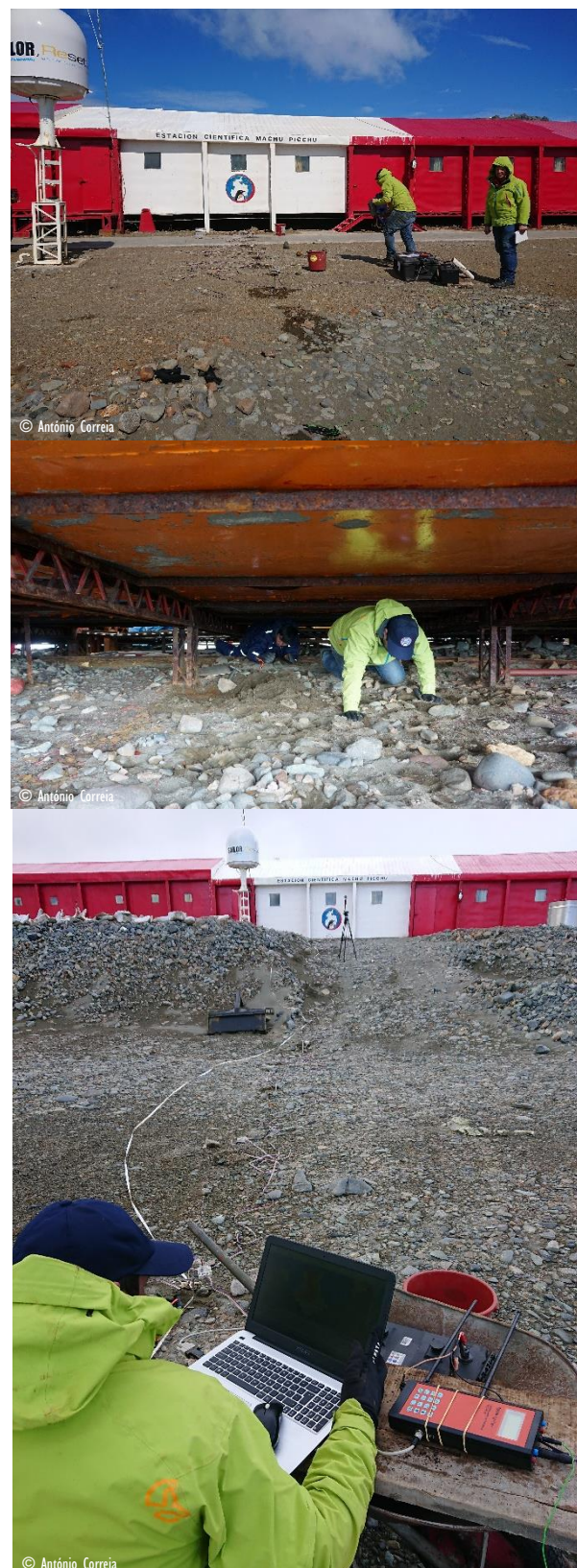
Therefore, in the PAS the proposed work was twofold:

- (1) a continuation of the work done in the campaign of 2017-2018, i.e., new ERTs were carried out to continue covering the entire area with lateral and vertical geoelectrical information so that two- and three-dimensional geoelectrical models could be constructed to infer the aquifer geometry and allow a better aquifer exploitation. The collected information gave insight to the vegetation cover distribution and the evolution of the local ecosystems.
- (2) Start permafrost and active layer monitoring of the ground beneath the station for ground stiffness evaluation.

The second part of the project had as objective to continue permafrost and active layer monitoring in two areas close to the BAS with ERTs. In the first of those two areas (a CALM site) geoelectrical monitoring has started in 2009 and was repeated in 2012, 2013, and 2017; in the second (PAPAGAL), ERT monitoring was carried out in 2012, 2013, and 2017.

The objectives of the project were twofold:

- (i) to continue geoelectrical surveys using ERT in the area near PAS (started in the campaign 2017/2018) and in the areas the CALM and PAPAGAL sites near the BAS (started in 2009). This allowed gathering new geoelectrical information to improve the data base necessary to construct two- and three-dimensional geoelectrical models for the aquifer that provides water for the PAS; not much is known about aquifer's geometry and recharge areas. Concerning the BAS, new ERTs allowed obtaining more geoelectrical information about space and time evolution of permafrost in the CALM and PAPAGAL sites;
- (ii) to start geoelectrical and temperature monitoring in the ground beneath the installations of the PAS where permafrost was detected in the campaign of 2017/2018. This had implications to the structural safety of the PAS' buildings.



LOADING AND TECTONICS OF ANTARCTICA PENINSULA - 2018-19



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



Pedro Almeida (UBI), Claudio Gabriel Matko (Instituto Antártico Argentino - IAA, Argentina)



Research project in Antarctica



PROPOLAR, UBI, IAA



Protected area visited ASPA 134, Cierva Point and Offshore Islands, Danco Coast, Antarctic Peninsula



Cierva Point, Antarctic Peninsula, Antarctica



The LATA 2018-19 project was extending the initial goals of the project LATA approved in 2014 and 2017. This project aimed to: (i) verifying ocean tide models around the Antarctica Peninsula using GNSS/gravity derived ocean tide loading, refined with local tide gauge observations, (ii) compute the angular velocities of the Antarctica Peninsula tectonic block, (iii) support the study of the consequences caused by human activity on the permafrost and of the rapid melting of the ice sheet at the Antarctic Peninsula. The LATA project resulted in the installation of the GNSS station (including a weather station) on the Argentinian base Primavera in January 2016. In 2018 the missing ancillary equipment was installed to acquire the GNSS data whole year round. This time, we carried out a tidal gravimetry and tide gauge campaign at this station. This provided additional results to verify the ocean tide models.



LOADING AND TECTONICS OF ANTARCTICA PENINSULA - 2018-19

The LATA (Loadings and Tectonics of Antarctic Peninsula) is a long term project to investigate the accuracy of Ocean Tide Loading (OTL) models and the tectonic plate motions within and around the Antarctic Peninsula using Global Navigation Satellite System (GNSS) derived solutions. Ocean tide loading is the weight of the ocean tides deforming the ocean floor and surrounding coastal areas which can be observed with GNSS. At the Primavera station, the differences between the predicted OTL using various ocean tide models can reach μGal and millimeter level due to the fact satellite altimetry does not cover the area and the number of tide gauges is few, causing large uncertainties in the ocean tides. The OTL can be observed with a gravimeter and GNSS to verify the tide models in the area. The Antarctica Peninsula has been considered to be located on the Antarctica tectonic plate, which is divided in two major geological provinces with the Antarctica Peninsula being one of the major terranes of West Antarctica. In its extreme northern tip, the Antarctica Peninsula forms part of a complex tectonic system resulting of the convergence between two major tectonic plates: Antarctica and South America that also created several minor plates/blocks, namely the Scotia plate and the South Shetland block. However, there are significant differences (up to 5mm/yr) between the predictions when different angular velocity models are used, and more observations are needed. Recent studies have also raised the concern on ice sheet melting rates and rapid bedblock uplift in the Antarctica Peninsula, stressing the need for further continuous observation of the vertical component that, due to the structure of the GNSS systems needs a longer time span for robust results.



The LATA 2018-19 project focused on the use of geodetic techniques to study geophysical and anthropogenic signals. The installed GNSS station and the proposed gravimetric/tide gauge campaign at Primavera base allowed us to investigate: (i) the ocean tides in the Bellingshausen and Weddell seas, (ii) the angular velocities of the Antarctica Peninsula tectonic block, (iii) the consequences caused by human activity on the permafrost around Primavera base, (iv) the improvement on the GNSS solutions of better OTL corrections for tectonic studies. In addition, the installed GNSS also contributed on a multi-disciplinary level by supporting other studies in the region where accurate geo-referencing is required.



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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



Paula Matos, Alexandra Oliveira (cE3c)



Research project in Antarctica



PROPOLAR



Livingston Island - South Shetland Archipelago, Antarctica



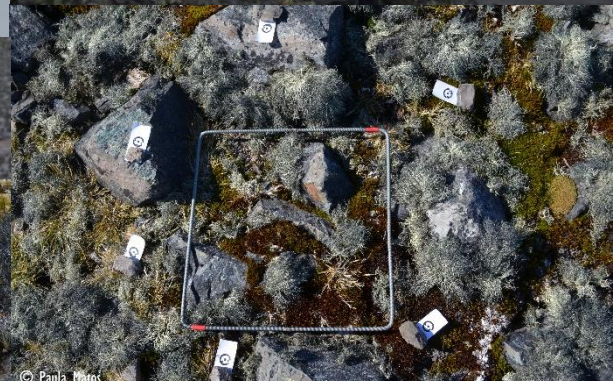
Lichens traits have been used as indicators of climate change with potential to be applied globally. In Antarctica, climate has been changing in a very dynamic way, impacting local ecosystems, and with feedbacks that have a global impact extension. In the Antarctic Peninsula and adjacent islands, lichens and mosses dominate the vegetation and have shown to be highly responsive to these dynamic climate fluctuations. Our objective was to combine for the first time previous knowledge from team members, developing a trait-based lichen ecological indicator capable of anticipating sudden changes in Antarctica climate. For that, lichen trait diversity was sampled and modelled with spatial climate variation; patterns of change were upscaled for larger regions with available high-resolution imagery and for future climate projections. The resulting ecological indicator anticipated sudden climatic changes and signal risk areas.



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

In Antarctica, namely in the Antarctic Peninsula, consistent and fast warming rates (0.32°C/decade) since the 1950s were followed by a drop in mean annual temperature (0.45°C/decade from 1998 to 2014), showing how fast and variable climate dynamics can be. These changes have contributed, for instance, to glacier retreat, and changes in permafrost (permanently frozen ground) properties and dynamics, ultimately leading to its degradation in some areas. This has impacted local ecosystems, and impacts are expected to extend globally. Because climate change in Antarctica has local and global implications, and because of its highly dynamic and variable nature, it is crucial that new approaches capable of giving some kind of early warning detection of the first signs of change at ecosystem level are developed. In the Antarctic Peninsula and adjacent islands, lichens and mosses dominate the vegetation. Lichen growth measured in a small set of species followed recent dynamic changes in Antarctica climate, and aerial high-resolution images of particular lichen species cover were used to track snow cover in the region. In parallel, a lichen trait-based ecological indicator was developed to track climate change effects at the global scale. This proposal combined for the first time previous knowledge, to develop a trait-based lichen ecological indicator capable of anticipating sudden changes in Antarctica climate. For that, lichen trait diversity was sampled and modelled with spatial climate variation. These patterns of change were upscaled for larger regions by calibration with lichen trait patterns obtained from aerial high-resolution imagery available from previous and forthcoming seasons, and for future climate scenarios. We expected the ecological indicator to anticipate sudden climatic changes in the future and to enable us to signal risk areas.

Our goal was to develop an ecological indicator to track and anticipate the effects of climate change in Antarctica using lichen trait diversity. We combined previous regional knowledge on lichens, high-resolution imagery from previous and future seasons in Hurd Peninsula, and new lichen trait data. The specific objectives of the project were: (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) use some lichen species data and their population structure to test its ecological indicator potential to signal effects of temporal climatic fluctuations in permafrost dynamics (focusing primarily in the area of Hurd rockglacier, in False Bay); (iii) calibrate patterns found 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.



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



Ana Mafalda Baptista, Adriana Rego (CIIMAR)



Research project developed in foreign institutions



PROPOLAR • University of Waikato, New Zealand



University of Waikato, New Zealand



Mafalda Baptista



Adriana Rego

Antarctica is characterized by its oligotrophic and extremely dry terrestrial environments. Around it oceanic water upwells bringing dissolved minerals to the surface, and sinks when cold carrying those minerals to the deep. Due to their aquatic and terrestrial lifestyle penguins are thought to play an important role in the biogeochemical cycles and transfer of elements between the ocean and the continent, although the extent and mechanism of that role is still poorly understood. At Cape Adare, one of the largest Adélie penguin colonies, we have gathered preliminary data to start to fill in this gap. In this study we aimed at investigating the level and the extent of nitrogen (N) transfer by a penguin colony at the tip of the Adare peninsula, up until the continent and towards the Transantarctic mountains. To achieve this aim we assessed soil N biogeochemistry and diversity and abundance of soil microbial communities whose activities drive N availability to the terrestrial biota.



© Mafalda Baptista

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

The importance of N for life on Earth and for human activities promoted its study across a wide range of environments. The Intergovernmental Panel on Climate Change (IPCC) recognizes that over the last century human activities have dramatically impacted the N cycle. The assessment of N re-circulation capacity at regional scales is essential for understanding its overall cycle. In extreme habitats N biogeochemical cycle is poorly known and information about microbial communities that mediate key N transformations in Antarctic soils is scarce. In Antarctica, penguin colonies may represent an important input and link for N cycling between ocean and terrestrial habitats. Previous studies have demonstrated influence of Antarctic coastal penguin colonies on the geochemical circulation of elements, but have not undertaken a level of specialization necessary to understand the key pathways of N recycling. In this study we proposed to fill in this gap by investigating the processes of N transfer by one of the largest Adélie penguin colonies at Cape Adare, in northern Victoria Land, Antarctica. The Adare peninsula, being close to the continental shelf edge, provides a connection from Antarctica terrestrial ecosystem, melt-water from receding glaciers, and ocean, which adds value to its study. From the point of view of N cycling this study offered a unique natural environment with extreme gradients, ideal to test fundamental and practical hypothesis concerning the role of microbial communities on N transfer, availability and transformations. From the point of view of microbial ecology this study offered a unique microbial community composition that has been shown to change across a gradient of N concentrations, which will certainly open new perspectives concerning the role of this element in patterns of microbial distribution and succession in terrestrial ecosystems.

This proposal aimed at understanding how the Cape Adare penguin colony influences N circulation and transfer from near shore environments to terrestrial habitats. We evaluated how the gradient of N availability from penguin colony to surrounding terrestrial habitats serves as a link for N exchange and drives differences on N recycling processes and the amount and type of N forms available for the microbial communities. Hence, we proposed to investigate the ecophysiology of soil microorganisms involved in the transformation of N compounds in the Adare peninsula and their role on N biogeochemical cycle by: (i) identifying the main factors (or interactions between factors) responsible for the observed differential spatial distribution of the communities involved in key steps of the N cycle, and (ii) characterizing these communities by targeting N functional genes and by genome sequencing and analysis.



PERMANTAR 2018-19

PERMAFROST AND CLIMATE CHANGE IN WESTERN ANTARCTIC PENINSULA



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Gonçalo Vieira, Carlos Neto and Joana Baptista (IGOT), Mohammad Farzamian (Instituto Dom Luiz – IDL, University of Lisbon, Portugal), Daniel Vonder Mühl (Swiss Federal Institute of Technology - ETH Zurich, Switzerland)



Research project in Antarctica



PROPOLAR • CEG-IGOT • IDL • ETH Zurich



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



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Carlos Neto



Mohammad Farzamian

The Antarctic Peninsula (AP) is one of Earth's regions with strongest air temperature increase since the 1950's. However, the signal is complex and recent studies report a cooling in the north of the AP since 2000\). To evaluate the consequences of climate change in the terrestrial environments, dominated by the presence of permafrost, monitoring and modelling are essential. This project aimed at increasing the understanding of the changes in the ice-free terrestrial environments of Western Antarctic Peninsula (WAP) and 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, we drilled a new 10-15 borehole in King George island and installed a new ERT monitoring system in Deception Island. The former allowed to fill an important gap in knowledge of the largest island of the South Shetlands and allowing to characterize permafrost thermal state and distribution.



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PERMAFROST AND CLIMATE CHANGE IN WESTERN ANTARCTIC PENINSULA

The Western Antarctic Peninsula (WAP) has been one of Earth's regions showing a strongest warming trend up to 1999 with an increase of more than 2.5 °C in the MAAT since the 1950's. Since 2000 an atmospheric cooling trend prevailed, but our data (unpublished) shows that the years of 2016 to 2018 have shown again warming. Several studies have been taking place on periglacial processes and their relation to permafrost in the WAP and the last overview 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. A study showed that despite no increase in MAAT in Deception Island, there was a thinning of the active layer associated with increased snow cover. It is 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 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 the region and support the continuation of our investigations, which are based on the long-term observatories that we have been installing and maintaining since 2000. It is worth mentioning that the interdisciplinary linkage between field observations, remote sensing and modelling in a key area for climate change, resulted in the PERMANTAR observatories being integrated in the ESA GLOBPERMAFROST. These observatories may also link to the Atlantic Interactions Initiative across a latitudinal climatic gradient from the Atlantic to the Southern Ocean.



This proposal built up on the long-term strategy of PERMANTAR for monitoring and modelling Antarctic Peninsula permafrost environments and aimed at continuing research by enabling field access to scientists. Its acceptance is essential for the maintenance of the data-series of GTN-P observatories, which contribute to the Global Terrestrial Network for Permafrost (IPAWMO). PERMANTAR targeted mainly at the SCAR key science priority nr. 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? In the season of 2018-19 PERMANTAR allowed to: (i) install a new 10 to 15m borehole in Barton Peninsula in King George Island; (ii) install a new Electrical Resistivity Tomography Monitoring equipment and soil moisture dataloggers to characterize the active layer dynamics in Deception Island, (iii) upgrade existing boreholes in Deception Island.



PHYTO-NAP

PHYTOPLANKTON RESPONSE TO CLIMATE TRENDS IN THE NORTHERN ANTARCTIC PENINSULA



Vanda Brotas Gonçalves, Marine Environmental Sciences Centre (MARE), University of Coimbra, Portugal



Catarina Guerreiro, Afonso Ferreira (MARE, University of Lisbon)



Research project in Antarctica



PROPOLAR • Programa Antártico Brasileiro (PROANTAR, Brazil)



Marine area off the Antarctic Peninsula (from the Bransfield and Gerlache Straits to the Weddell Sea), Antarctica



Catarina Guerreiro



Afonso Ferreira

The Antarctic Peninsula (AP) is highly considered as a climate change (CC) hotspot. CC impact on phytoplankton has been a priority given their importance in ecosystem functioning. Moreover, chlorophyll *a*, a phytoplankton proxy, is an essential climate variable. This proposal's work plan innovatively uses an interdisciplinary approach that integrates the analysis of *in situ* and remote sensing data to assess the response of phytoplankton to climate trends in the Northern Antarctic Peninsula (NAP). An integrated analysis will be performed, comparing the results from each approach. This project delivered relevant and thorough information on phytoplankton biomass and community composition in the NAP and its changes under recent climate trends which may be useful for future comparisons with other CC-impacted areas. Overall, this project increased the scientific knowledge needed to protect marine ecosystems and minimize adverse impacts of CC.

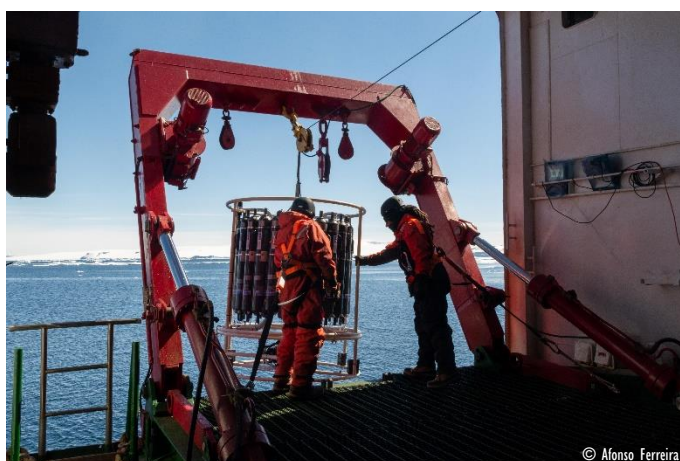


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PHYTOPLANKTON RESPONSE TO CLIMATE TRENDS IN THE NORTHERN ANTARCTIC PENINSULA

It is now virtually certain that atmospheric $p\text{CO}_2$ has increased and the upper ocean has warmed since 1971. Moreover, changes in currents and mixed layer depth are already affecting climate and marine ecosystems. The Antarctic Peninsula (AP) is amongst the regions with the highest reported sea surface temperature increases. Consequently, the ice sheet has been receding, decreasing salinity in the Southern Ocean. Moreover, the AP is a key CO_2 sink region. Climate change (CC) impact on phytoplankton, the basis of marine food chains, has been a priority given phytoplankton relevance to ecosystems. They are also responsible for half of worldwide carbon sequestration. Additionally, chlorophyll a , the proxy of phytoplankton biomass, is an essential climate variable, as it can be monitored in synoptic scales by ocean colour remote sensing (OCRS). Parameters such as cell growth and decay rates are known to respond rapidly to environmental changes. Changes in phytoplankton phenology can also cause deleterious mismatches between plankton blooming and fish larvae hatching. Phytoplankton biomass and community structure are expected to change due to environmental forcing, e.g., changes in nutrients, temperature, salinity and CO_2 . However, most studies fail in integrating results from complementary approaches, being frequently based either on experimental or regional models derived from *in situ* sampling or OCRS. This proposal's innovative nature laid in its interdisciplinary approach that integrates the analysis of *in situ* and OCRS data to detect changes in phytoplankton communities in the Northern Antarctic Peninsula (NAP) caused by CC. Furthermore, this allowed a valuable comparison with phytoplankton off the Western Iberian Coast and their response to CC.

The strategic plan aimed to unravel the following research question: how have phytoplankton changed in the NAP under recent climate trends? To address this question, the overarching aim of this study was to assess the response of phytoplankton to climate trends in the NAP. This work plan took advantage of an on-going project that guaranteed two berths aboard an oceanographic cruise on the NAP (INTERBIOTA). This enabled *in situ* data sampling and access to all necessary conditions for the implementation of the work plan. Several specific objectives were proposed to: (i) understand the summer spatial distribution of phytoplankton biomass and community composition in the NAP, (ii) assess spatio-temporal changes on the community structure and composition of NAP phytoplankton assemblages, and (iii) investigate temporal variation of El Niño-Southern Oscillation-related tropical forcing and Southern Annular Mode-related forcing on the regional climate of NAP during spring/austral summer.



POLAR LODGE

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



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 • University of Bahrain



King George Island, South Shetland Archipelago, Antarctica



Manuel Guedes



Susan Roaf



João Pinelo

The purpose of this project was to design and build a sustainable, low-impact, optimized, modular lodge, to facilitate scientific studies in the Antarctic. This lodge presented a new environmental and sustainable approach to creating resilient structures for the extreme cold combining ancient tent design with leading edge modern technologies and materials. The major drivers for the design included that the structure was: modular; easy to transport and fast to assemble by a small team; resistant to high winds; have minimum impact on the ecosystem; and comfortable.

Built in Carbon Fibre and Biocomposites, it is the first module of its kind to be able to withstand 200Km h^{-1} winds. Scientific data was collected and analysed regarding the lodge's performance. This work also intended to contribute to the scientific efforts of low energy building, within the concerns of climate change and sustainability and to inform design on low cost shelters in extreme conditions.



© Manuel Guedes

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

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. However, research into building designs for extreme cold climates such as the Antarctic is still in its infancy. Information is still necessary on a number of variables and, most of all, built examples of sustainable design, using low-energy strategies and eco-friendly and advanced materials. This proposal aimed at producing such an example: a strong, sustainable and self-sufficient lodge for polar scientists in the Antarctica. The lodge is a pioneering temporary structure that has been shown by detailed modelling to be able to withstand 200 Km h^{-1} winds, a major innovative feature, particularly in light of escalating wind strengths in storm events around the world. Being a high-profile case study, this constituted a unique opportunity to not only promote research in the sustainable building area but also to work collaboratively with industry to fast track developments in the field. Because building in the extreme polar regions is a relatively rare occurrence, the opportunity for replicability is limited. Therefore any principle that is demonstrated must be able to be extrapolated to more common situations, e.g. housing in high latitudes, or for refugee camps in windy climates. Additionally there are huge ethical issues about any development in pristine areas such as Antarctica. This constituted a motivating challenge, with positive impact in terms of the long-term replicability of the solutions for other contexts, such as in cold climate regions in Europe.

The research objectives of the Polar Lodge project were to: (i) analyze building design strategies for the context of the Antarctic, (ii) produce the design of a sustainable modular building for the Antarctic, self-sufficient in terms of energy use, and with an optimized environmental performance, and (iii) test the proposed building, in a chosen location. The mission was carried out in the beginning of 2019, and aimed at mount up the Lodge and monitor its performance, and access energy and comfort performance of different Antarctic Stations (including non-intrusive, brief questionnaires, and measurements with data loggers), in order to complete the study carried out in 2014. The present project was a development of a first prototype, tested *in situ* in 2016. The current design solution for the Lodge significantly enhances the original design of the structure to enable it to comfortably resist 200 Km h^{-1} winds, which was a unique achievement in this market.



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



Pedro Pina, Vasco Miranda (CERENA, University of Lisbon)



Research project in Antarctica



PROPOLAR • CERENA



Protected area visited ASPA 171, Narebski Point, Barton Peninsula, Antarctica



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



Pedro Pina



Vasco Miranda

The main objective of VEGETANTAR was to make a multitemporal mapping of the vegetation in the Antarctic Peninsula (AP) through remote sensing. Although the most adequate satellite dataset covering the AP (Landsat series since the 1970s) does not have enough spatial resolution (30m and worse) to directly identify most of the sparse and patchy vegetated surfaces, their spectral unmixing with the aid of higher spatial resolution imagery can overcome this issue. Therefore, VEGETANTAR proposed to develop and validate a novel 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). The spectral unmixing is modelled first with contemporary datasets in a sequential procedure between adjacent scales (from the highest to the lowest) and then extrapolated to previous dates with only Landsat datasets. Barton was the first test site, which will be followed by more test sites in the next years.



© Pedro Pina

MULTITEMPORAL VEGETATION MAPPING IN THE ANTARCTIC PENINSULA THROUGH MULTISCALE REMOTE SENSING

The warming and absence of warming and the exposure of landscape in the AP due to ice retreat is allowing ecosystems to experience an accelerated dynamics, namely through variations in the active layer, spreading of the vegetation or 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 repeatable and extended coverage of 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 was necessary to incorporate intermediate scales of observation in the procedure.

The main aim of VEGETANTAR was to make a multitemporal mapping of vegetation in the Antarctic Peninsula (AP) through remote sensing since the late 1970s, when availability of satellite images became a reality. But the relatively low spatial resolution of most of those datasets, that anyway cover the entire AP, does not permit direct and adequate identification of the sparse and patchy vegetation covers. A novel methodology, aided by the more recent imagery (UAV and satellite) of higher spatial resolution imagery and based on spectral unmixing procedures, was developed to adequately classify the vegetation. The approach intended to achieve 4 tactic objectives: (i) development and validation with current contemporary multiscale imagery (UAV-WV-Sentinel2-Landsat) and groundtruthing, (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.



REIMUNE

RENAL AND IMMUNE RESPONSES IN ANTARCTIC FISH



Adelino Canário, Centre of Marine Sciences (CCMAR), University of Algarve, Portugal



Adelino Canário, Pedro Guerreiro, Carmen Sousa (CCMAR)



Research project in Antarctica



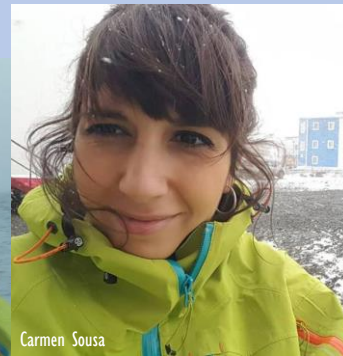
PROPOLAR • Portuguese Foundation for Science and Technology (FCT)



Protected area visited ASPA 171, Narebski Point, Barton Peninsula, Antarctica



King George Island, South Shetland Archipelago, Antarctica



This proposal combined two FCT-funded research projects that explored the physiology and susceptibility to climate change of Antarctic notothenioids. The questions asked in these proposals were related to their ability to adjust in scenarios of environmental and immune challenges. In the first we explored the stress and osmoregulatory responses of Antarctic fish to environmental factors such as temperature and salinity, as variables affected by climate change. Having established the branchial and liver responses, we aimed to complete this project by evaluating the renal capabilities of these aglomerular species. In the second we aimed to study if the immune system in Antarctic fish evolved due to a close interplay between the host response, the microbiota and cold-adaptive evolution. Knowing how temperature influenced immune system helped predict the impact of global warming on host defense and disease susceptibility.



RENAL AND IMMUNE RESPONSES IN ANTARCTIC FISH

The existence of small antifreeze proteins from the absence of kidney filtration mechanisms, prevents their loss into urine. Agglomerular kidneys, while not common, developed in other benthic marine species millions of years before the rise of notothenioids and we believe that it was this inherited feature that facilitated the appearance of antifreeze proteins. Antarctic marine fish are expected to drink copiously and do show high plasma osmolality due to increased Na/Cl levels. However, contrarily to other seawater fish, we have observed very large amounts of urine in their bladders - whether this contributes to maintain plasma osmolality by removing water is unknown, as are the mechanisms that allow urine not to freeze. Having characterized the branchial response to salinity and temperature we aimed to study the renal system under such challenges using cannulated fish. In previous campaigns, we observed that all fish sampled display internal and/or external parasites. Little information exists on the capabilities of the fish immune system at these low temperatures and on the effect that temperature changes may have on its function. Low temperatures exercise a considerable constraint on protein/enzyme structure and function. Innate responses are primarily based on the action of specialized enzymes and cell types that “attack” and degrade the pathogen intruder and in our preliminary data from the last campaign, which needs confirmation, we observed a significant correlation between plasma lysozyme and the number of intestinal parasites. The Antarctic environment harbors a unique community of microorganisms and the evolution of fish immune system in a secluded environment may not be prepared for novel challenges as fluctuations in environmental conditions will likely alter the relative dominance of each species. The impact of the environment and microbiota on Notothenioidei immune system is dissected by fish at different temperature niches.

The objectives for this campaign were related to the specificities of each project, and we tackled them in parallel. One objective was to collect data to complete and extend the aims associated with tasks of project PTDC/BIAANM/3484/2014, by looking into the features and functions of osmoregulatory organs, the agglomerular kidney and the urinary bladder, to tackle a question that arose from *in situ* observations in previous campaigns and that may have wide relevance to the discussion on the role of the urinary bladder in fish. The other was to develop the experimental tasks proposed in project FCT/NSFC/0002/2016, by collecting samples for transcriptome signatures of immune tissue of fish under different challenges and to characterize microbiota mucosal and environmental diversity from fish intestinal section and water samples at different collection points.



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LIST OF OTHER PROJECTS
SUPPORTED BY PROPOLAR

LIST OF OTHER PROJECTS SUPPORTED BY PROPOLAR

The list of projects supported by PROPOLAR, since 2011, is herein presented:

2011-2012

COOPANTAR - DYNAMICS OF INTERNATIONAL COOPERATION IN ANTARTICA

 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

LIST OF 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
-  Kuujjuarapik, 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

LIST OF 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
-  Kuujjuarapik, 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

LIST OF 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




LIST OF 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
-  Kuujuarapik, 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

LIST OF 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




POLARUBI - 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

ARCTISED - 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

LIST OF 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




NITROXTREM 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

LIST OF 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)

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

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




LIST OF 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



FUNDING FOR PARTICIPATION
IN CONFERENCES

PROJECTS 2018-19

FUNDING FOR PARTICIPATION IN SCIENTIFIC CONFERENCES

The annual Call for Polar Research Projects 2018-19 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. Some projects applied for and received this additional funding.

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

PREVIOUS PROJECTS BENEFITING FROM FUNDING FOR PARTICIPATION IN SCIENTIFIC CONFERENCES

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

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 2018-19, received environmental certification, with activities foreseen in the projects considered as having a minor or transitory impact.

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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 2018 and January 2019.



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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 2018-19, the meeting took place on the 15th of November 2018, gathering polar researchers with projects to be carried out in the Arctic and Antarctica. 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.



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Specific information and training on polar safety, such as safety and survival 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. The 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 all involved, the PROPOLAR also covered other topics, such as code of conduct, harassment and sexual harassment, in order to reinforce important principles for professional conduct and acceptable behaviour and thus promote a safe and responsible working environment in these extreme areas.



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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 polar field work. As a rule, two separate sets of clothing are available, one for the Arctic and the other for Antarctica.



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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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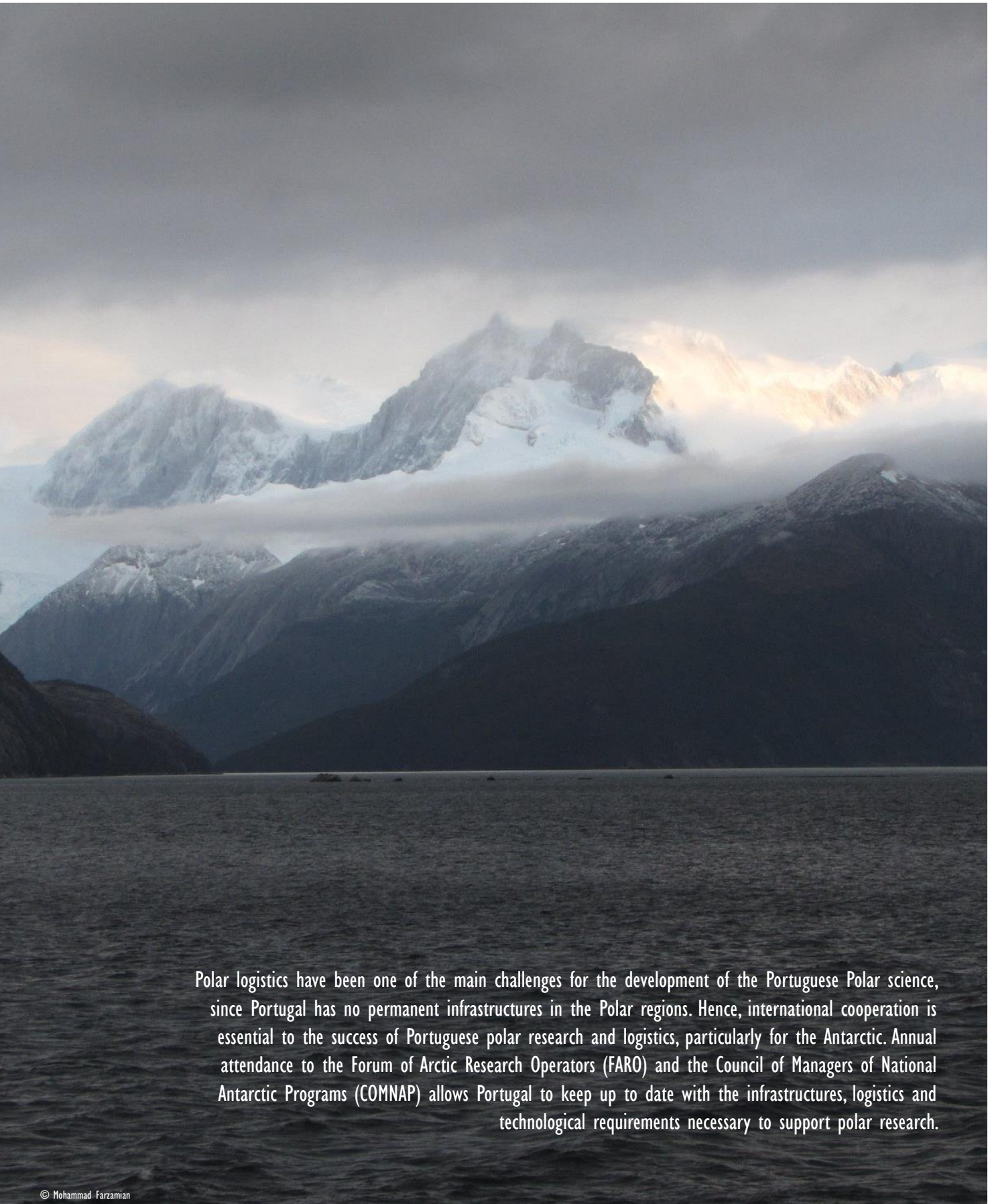
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LOGISTICS



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 is essential to the success of Portuguese polar research and logistics, particularly for the Antarctic. Annual attendance to the Forum of Arctic Research Operators (FARO) and the Council of Managers of National Antarctic Programs (COMNAP) allows Portugal to keep up to date with the infrastructures, logistics and technological requirements necessary to support polar research.

ARCTIC LOGISTICS

Commercial flights are arranged by PROPOLAR, for the transport of researchers to Arctic nations where they develop their projects. The organisation of the field logistics lies with the research teams, such as transport to field sites requiring aircraft or helicopter chartering.



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During the PROPOLAR campaign 2018-19, contacts made by Arctic research teams with the South Iceland Research Centre (Iceland University), Centre d'Études Nordiques (CEN, Canada), the University of Laval (Canada), and the Geological Survey (GSC) of the Natural Resources Canada (NRCan), made the implementation of the work on the ground possible for 4 projects (GEOWHIMBREL IV, NUNATARYUK, PERMAMERC and THAWPOND; see section THE PROJECTS).

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), Bulgaria (Bulgarian Antarctic Institute, BAI), Chile (Instituto Antártico Chileno, INACH), China (Chinese Arctic and Antarctic Administration, CAA-CHINARE), Peru (Direção de Assuntos Antárticos), Republic of South 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 involved shipping equipment and materials to Antarctica, to support the scientific activities. 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 a noteworthy coordination and collaboration effort between CPE, the PROPOLAR logistics team in Portugal and the researchers already in Antarctica.



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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 located between South America's Cape Horn and the South Shetland Islands in Antarctica. During the 2018-19 campaign, Portugal has received support from the vessels BIO Hespérides from the Spanish Navy (managed by Unidad de Tecnología Marina - UTM), NApOc Ary Rongel (H-44) from the Brazilian Navy, BAP Carrasco from the Peruvian Navy, and the Chilean vessel, BETANZOS, freighted by the Turkish ITU Polar research Center (PolReC).

ANTARCTIC LOGISTICS



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

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On the scope of the PROPOLAR campaign 2018-19, support was provided for accommodation of researchers in the Korean King Sejong, Peruvian Machu Picchu, Chinese Great Wall, Spanish Gabriel de Castilla and the Chilean Professor Julio Escudero stations, located in King George Island, the Argentinian Primavera station at Cierva Cove, and the Bulgarian St. Kliment Ohridski and Spanish Juan Carlos I stations in Livingston 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.



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During the PROPOLAR campaign 2018-19, the Portuguese flights were carried out on the 2nd of March 2019. The inbound and outbound flights carried a total of 48 passengers, respectively, from Bulgaria, Chile, Czech Republic, France, Germany, Portugal, Republic of Korea, Spain, Switzerland, Turkey and United Kingdom. A total of 300 kg of additional cargo was transported. In this way, Portugal was able to provide support to partner polar programs, such as the Bulgarian Antarctic Institute (BAI), the Comité Polar Espanhol (CPE), the Instituto Antártico Chileno (INACH), and the Korean Polar Research Institute (KOPRI).

ANTARCTIC LOGISTICS

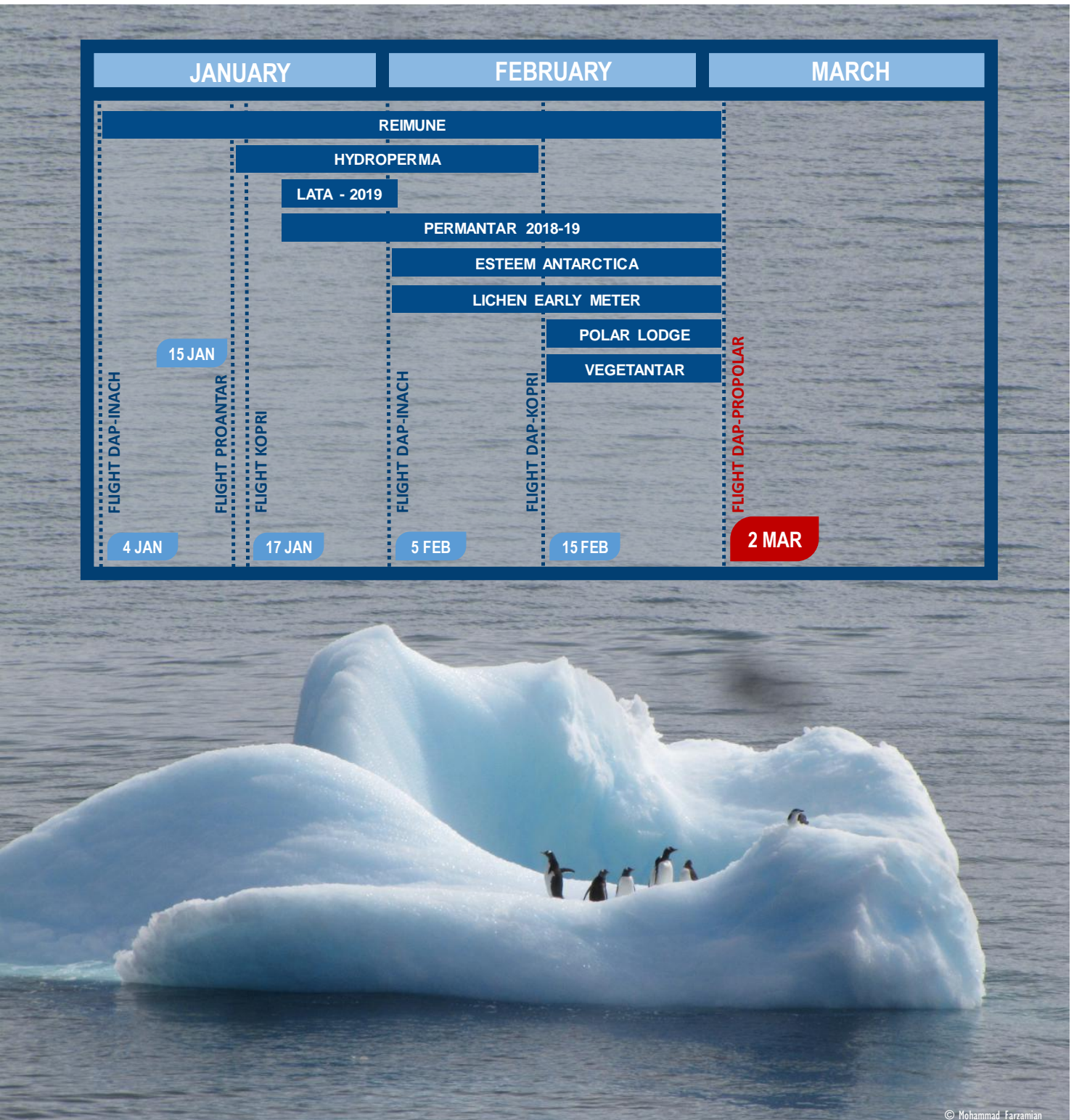
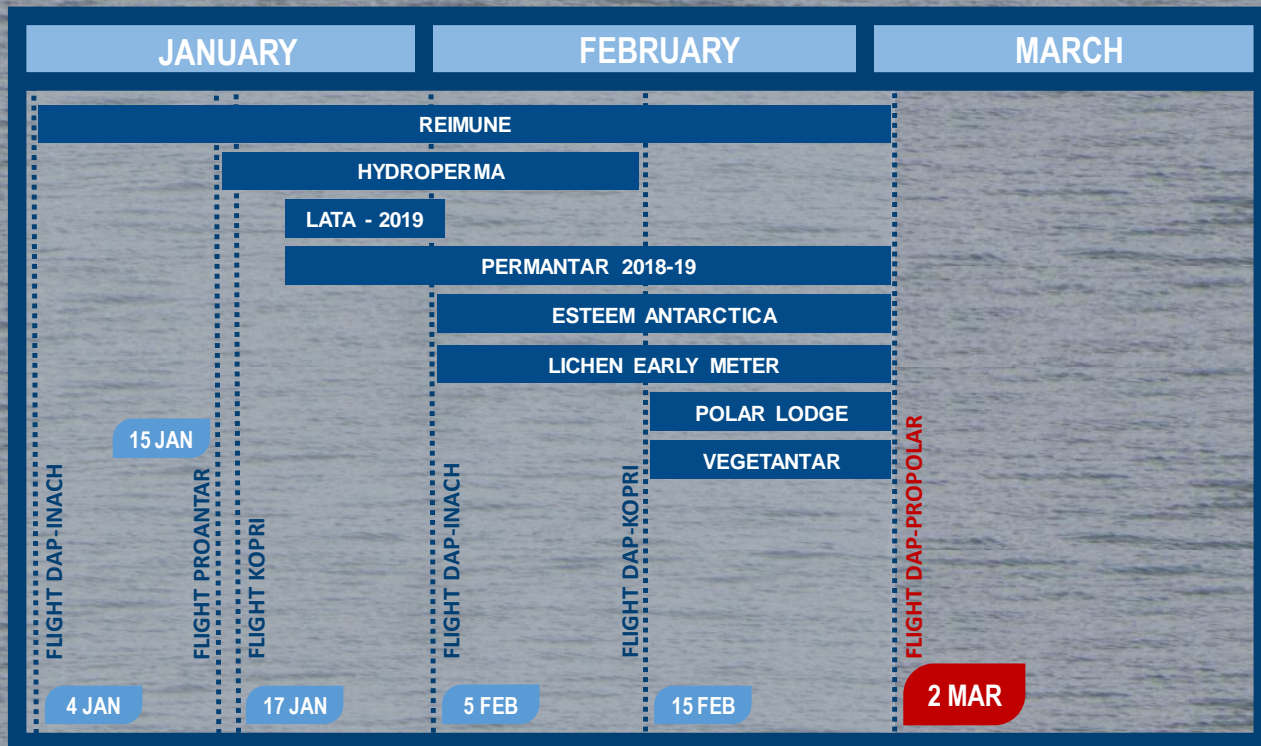
Besides the Portuguese flight, Portuguese scientists were also transported to King George Island on flights of other national Antarctic programmes. During the PROPOLAR campaign 2018-19, Portuguese researchers have benefited from flights managed by INACH, KOPRI and PROANTAR. Once at King George Island, researchers were accommodated in research stations, or transported by ship to other islands in the South Shetlands Archipelago, such as, Deception and Livingston Islands, and Cierva Cove, located on the Antarctic Peninsula.



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ANTARCTIC LOGISTICS

The logistical support received by PROPOLAR, allowed the implementation of 8 projects in Antarctica (ESTEEM ANTARCTICA, HYDROPERMA, LATA 2019, LICHEN EARLY METER, PERMANTAR 2018-19, POLAR LODGE, REIMUNE, VEGETANTAR; 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.



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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 2018-19, the 10th PORTUGUESE POLAR SCIENCE CONFERENCE was hosted by the University of Aveiro (UA), at Aveiro (Portugal), on the 25th and 26th of October 2018.



The conference started with the Opening Session with the presence of Paulo Jorge Ferreira (Rector of the University of Aveiro), Ana Isabel Lillebø (Scientific Coordinator of the Centre for Environmental and Marine Studies), José Xavier (Coordination Committee of PROPOLAR), Germana Santos (Coordinator of the Polar Office of the Portuguese Foundation for Science and Technology), and Joana Pereira (Head of the Conference Organizing Committee). Several communications followed, from APECS-Portugal (José Seco and José Queirós), PROPOLAR (Teresa Cabrita) and Polar Office (Germana Santos), showing how these organizations work and support investigation of polar regions.

PORTUGUESE CONFERENCE ON POLAR SCIENCES

Several topics were covered by invited guests, namely Peder Roberts (Royal Institute of Technology, Stockholm, Sweden) - *Why does History matter to polar research today?*, Rafel Simó (Spanish National Council for Scientific Research, Barcelona, Spain) - *Challenges, priorities and opportunities in Polar research*, and Kirstin Werner (Polar Prediction Office, Alfred-Wegener Institute, Germany) - *Atmosphere exchanges in the Polar Oceans*.



© Joana Pereira



Thematic sessions of oral presentations on the topics SOCIETAL ARENAS IN POLAR REGIONS, WIDE MONITORING EFFORTS IN POLAR REGIONS, POLAR REGIONS IN THE GLOBAL CLIMATE SYSTEM, and CHARACTERIZING BIOLOGICAL RESPONSES IN POLAR REGIONS, performed by the Portuguese polar researchers, with a view to sharing and discussing the newest results obtained from the work developed in the Arctic and Antarctica under the scope of the research projects.

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The conference also hosted the IX Workshop APECS Portugal, focused on Science Communication, and covered different forms of communicating as part of the daily life of a scientist. Natalie Carter (University of Ottawa, Canada), Kirstin Werner (Alfred Wegener Institute, Germany) José Xavier (University of Coimbra, Portugal), Pedro Pombo (Fábrica Centro de Ciência Viva de Aveiro, Portugal), Vítor Paiva (MARE, University of Coimbra, Portugal) and Paulo Santos (Take The Wind, Portugal) participated as invited guests. Lively and interactive sessions clearly pointed out to the importance of training scientists to develop effective communication skills for public communication as a way of strengthening support for science, promoting understanding of its wider relevance to society, and encouraging more informed decision-making at all levels, from government to communities to individuals, and thus make science more diverse and inclusive.

SYMPOSIUM

“POLAR RESEARCH AND EUROPE: NEW CHALLENGES AND OPPORTUNITIES”

POLAR RESEARCH AND EUROPE: NEW CHALLENGES AND OPPORTUNITIES

Simpósio • PARTICIPAÇÃO LIVRE

25 Março 2019 • 9:30 • Centro Académico do Caleidoscópio, Universidade de Lisboa, Jardim do Campo Grande, Edifício CALEIDOSCÓPIO, Lisboa

PROGRAMA

Moderadora: Maria Teresa Cabrita (CEG/IGOT-ULISBOA)

09:30 | Abertura

10:00 | International challenges and opportunities in Polar research, Antje Boetius (AWI)
Significance of Polar research for Spain, Antonio Quesada (CPE)

11:15 | Coffee break

11:45 | EU Polar Research Strategy: Actions and Objectives, Attilio Gambardella (Comissão Europeia)

12:00 | EU-PolarNet's strategic research planning efforts, Nicole Biebow (AWI)

12:15 | Strategy of the AIR Centre and Polar interactions with the Atlantic, Joaquín Hernandez Brito (AIR Centre)

12:30 | Terrestrial Multidisciplinary distributed Observatories for the Study of Arctic Connections (T-MOSAIC), João Canário (CQE/IST-ULISBOA)

12:45 | Portuguese research in the Polar Regions, Gonçalo Vieira (CEG/IGOT-ULISBOA)

13:00 | Encerramento

INSCRIÇÕES: Participação livre, inscrições até 21/03/2019 por email para info@propolar.org

Within the framework of the activities of the Rede Espaço of the University of Lisbon, and organised EU-PolarNet - Connecting Science with Society and the Portuguese Polar Program, the symposium on Polar Science and Europe: New challenges and opportunities, was held at the Caleidoscópio building of the University of Lisbon, on the 25th of March 2019. The symposium was also integrated within the events promoted by the national coordination network PERIN - Portugal in Europe Research and Innovation Network. The symposium aimed to bring together the Portuguese scientific community working in Polar regions, academic scientists, researchers, students and everyone with an interest in polar research.

The symposium also served as a platform to facilitate the exchange of ideas and to promote new opportunities to create and improve synergies in polar science research, particularly for new research teams, young researchers and students.

Specific topics were introduced by Keynote speakers, namely Antje Boetius (AWI, Germany) - *International challenges and opportunities in Polar research*, Antonio Quesada (CPE, Spain) - *The significance of Polar research for Spain*, Attilio Gambardella (European Commission) - *The European polar research strategy*, Nicole Biebow (AWI, Germany) - *EU-PolarNet's strategic research planning efforts*, Joaquín Hernandez Brito (AIR Centre, Portugal) - *Strategy of the AIR Centre and Polar interactions with the Atlantic*, João Canário (CQE/IST-ULISBOA) - *The Terrestrial Multidisciplinary distributed Observatories for the Study of Arctic Connections (T-MOSAIC)*, and Gonçalo Vieira (CEG/IGOT-ULISBOA) - *The Portuguese research in the Polar Regions*.



Antje Boetius



Antonio Quesada



Attilio Gambardella



Nicole Biebow



Joaquín Brito



João Canário



Gonçalo Vieira

PARTICIPATION IN INTERNATIONAL WORKSHOPS

WORKSHOP TOWARDS HARMONISATION OF POLAR INFRASTRUCTURE ACCESS • PLOVDIV 2019

The PROPOLAR participated in the workshop *Towards harmonisation of polar infrastructure access*, organized by Arctic Research Icebreaker Consortium (ARICE), European Polar Board (EPB), EU-PolarNet, Forum of Arctic Research Operators (FARO), Geo Cold Regions Initiative (GEOCRI) and the International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT). The meeting was hosted by the Bulgarian Antarctic Institute (BAI) in Plovdiv (Bulgaria) on the 1st of August 2019. The workshop aimed at exploring best practice examples for improving access to Arctic and Antarctic research infrastructure, by identifying information needs on access requirements, and discussing existing initiatives for improving access to polar infrastructure.



An overview of the Portuguese Polar Program (PROPOLAR) was presented, providing insight on a Polar program without its own infrastructure. Best practice recommendations from PROPOLAR emphasized the importance of networking, both for logistics and science, stressing sharing of information and cooperation as key factors for improving access to Arctic and Antarctic research infrastructure.

WORKSHOP ON EDUCATION AND OUTREACH • PLOVDIV 2019

Presenting *Education and Outreach to highlight the importance of Polar research for Portugal*, the PROPOLAR participated in the workshop *Education and Outreach*, convened by the Council of Managers of National Antarctic Programs (COMNAP), and co-hosted by the Bulgarian Antarctic Institute (BAI) and the Ministry of Education and Science of the Republic of Bulgaria, in Plovdiv (Bulgaria) on the 31st of July 2019. The workshop was proposed in support of the goals of the COMNAP Expert Group on Education, Outreach & Training, in consideration of the current Antarctic Treaty Consultative Meeting (ATCM) Intercessional Contact Group (ICG) on Education and Outreach, and building on previous workshops.

The theme of the workshop “Communicating the importance of our Antarctic activity” articulated the need to showcase and share the best practices used by National Antarctic Programs to promote their Antarctic work through Education and Outreach activities.



HOSTING INTERNATIONAL MEETINGS

5TH EU-POLARNET GENERAL ASSEMBLY • LISBON 2019

The 5th and last EU-POLARNET General Assembly was hosted at the Instituto de Geografia e Ordenamento do Território of the University of Lisbon, from the 25th till the 26th March of 2019. The General Assembly was hosted by Antje Boetius and Nicole Biebow (AWI, Germany) and gathered 50 participants from all over Europe.

Advances made in EU-PolarNet and further actions were discussed, for instance, the design of an Integrated European Polar Research Programme with the participation of all relevant stakeholders, which was one of the EU-POLARNET's most inspiring challenges as at the date of the meeting. Fruitful discussions on the development of white papers on infrastructure access and interoperability, on data management and on meaningful stakeholders engagement in Polar Regions also took place.



EU-PolarNet is the world's largest consortium of expertise and infrastructure for polar research. Seventeen countries are represented by 22 of Europe's internationally-respected multi-disciplinary research institutions.

From 2015-2020, EU-PolarNet has developed and delivered a strategic framework and mechanisms to prioritise science, optimise the use of polar infrastructure, and brokered partnerships that led to the co-design of polar research projects able to deliver tangible benefits for society. By adopting a higher degree of coordination of polar research and operations than has existed previously the consortium engaged in closer cooperation with all relevant actors on an international level.

EU-PolarNet also benefits from its close cooperation with the European Polar Board (EPB), as outcomes from EU-PolarNet will add long-term value to EPB activity in providing strategic science policy advice to the European Commission and other international bodies. A major benefit of the involvement and support of the EPB is that the legacy of EU-PolarNet can be reliably sustained by the Board into the future.

HOSTING INTERNATIONAL MEETINGS

EUROPEAN POLAR BOARD SPRING PLENARY MEETING • LISBON 2019

The PROPOLAR collaborated in the organization of the EPB's Spring 2019 Plenary Meeting at the Instituto de Geografia e Ordenamento do Território, from the University of Lisbon, from the 27th till the 28th March of 2019.



© Renuka Badhe

The European Polar Board (EPB) is an independent organisation that focuses on major strategic priorities in both the Arctic and Antarctic regions. Current EPB membership includes research institutes, funding agencies, scientific academies, and polar operators from across Europe. Its mission is to improve European coordination of Arctic and Antarctic research by optimising the use of European research infrastructure. Multilateral collaborations between members are promoted and a single contact point for the global polar research community is provided. EPB advances the collective knowledge of polar issues, particularly in the context of European societal relevance.



© Renuka Badhe

HOSTING INTERNATIONAL MEETINGS

2ND ARICE GENERAL ASSEMBLY • LISBON 2019

The 2nd ARICE (Arctic Research Icebreaker Consortium: A strategy for meeting the needs of marine-based research in the Arctic) General Assembly was hosted at the Instituto de Geografia e Ordenamento do Território, of the University of Lisbon, from the 28th till the 29th March of 2019. The full ARICE consortium, gathering 40 participants from Europe, Canada and USA, discussed the progress made in ARICE and planned its future activities, such as the next call for ship-time which will open in April 2019.



© Veronica Willmott

ARICE's overall objective is to provide Europe with better capacities for marine-based research in the ice-covered Arctic Ocean. ARICE aims at reaching this goal with the existing polar fleet by:

- Networking

ARICE will develop strategies to ensure the optimal use of the existing polar research vessels at a European and international level. The aim is to establish an International Arctic Research Icebreaker Consortium which shares and jointly funds ship time for scientists on the available research icebreakers.

- Transnational access

ARICE will provide transnational access to four European and two international research icebreakers. Access is granted based on scientific excellence of the research proposals, which researchers need to submit during the application process. The participating icebreakers are: PRV Polarstern (Germany), IB Oden (Sweden), RV Kronprins Haakon (Norway), MSV Fennica (Finland), CCGS Amundsen (Canada), and RV Sikuliaq (United States of America).

- Joint research activities

ARICE will improve research icebreakers' services by working closely together with maritime industry on a so called "ships and platforms of opportunity" program. Through this program, commercial vessels operating in the Arctic Ocean will collect oceanic and atmospheric data on their cruises. At the same time, science and industry will work together to explore new technologies, which can improve ship-based and autonomous measurements in the Arctic Ocean. ARICE will also implement virtual and remote access of data via an innovative 3D Virtual Icebreaker, which will provide real-time information from the Arctic.

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 2018-19, several of these activities were carried out throughout the country. The Education & Outreach efforts activities have been very successful, with Portugal being internationally recognized for the excellence of its polar educational and outreach program.



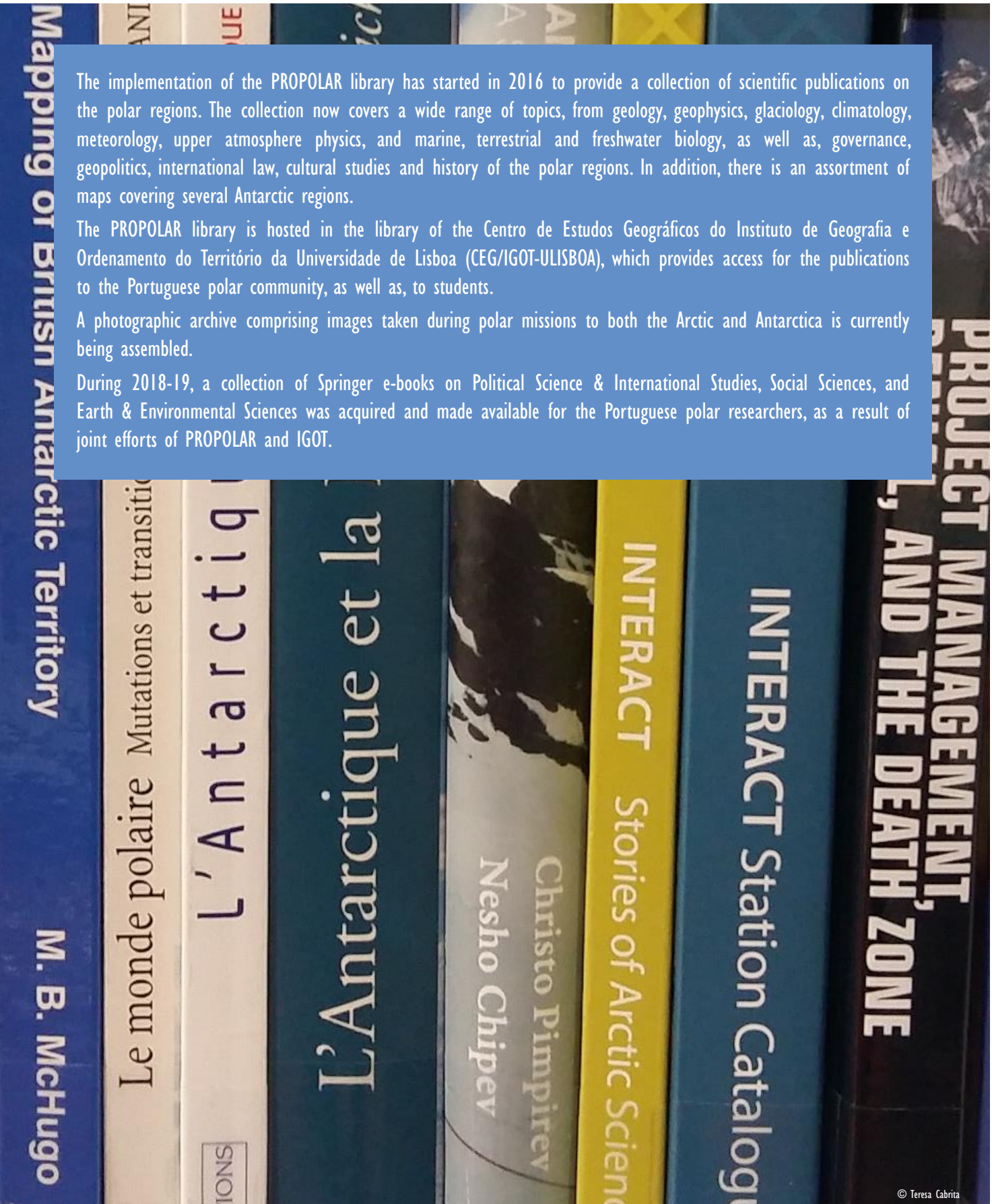
PROPOLAR LIBRARY

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.

During 2018-19, a collection of Springer e-books on Political Science & International Studies, Social Sciences, and Earth & Environmental Sciences was acquired and made available for the Portuguese polar researchers, as a result of joint efforts of PROPOLAR and IGOT.



© Teresa Cabrita

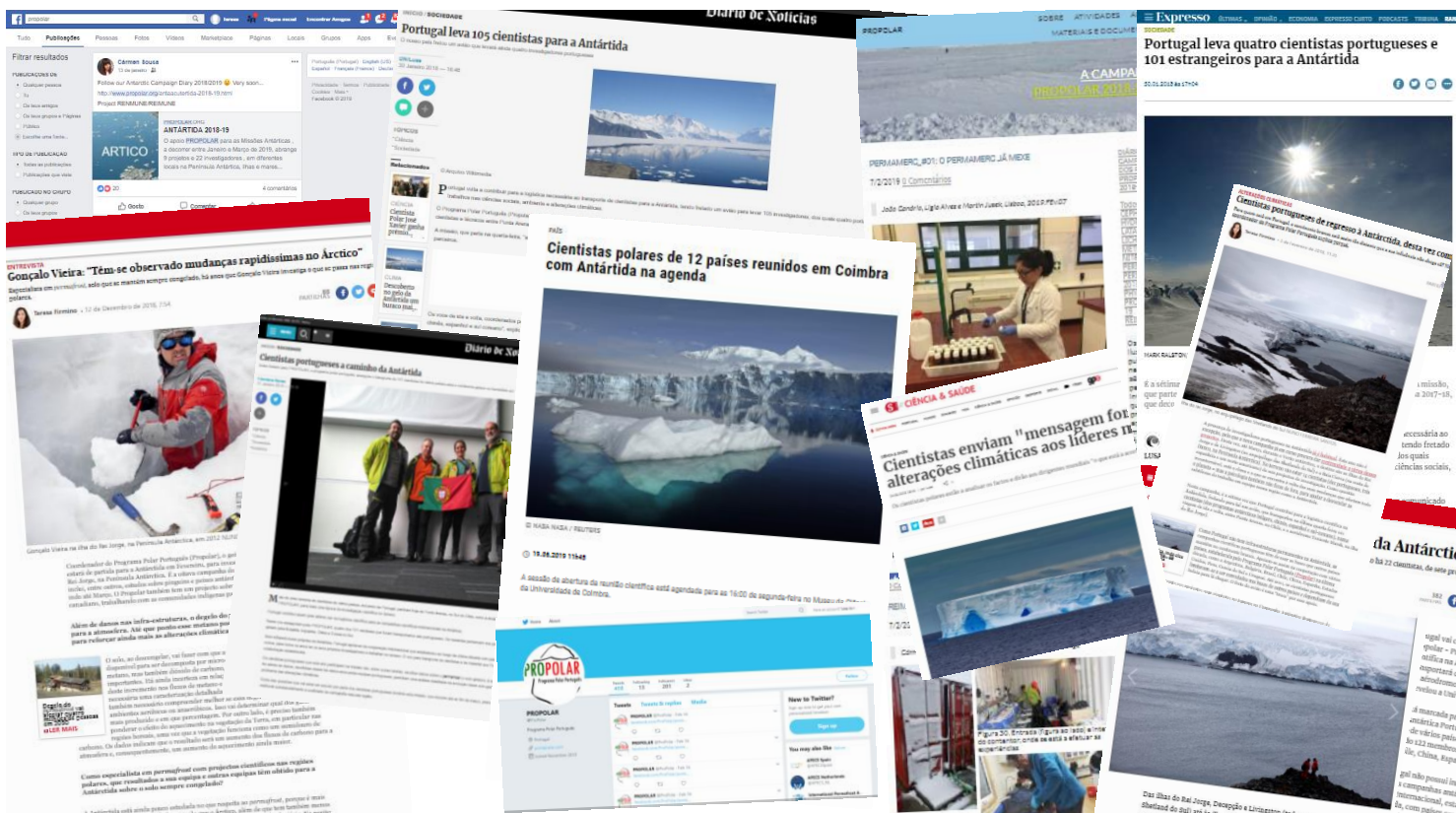
PROMOTING POLAR SCIENCE AND THE IMPORTANCE OF POLAR REGIONS

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 2017-18, 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 given to the Portuguese media, generating articles mostly published in online journals, magazines and newspapers. A face-to-face interview given by Gonçalo Vieira, Teresa Cabrita and a Master's student, Pedro Freitas, focused on a decade of Portuguese polar research and on the scientific and logistic features of the polar campaign, and was broadcasted on the national weekly radio programme called "The days of the Future". The interview entitled "The 10 years of the Portuguese Polar Program - PROPOLAR", aired on the 10th of March 2018, and can be heard through the link: <http://www.rtp.pt/play/p383/e335337/os-dias-do-futuro>.

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/>), a **TWITTER ACCOUNT** (<https://twitter.com/propolar?lang=en>), **FACEBOOK ACCOUNT** (https://www.facebook.com/search/str/programa+polar+portugu%C3%AAs/keywords_search?epa=SEARCH_BOX) and a **NEWSLETTER**, all kept by PROPOLAR, display the activities, events and news related to the Portuguese polar research.







A GLIMPSE INTO 2020-21

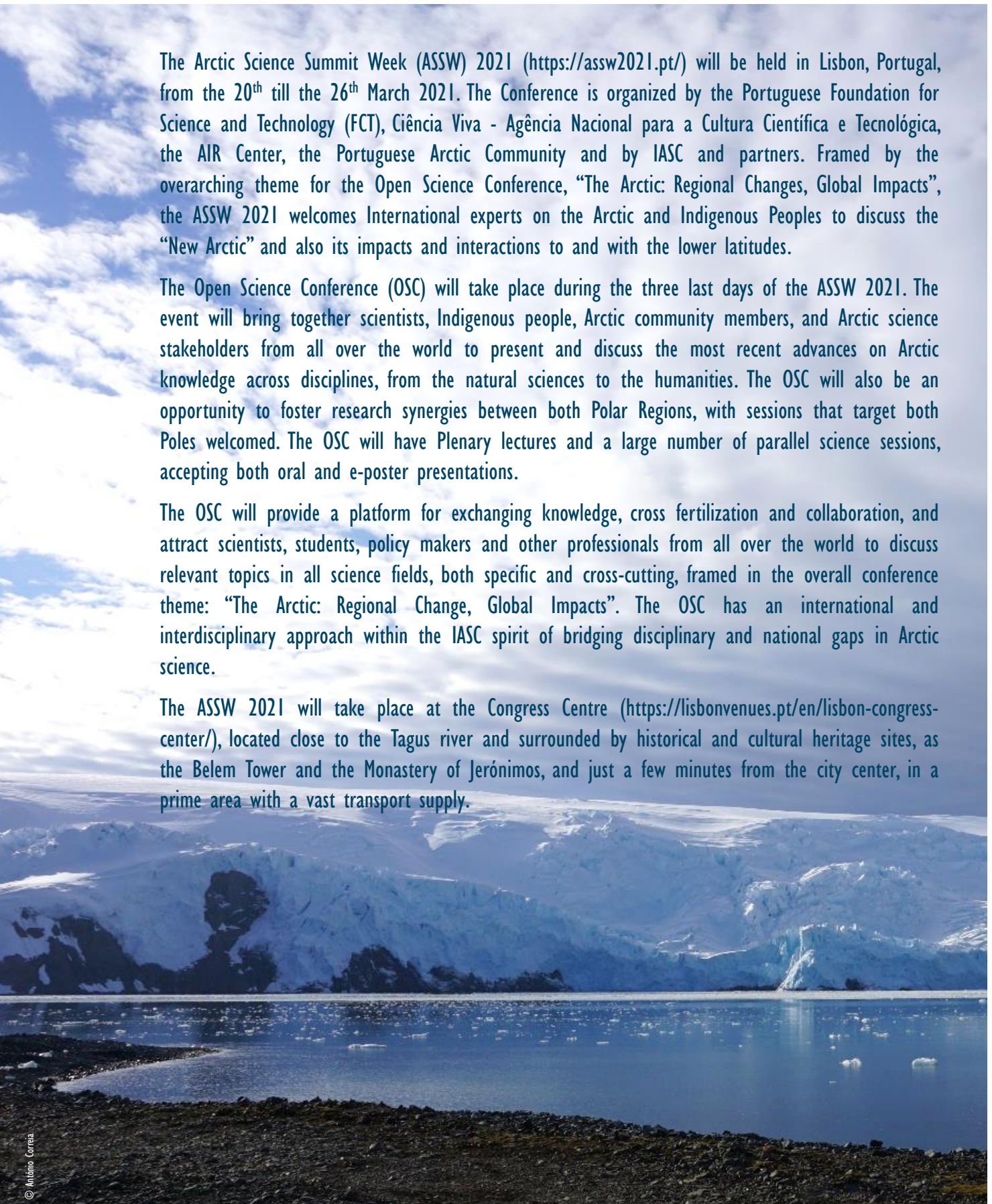
ARCTIC SCIENCE SUMMIT WEEK (ASSW) 2021

The Arctic Science Summit Week (ASSW) 2021 (<https://assw2021.pt/>) will be held in Lisbon, Portugal, from the 20th till the 26th March 2021. The Conference is organized by the Portuguese Foundation for Science and Technology (FCT), Ciência Viva - Agência Nacional para a Cultura Científica e Tecnológica, the AIR Center, the Portuguese Arctic Community and by IASC and partners. Framed by the overarching theme for the Open Science Conference, “The Arctic: Regional Changes, Global Impacts”, the ASSW 2021 welcomes International experts on the Arctic and Indigenous Peoples to discuss the “New Arctic” and also its impacts and interactions to and with the lower latitudes.

The Open Science Conference (OSC) will take place during the three last days of the ASSW 2021. The event will bring together scientists, Indigenous people, Arctic community members, and Arctic science stakeholders from all over the world to present and discuss the most recent advances on Arctic knowledge across disciplines, from the natural sciences to the humanities. The OSC will also be an opportunity to foster research synergies between both Polar Regions, with sessions that target both Poles welcomed. The OSC will have Plenary lectures and a large number of parallel science sessions, accepting both oral and e-poster presentations.

The OSC will provide a platform for exchanging knowledge, cross fertilization and collaboration, and attract scientists, students, policy makers and other professionals from all over the world to discuss relevant topics in all science fields, both specific and cross-cutting, framed in the overall conference theme: “The Arctic: Regional Change, Global Impacts”. The OSC has an international and interdisciplinary approach within the IASC spirit of bridging disciplinary and national gaps in Arctic science.

The ASSW 2021 will take place at the Congress Centre (<https://lisbonvenues.pt/en/lisbon-congress-center/>), located close to the Tagus river and surrounded by historical and cultural heritage sites, as the Belem Tower and the Monastery of Jerónimos, and just a few minutes from the city center, in a prime area with a vast transport supply.



T-MOSAIc - TERRESTRIAL MULTIDISCIPLINARY DISTRIBUTED OBSERVATORIES FOR THE STUDY OF ARCTIC CONNECTIONS

T-MOSAIc is an IASC pan-Arctic, land-based program that will extend the activities that are currently in advanced planning for the IASC flagship program MOSAIc - The Multidisciplinary drifting Observatory for the Study of Arctic Climate. MOSAIc is a multinational year-round study (2019-2020) of the central Arctic Ocean to measure the coupling between atmosphere, sea ice, ocean and ecosystem processes. The aim of the satellite program T-MOSAIc is to coordinate complementary activities that will both aid and benefit from MOSAIc by extending the work to the lands surrounding the Arctic Ocean and to the northern communities who live on those lands.

T-MOSAIc will address the overarching question: what are the implications of changing sea ice, oceanography and climate of the Arctic Ocean for the surrounding land-based geosystems, ecosystems and human systems? The program will focus on hypotheses related to gradients, discontinuities (regime shifts), feedbacks and extreme events. It will place the 2019-20 window of MOSAIc observations in the central Arctic Ocean into a broader temporal and spatial context by synthesizing data records throughout the circumpolar terrestrial environment, with emphasis on new land-based observations throughout the T-MOSAIc year 2020.

T-MOSAIc is managed through an Executive Committee, with scientific direction provided by a Steering Committee. Day-to-day operations are coordinated through the T-MOSAIc Science Coordinator, Mr. Diogo Folhas, who is based at the T-MOSAIc Secretariat at the University of Lisbon.



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PORTUGUESE POLAR PROGRAM ANNUAL REPORT 2019

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