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Domain 1 Marine Protected Area Preliminary Proposal – PART A: MPA Model

Delegations of Argentina and Chile

EN

Domain 1 Marine Protected Area Preliminary Proposal

PART A: MPA Model

On behalf of Argentina and Chile

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Abstract:

This draft is aimed to describe the process for the designation of an MPA in Domain 1 led by Argentina and Chile. The process has resulted in the compilation, analysis, integration and display of a large amount of information, not only contributing to the best science available but also providing a platform for the sharing and visualization of information. We highlight the multinational approach in all stages of the decision making process towards identifying Priority Areas for Conservation (PAC) in Domain 1. A technical description of the software and analyses used for the identification of the PAC is provided. Thereafter, considerations of both ecological and management components are described to finally arrive to a Domain 1 MPA model to be discussed among members during the EMM-2017. The MPA management will be done in accordance with the Objectives of the Convention. Having in consideration all the issues mentioned above, a multinational Research Steering Committee is proposed in order to engage all interested Members in the discussion and development of a Research and Monitoring Plan, thus reaching the best available solution for the management of the proposed MPA, one that takes into account conservation objectives, as well as other ecosystem services, such as krill fishing.

OVERVIEW

This report is aimed to describe the process for the designation of an MPA in Domain 1 led by Argentina and Chile. The process has resulted in the compilation, analysis, integration and display of a large amount of information, not only contributing to the best science available but also providing a platform for the sharing and visualization of information, further improving the decision making process.

The entire data collection and decision-making process were done following a multinational approach, on the occasion of two relevant international workshops, intercessional consultations and supplementary analyses (via data sharing mechanisms).

In order to fully describe the process of the draft of MPA proposal, we will introduce 3 documents:

1- Domain 1 Marine Protected Area Preliminary Proposal. PART A: MPA Model

2- Domain 1 Marine Protected Area Preliminary Proposal. PART B: Conservation Objectives

3- Domain 1 Marine Protected Area Preliminary Proposal. PART C: Biodiversity Analysis by MPA zones

Domain 1 Marine Protected Area Preliminary Proposal.

PART A: MPA MODEL

Content

Background of CCAMLR MPAs

Since 2005, CCAMLR has shown increasing interest in the development of Marine Protected Areas (MPA), seeking the Scientific Committee advice in accordance with articles II and IX of the Convention. The first workshop on MPA set as the primary aim to establish a harmonised regime for the protection of the Antarctic marine environment across the Antarctic Treaty System (ATS), already stating that this may require clarification of the roles and responsibilities of ATCM and CCAMLR in respect of the management of different human activities in the region (SC-CAMLR-XXIV, paragraph 3.52). The development of a system of protected areas was required in order to assist CCAMLR in achieving its broader conservation objectives, obtaining scientific knowledge at a broad-scale: bioregionalisation and also at a fine-scale: subdivision. A few years later, eleven priority areas were identified, and then reviewed and re-scaled into nine large-scale MPA planning domains, to better reflect the scale and location of current and planned research effort, considered to be more helpful at monitoring units (second workshop on MPA in 2009). In 2009, the Convention adopted the first MPA in the South Orkney Islands southern shelf (Conservation Measure 91-03) as a first step towards the development of a representative network of protected areas. Later on, in 2010, to further preserve the significant marine biodiversity of the Convention Area, the Commission endorsed the Scientific Committee's work program to develop a representative system of Antarctic MPAs and one year after, Conservation Measure 91-04 (2011) was adopted, providing a general framework for the establishment of CCAMLR MPAs, including overarching MPA objectives, key elements and limitations of MPA conservation measures, and requirements for management and research and monitoring plans.

Within such a framework, several MPA proposals and advances towards the conservation of marine living resources including rational use have been developed and put forward for the consideration of the CCAMLR Scientific Committee and the Commission. USA and New Zealand presented a joint proposal for MPA in the Ross Sea planning domain. After intense negotiations that lasted over four years, in 2016, CCAMLR finally created the largest MPA in the world, in the Ross Sea region (RSRMPA), thus establishing an important international precedent that once again shows the necessary coexistence of conservation and the rational use of marine resources. In order to continue working towards achieving CCAMLR's objective of creating a representative network of MPAs, other MPA proposals are in discussion at the moment. Australia and France jointly presented a proposal for a representative system of MPAs for the whole East Antarctic planning domain, incorporating input from three consecutive years of work (CCAMLR-XXXIV/30). Germany, on behalf of the European Union, formally presented in 2016aproposal for a Weddell Sea planning domain (CCAMLR-XXXIV/BG/37).

The main objective of establishing a system of Marine Protected Areas (MPAs) in the Southern oceans is to preserve biodiversity. This is achieved by maintaining a healthy ecosystem, and therefore, specific objectives include the protection of benthic and pelagic habitats, ecosystemic processes and the feeding and reproduction areas of key marine species. These ecosystems are important in several ways, including its biogeochemical cycles, their contribution to food security as well as maintaining unique biological biodiversity (Murphy et al. 2013). However, individual MPA should complement each other based on the differential conservation objectives and threats present on each of CCAMLR's Planning Domains.

Domain 1 MPA Background

Climate Change in Domain 1

One of the most productive areas of the Southern oceans is the Southwest Atlantic sector, from the Antarctic Peninsula to the Antarctic Convergence and Scotia Arc, including the South Georgias and South Sandwich Islands. The Antarctic Peninsula is one of the areas that have experienced the most evident effects of global warming (Vaughan et al. 2003). Here, the surface air temperature has increased an average of 3- 4°C and, in particular, the average winter temperatures increased 6°C from 1950 to 2005 (Meredith and King 2005, Turner et al. 2005). During the same period, an increase in the average sea surface temperature was recorded in more than 1°C during summer.

Because of the warming experienced in the region, there have been changes in the dynamics of sea ice; their average extension declined by 40% and duration of ice cover was reduced by 80 days (Ducklow *et al*. 2013, Stammerjohn *et al*. 2003, 2008a,b). It has also decreased the frequency of occurrence of cold years and increased melting of glaciers, while the collapse of several ice shelves was recorded (Skvarca *et al*. 1999, Cook *et al*. 2005). Other consequences that have been observed include changes in atmospheric circulation, increased wind speed, and increased frequency of cloudiness and snowfall.

A surprising aspect of regional climate change is the magnitude of the impact caused by a relatively small change in temperature. The rise of a few degrees of air temperature produces the increase in ocean temperature and can cause large hydrologic changes that affect both the physical environment and the organisms. Increasing freshwater input from melting glaciers has contributed to the seasonal change in species diversity of phytoplankton and, thus, the marine zooplankton (Moline *et al*. 2004, McClintock *et al.* 2008). In addition, the decline in winter sea ice modifies the variety and regional composition of phytoplankton, which favors the proliferation of salps in detriment of krill. Krill recruitment has been linked to years of heavy sea ice during the winter (Fraser and Hoffman 2003), and it has been proposed that both the decrease in the extent and the duration of ice during the winter are the cause of the decline in krill abundance in the Antarctic Peninsula region (Atkinson *et al.* 2004). Because of the key role that krill plays in the Antarctic ecosystem, negative effects produced by climate change may cascade to the trophic web and hence, to the entire ecosystem. Alternatively, these changes also affect top predators; either by the loss or gain of critical habitat such as the territory used during reproduction and/or by modifying foodwebs, having a direct impact on birds and mammals feeding habits. Either way, the reduction of the sea ice is likely to affect the reproductive success of ice-dependant species, noting that species that do not depend on sea ice could benefit (Forcada 2007).

According to the Expert Group on Antarctic Climate Change and the Environment (ACCE), the warming of the climate system is unequivocal: there is increasing evidence showing that the atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased (IPCC 2013). In agreement with Conservation Measure 91-04, the development of conservation strategies for the marine living resources, particularly the designation of a representative system of MPAs, is of particular importance in maintaining the ability to adapt in the face of climate change.

Human activities in Domain 1

While climate change effects are of particular importance for the conservation of the Antarctic marine living resources, other activities need to be taken into account when designing conservation strategies. In Domain 1 several human activities contemplated within the Antarctic Treaty System take place simultaneously. Krill fishing and tourism, along with logistic/scientific activities, need to be considered in the decision making process in order to increase the efficacy in the application of the conservation strategies.

Krill Fishery activity began in 1961 but it became more active by the 1970s. As the fishery industry developed, its fishing location switched from the Indian Ocean to the Atlantic Ocean sector, where it focussed almost entirely since the early 1990s. In the past 10 years and most likely due to the decrease of sea ice extension, the spatial distribution of the fishery has been moving to the south, where nowadays it is mainly concentrated in i) the region of the Bransfield Strait/Mar de la Flota off the Antarctic Peninsula, to ii) the northwest of Coronation Island, and to iii) the north of South Georgias Islands (Fishery Report 2015). In this area, krill fishery industry is regulated by CCAMLR through Conservation Measures 51-01 and 51-07, in which precautionary limits and trigger levels are established as 'decision rules' to determine what proportion of the stock can be fished while still achieving the Convention objectives.

DOMAIN 1 MPA Process

All data use in this process comes from a variable range of sources that not only comprise data from CCAMLR domains but also from the wider community, including public global databases such as the Global Seafloor Geomorphology dataset (www. bluehabitats.org), KrillBase (Atkinson et al. 2017), and the U.S. National Snow and Ice Data Center (NSIDC), among many others.

Spatial data layers that were included in the analyses were provided on the basis of cooperation among Members and in agreement with experts on the occasion of several international workshops, intersessional consultations and supplementary analyses (via data sharing mechanisms). They represents the best science available gathered through the entire MPA process up to March 2017.

Main outcomes of the I International Workshop for Domain 1 (Valparaiso-Chile, 2012)

- Data compilation and agreedlist of conservation objectives to be included in the analysis
- A definition of the cost-layer to be included.
- A recommendation on the analysis and software to be used for aide on identifying priority areas for conservation.
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The report of the meeting (WG EMM 12/69) can be found in the Domain 1 e-group.

Data sharing: Before the Second Iinternational Workshop, and in line with WG-EMM recommendation in which members are encouraged to develop different preliminary activities in their own countries (WG-EMM 2014, para 3.25), the data files were shared through a CCAMLR e-group. Examples of these activities include national workshops carried out by Argentina, Chile, the USA and the UK and aimed to (i) compile new data, (ii) discuss different conservation objectives, (iii) analyze penguins' habitat modeling and,(iv) identify high priority areas for conservation within Domain 1. All data is available at https://groups.ccamlr.org/d1pg/

Main outcomes of the II international Workshop (Buenos Aires, Argentina, 2015)

- Compilation and review of all available data for Domain 1.
- Review of target levels for each conservation object.

- Compilation and review of all available data on human activities.
- Discussion of parameters involved in estimating the cost layer related to human activities.

This information is available the Report of the Second International Workshop for Domain 1 [WG-EMM 15/42], which can be found on the Domain 1 planning e-group.

At that time, two objectives of the workshop remained incomplete:

- (1) Development and analysis of alternative MPA scenarios using Marxan.
- (2) Developing of a Draft Proposal with the identification of preliminary areas for consideration of SC-CAMLR.

Data review and data sharing (Before WG-EMM 2016 held in Bologna, Italy)

• Domain 1 MPA GIS database, including layers for Conservation Objectives and Marxan Costs were uploaded for all Members consideration within the Domain 1 planning e-group at https://groups.ccamlr.org/d1pg/.
• Domain 1 MPA Marxan database, including input files for running Marxan, were uploaded in the Domain 1 Planning e-group (https://groups.ccamlr.org/d1pg/).

Informal workshop on Domain 1 MPA (Bologna-Italy 9th July 2016)

In order to show the progress made from 2015 to 2016, and to fulfil the multinational commitments made at the II International Workshop, an informal workshop was held with the following objectives:

- To introduce alternative/possible scenarios according to what was discussed during the II International Workshop.
- To introduce and integrate different analysis, views and experiences performed by other Members into Domain 1 MPA designation process.

Regarding these objectives, there were three presentations introduced and discussed at the workshop, all of which complemented each other. The first presentation, introduced by Argentina, described the technical progress on Marxan analysis, following the agreement made during the previous year at the international workshop in Buenos Aires. The second presentation was introduced by the UK and described Marxan outcomes when only specific benthic conservation features were considered. The third presentation, by Adrian Dahood from the U.S., introduced the use of ecosystem modelling (Ecopath), which incorporates trophic relationships into the MPA planning process for the Western Antarctic Peninsula Region. Data and information for these analyses was available at Domain 1 Planning e-group.

The general agreements of the Informal workshop were:

Related to technical progress, several discussions were held and aimed to seek advice on the next stages of analysis.

<u>1) Advice on target protection levels: </u>several scenarios testing conservation targets levels were run in order to show how this parameter influences the selection of priority areas for conservation.

During the Informal Workshop, it was agreed that medium target protection levels were going to be used in final Marxan analysis as they better represent the protection sought within Domain 1 MPA.

<u>2) Advice on fishery cost layer</u>: several other scenarios testing the influence of the krill fishery cost layer were presented at the Informal Workshop. It was shown that the variable selected

to represent the krill fishery and its range had a strong influence in the selection of priority areas for conservation. It was agreed to seek for the WG-EMM-16 advice on this matter.

During the EMM 16, advice specifically related to the fishery cost layer was sought, to better represent its spatial and temporal variability, including the utility to further split krill fishing time period matching predators-prey seasonality, for instance, during breeding and non-breeding distributions. The Working Group agreed on the use of a 3-year period for the most recent krill fishing activity (current krill fishing pattern), extending it to 10-year periods prior to current fishing pattern (historical krill fishing patterns) [Report of EMM 16 para. 3.19]

<u>3) Overlap between Domain 1 and 3:</u> it was agreed to extend data layers from Domain 1 into a 30km buffer zone through Domain 3, and to run Marxan analysis to identify priority areas for conservation within the buffer to help validate analysis done within the Weddell Sea MPA process.

Until the Data sharing CCAMLR website reaches in its final version, Domain 1 MPA data and other relevant information (WG-EMM documents) are shared through Domain 1 MPA Planning e-group.

New Developments from July 2016 to April 2017

A. Sensitivity analysis and analyses by zone in order to interpret the conservation objects that have more influence in the identification of priority areas and MPA model (see Domain 1 MPA proposal – PART C)

B. Inclusion of the border area between Domains 1 and 3 as validation of independent analysis;

C. Technical adjustments in the identification of critical habitats for mammals and birds, to better improve their spatial representation; (See dataform objective 5c)

D. Temporal-spatial analysis of Domain 1 krill fisheries, with the aim of identifying relevant areas, as well as the areas where krill dependent predators and preys overlap.

<u>B) Overlap between DOMAIN 1 and 3</u>

All relevant conservation objectives layers were extended to the 30 km buffer zone into Domain 3 and Marxan analyses were performed with this new data set. We found that priority areas for conservation are being selected around the north tip of the Antarctic Peninsula, including areas to the east into the buffer zone between domains, suggesting that both MPA processes (Domain 1 and Weddell Sea) independently identify those areas as important for conservation. (See Annex 1).

<u>D) Temporal-spatial analysis of Domain 1 krill fisheries (for further details see WG-EMM-17/XX):</u>

Several analyses were performed to understand the spatial and temporal variability of the krill fishery in the Domain 1. Krill fishery hotspots were identified and results proved that this fishery varies intra- and inter-annually. Moreover, krill catches also change across time and space. The analyses concluded that the development of a single krill fishing cost layer to be included in the Marxan analysis is not feasible, as it might not adequately represents current or future fishing patterns for Domain 1.

It is important to take into consideration the areas that might be more resilient to future condition in the Climate Change context. Simulations are being conducted in order to estimate favourable nursery areas for Antarctic krill assessing how the effect of projected environmental variation, including increased temperature and winds, enhanced transport of CDW, may alter circulation pathways and hence advection of krill larvae and the distribution of krill along the WAP shelf. Results obtained from this modelling study conducted by Chile (Andrea Piñones, UACH/IDEAL) will be presented during next SC-CAMLR meeting in Hobart (October, 2017).

In addition, the involvement of experts in order to assess current and future ice dynamics will be important for future discussions about the management of different area. Further considerations on this issue could be presented during next SC-CAMLR meeting in Hobart (October, 2017).

IDENTIFICATION OF PRIORITY AREAS FOR CONSERVATION

TECHNICAL ANALYSIS

The Domain 1 MPA planning process used the Marxan software (WG-EMM 12/69), a widely used decision-support tool that is based on systematic conservation planning and assists in the process of protected area system design (Ball et al., 2009). Marxan efficiently identifies priority areas for conservation where spatial features are captured based on their established conservation targets.

Conservation objectives

Eight conservation objectives comprising 143 spatial layers were used in the analysis for the identification of Priority Areas for Conservation (PART B, Annex 2, Table A). Due to the intrinsic differences among spatial features based on the various objectives they seek to protect, variables defined to run Marxan differ. Most variables were directly related to the area that each spatial feature occupy in Domain 1 (conservation objectives 1, 2, 3, 4, 6, 7 and 8); meanwhile in some cases the variable was related to the intensity of use of a determined area (conservation objective 5). Conservation target for each spatial layer was defined and agreed by experts (WG-EMM-15/42, Annex 1).

The Southern Shelf South Orkney Islands MPA (SS SOI MPA), Vulnerable Marine Ecosystems (VME), and Antarctic Specially Protected Areas (ASPA) and Antarctic Specially Managed Areas (ASMA) with marine components (ASPAs 144, 145, 146, 149, 151, 152 and 153; ASMAs 1, 4 and 7), were all “locked-in” in Marxan analyses to allow for protection already given by these areas.

Cost layer

Although Marxan is able to incorporate human activities in the process of identifying priority areas for conservation, the changing spatial-temporal variability in krill fishing activities was deemed to be a constraint in the development of a single cost layer that adequately accounted for fishing dynamics (see WG-EMM-17/XX). According to this, the Domain 1 MPA planning process has used a fixed-value cost layer that does not incorporate data on krill fishing. Nevertheless, krill fishing catch and effort information has been an integral part of this preliminary proposal and has been considered during the definition of the MPA model and its management zones.

Calibration

Marxan results highly depend on appropriate calibration of its parameters (Ardron et al., 2010; Ball et al., 2009). Extensive analyses were performed pursuing the most adequate values for BLM (Boundary Length Modifier) - that accounts for the compactness of the design reserve -, SPF (Species Penalty Factor) - that contemplates penalties for not meeting protection targets -, and NUMITNS/NUMREPS (Number of Iterations/Number of repeat runs) – where both ensure that enough optimal solutions are found; please refer to the above references for further details on these parameters. Domain 1 MPA planning process used the following values for final runs: BLM=0.03, SPF=11.68, and NUMITNS=1e7, NUMREPS=100, based on calibrations performed using ZONAE COGITO (Watts et al., 2011).

RESULTS

Final Marxan run identified Priority Areas for Conservation (PAC) in Domain 1 (Fig. 1). These PAC were identified based on the frequency selection of planning units, e.g. the number of times a planning unit was selected as part of a good solution from all repeat runs. Interestingly, PAC seem to be rather consistent among runs, likely associated with an adequate calibration (note the low dispersion in PU frequency selection in Fig. 1).

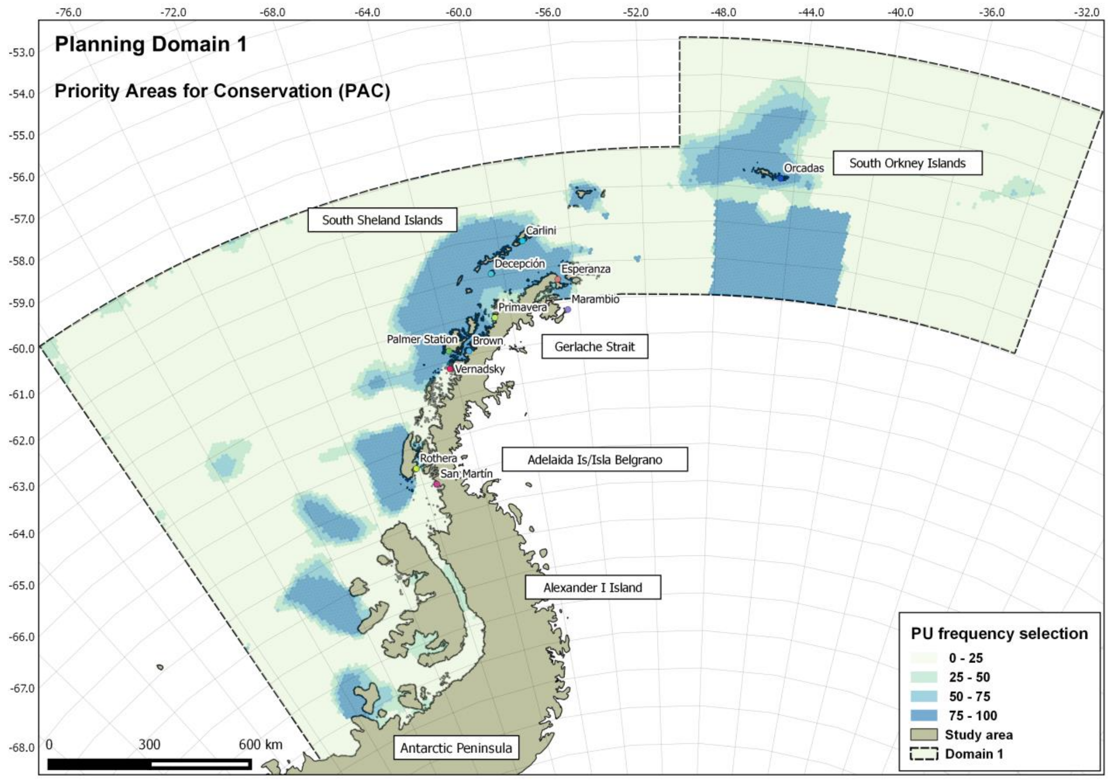

Figure 1: Location of Priority Areas for Conservation (PAC). Planning Unit (PU) selection frequency after performing 100 Marxan repeat runs. South Orkney Island Southern Shelf MPA was locked in into the analysis, so conservation objects already cover by the area were considered.

Although these PAC captured spatial features based on their established conservation targets, it is generally complicated to protect all the areas identified by Marxan, even more so when the distribution of spatial features is complex.

The process then requires the design of models that are based on the results of Marxan and incorporate other relevant information. In the following section, we provide the rationale behind the construction of the Domain 1 MPA model.

ECOREGIONS

Ecoregions are large geographical areas characterized by the uniqueness of their morphology, geology, climate, flora and fauna. This ecological division has also been used in discussions and has led to the partition of relevant data layers. So far, it has been distinguished the ecoregion of South Orkney Islands (48.2), the Northwestern Antarctic Peninsula and the Southwestern Antarctic Peninsula for objective 1 (benthic ecoregions), objective 2 (pelagic ecoregions), objective 5 (breeding colonies), objective 6 (fishes) and objective 8 (canyons) (WG-EMM 15/42). As to keep in line with previous agreements, and to clarify the MPA designation rationale, Domain 1 can be thought in terms of these ecoregions and further divided based on fishery management and Climate Change.

The first specific division is between FAO statistical subareas 48.1 and 48.2. Thus, we incorporate into the process an ecological and a management division. This, in turn, will facilitate management strategies for both subareas.

The second specific division is between the north and the south of the west Antarctic Peninsula, and takes into consideration the effects of Climate Change. The limit of 65° between North WAP (NWAP) and South WAP (SWAP) was decided following Steinberg et al. (2015). The authors demonstrated the existence of a latitudinal gradient along the WAP wherein the south the climate is colder and drier (continental climate) while in the north, the climate is warmer, mostly maritime (Ducklow et al. 2013). In the WAP this gradient has been observed in Anvers Island with an ice free season while in the south of Marguerite Bay, the ice persist more than 7.5 month.

It is well known that the western Antarctic Peninsula is one of the areas that has experienced one of the most evident changes in air and water temperature since the second half of the 20th century (Convey et al. 2009; Turner et al. 2009, Meredith and King 2005).Since the 1950's, air temperature has warmed by 3^{o}C and surface seawater by 1^{o}C (Meredith and King 2005; Clarke et al. 2007). The Antarctic Peninsula is expected to continue to experience some of the most rapid climatic warming on the planet, with a further increase in seawater temperature of 2^{o}C predicted over the next 100 years (Vaughan et al. 2003; Meredith and King 2005, IPCC 2014). Marine communities in Antarctica are considered climate-sensitive due to their high regional heterogeneity and uniqueness (Grange and Smith 2013) and the current and projected changes in air and water temperature and ocean acidification (OA) on the Antarctic Peninsula constitute potentially major threats to these communities that may not only result in altered species distributions, community composition and food web structure, but also ecosystem functioning (Berg et al. 2010). In this regard several studies have identified threats at different levels (individual/species, community and ecosystem level).

Considering the importance of Antarctic krill as key species in the Antarctic marine food web, the effect of Climate Change can have important implications. In this regard, several studies have assessed the effects of factors such as OA and increased temperature on reproduction and physiology of Antarctic krill (Kawaguchi et al. 2013, Cascella et al. 2015). In addition Cook et al. (2016) recently demonstrated the importance of mid-ocean temperature influencing glacier in the WAP, which can have important implications as glacial melting and consequent increased occurrence of suspended particles in the water column can be detrimental for krill (Fuentes et al. 2016), hence cascading to the entire food web. A recent study addressed the negative consequences of the combined effects of different stressors such as increased water temperature, changes in timing and covers of sea ice, and reduced chlorophyll a availability in krill habitats (Piñones and Fedorov 2016). This type of approach highlights the importance of improving our knowledge about climate change and its effects not only on Antarctic species, but also on processes and ecosystems.

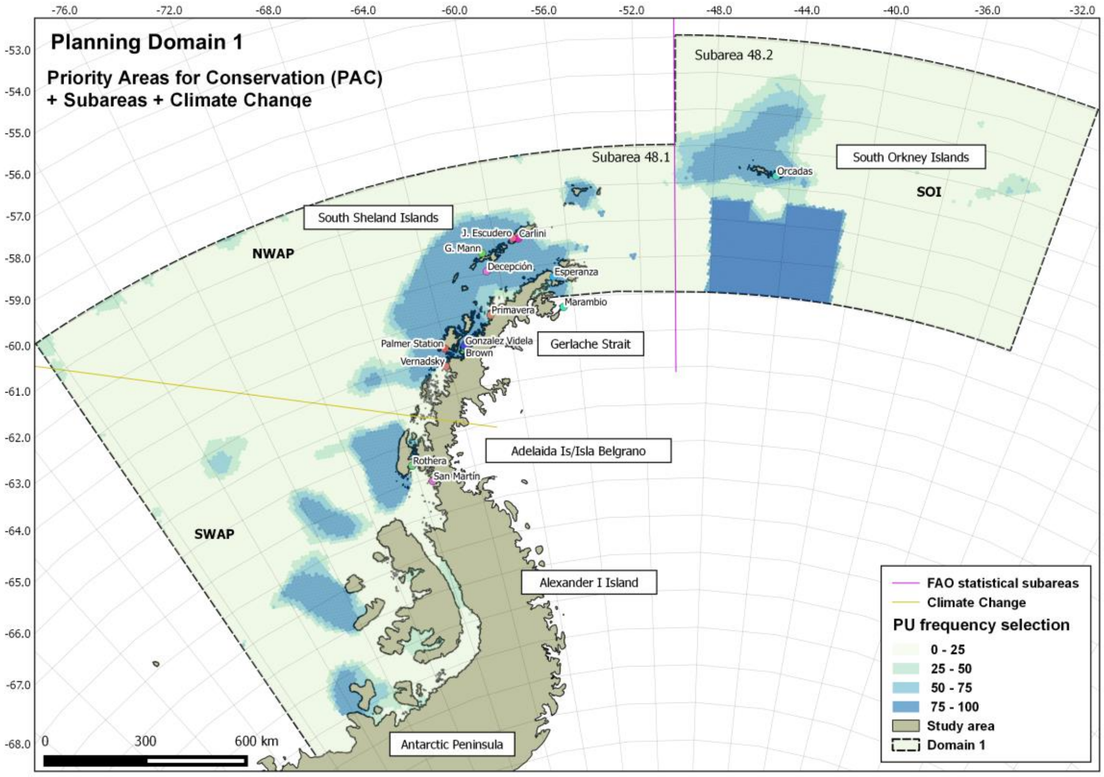

Figure 2: Priority areas for conservation considering the three distinguished ecoregions: South Orkney Islands (SOI), northwestern Antarctic Peninsula (NWAP) and southwestern Antarctic Peninsula (SWAP). Specific divisions are: 1) between Subareas 48.1 and 48,and 2) at approx.66ºS,to divide between North and South of the Antarctic Peninsula.

DOMAIN 1 MPA MODEL

Considering the divisions already explained and the priority areas for conservation identified with the analysis, a Domain 1 MPA model was built to capture variability and provide preliminary boundaries (Fig. 3). In this regard, 3 areas were identified in SWAP (SWAP-Emperor, SWAP-Alexander I Is. and SWAP-Marguerite Bay), one in NWAP (Foraging Grounds) and one in SOI (Benthic).

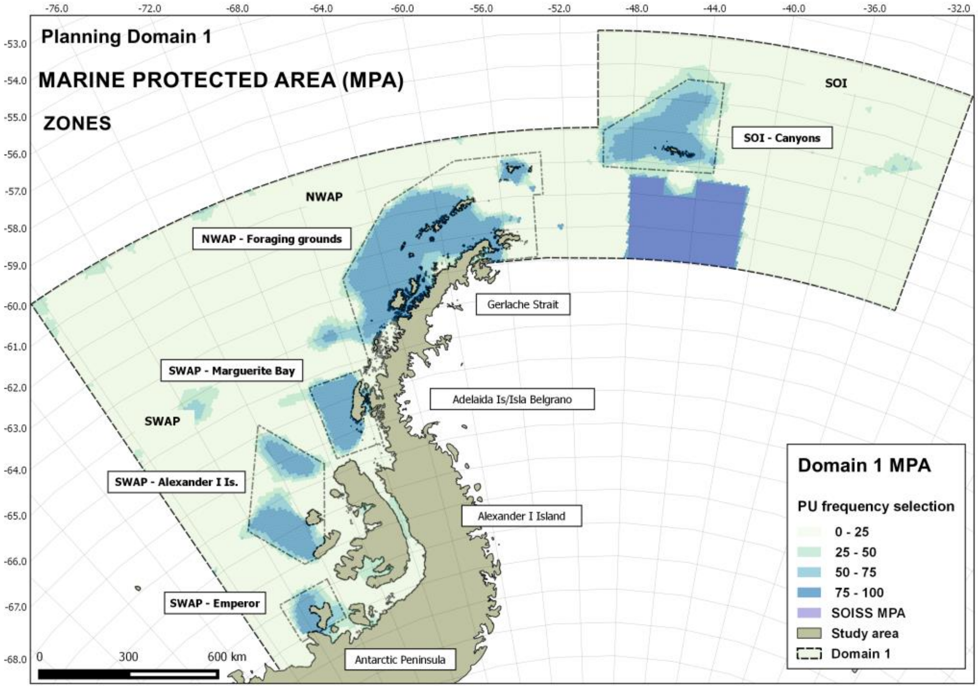

Figure 3: Domain 1 MPA model in relation to the priority areas for conservation. Three zones are identified in SWAP, and one in both NWAP and SOI.

A detailed analysis by zone was performed to identify which conservation objectives are covered by each zone (Fig. 3 and see Domain 1 MPA proposal – PART C 17/XX). Below, we provide a summary with the main results.

South West Antarctic Peninsula (SWAP): composed by 3 zones

SWAP-EMPEROR- It covers approximately 21000 sq km and mainly protects the emperor colony located at Smiley Island and important benthic habitats located at the Antarctic Peninsula shelf. Over 50% of the targets are also met for several pelagic bioregions and large-scale pelagic ecosystem processes such as polynyas and sea ice extension during summer **(**see Domain 1 MPA Proposal – PART C. Fig 3**)**

SWAP-ALEXANDER I IS- It covers approximately 82,000 sq km and mainly protects, several important benthic habitats, almost 40% of the important pelagic bioregions, large-scale pelagic ecosystem processes such as southern parts the Antarctic Circumpolar Current front, important areas for the life cycles of fishes and krill by protecting occurrence areas for exploited fish species and krill nurseries in the Bellingshausen region respectively **(**see Domain 1 MPA Proposal – PART C Fig. 4**)**

SWAP-MARGUERITE BAY- It covers approximately 38,000 sq km and mainly protects few benthic (Canyons and cross shelf valleys) and pelagic bioregions (polynyas margins and shallow shelf areas); important areas for birds and mammals, particularly associated with breeding foraging distribution of Adélie penguin; parts of the distribution of crystal krill and over 50% of the non-breeding foraging distribution of killer whales type B1; spawning/early stages habitat fishes are also protected at some extent (see Domain 1 MPA proposal – PART C**,** Fig. 5).

North West Antarctic Peninsula (NWAP):

NWAP-FORAGING GROUNDS- It covers approximately 215,000 sq km and comprise the protection of a large quantity of conservation objects but it is mainly characterized by covering important areas for birds and mammals, including breeding foraging distribution of fur seals, and Adélie, chinstrap and gentoo penguins; and non-breeding foraging distribution of humpback, minke and killer whales (types A, B1 and B2), and Weddell and leopard seals (see Domain 1 MPA proposal – PART C**,** Fig. 6). It also protects important areas for fish life cycles such as spawning/early stages habitat and occurrence areas for exploited species; and important areas for zooplankton life cycles, including the Gerlache and Weddell krill nurseries and the section of the Circumpolar Deep Water located in the Bransfield Strait / Mar de la Flota (Fig. 6); also echinoderms communities and diverse benthic environment types; Polynyas margins; Shelf incising canyon and part of the seamounts.

South Orkney Islands region (SOI)

SOI-BENTHIC- It covers approximately 90000 sq km and mainly protects important benthic areas, with near 40% of them covered in at least 50% of their target **(**see Domain 1 MPA proposal – PART C**,** Fig. 7). High protection is also given to important areas for birds and mammals including breeding foraging distribution of pygoscelid penguins, and important areas for zooplankton life cycles including the SOI krill nursery (Fig. 7). Also, areas associated with ACCF; sponges communities and most seamounts located in depths lower than 2,000 meters.

SOI SS AMP It covers approximately 94000 sqkm and mainly protects important benthic habitats including the plateau, the plateau slope at different depths; seamounts > 2000m and seamount ridge (Fig. 8) and sponges communities. Two pelagic bioregions and non-breeding foraging distribution of Adélie penguins are also captured by this area.

DOMAIN 1 MPA MANAGEMENT

The three ecoregions identified in Domain 1 -SWAP, NWAP and SOI - differ not only in their ecology, but also in their current management and resilience to climate change.

In this sense, our proposed Marine Protected Area has different management components (Fig.4):

1) General Protection Zones (GPZ): where only research fishery is allowed
2) Special Fishery Management zones (SFMZ): where commercial fishery is allowed

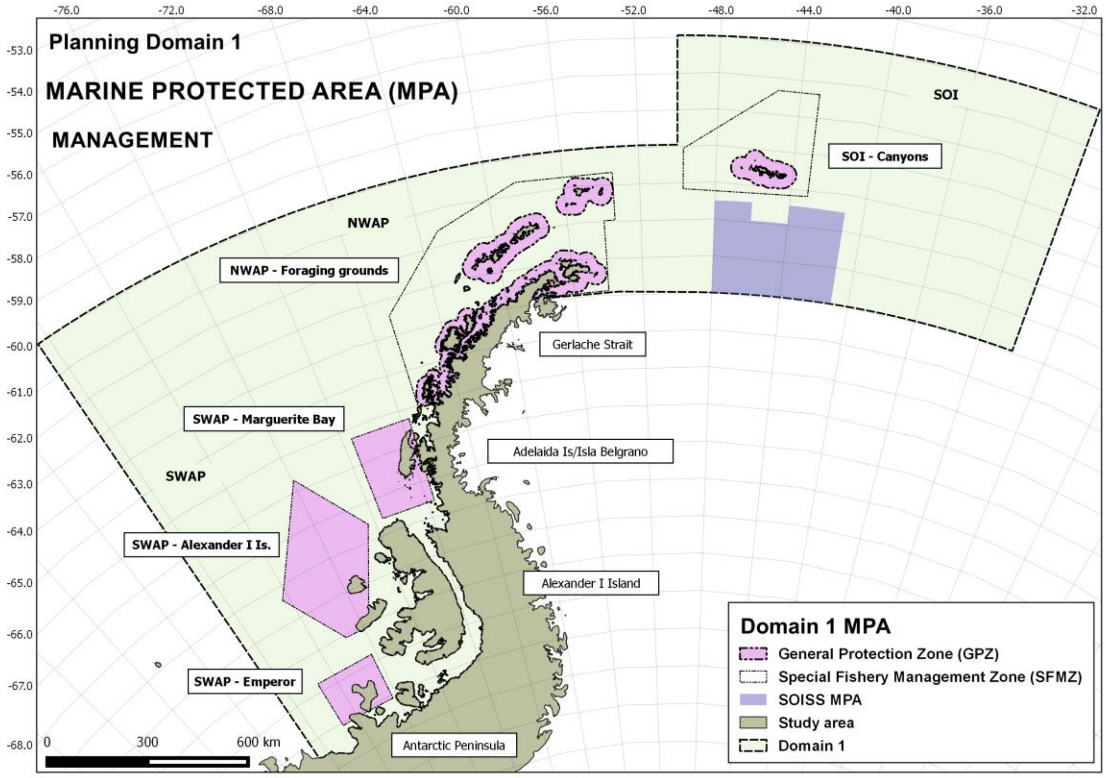

Figure 4. Domain 1 MPA model including management components. SWAP is composed of three GPZ, and NWAP and SWAP have both components GPZ and SFMZ.

South West Antarctic Peninsula (SWAP): managed as General Protection Zone

GPZ- Emperor, GPZ-Alexander I Is., and GPZ-Marguerite Bay: These zones would be managed as General Protection Zones, in which only research fishing would be allowed.

NWAP-Foraging grounds: *managed as General Protection Zone and Special Fishery Management Zone*

- GPZ-Foraging grounds: given by a 30 km buffer around the Antarctic Peninsula and South Shetland Islands, where only research fishing will be allowed.*
- SFMZ-Foraging grounds: where commercial krill fishery will be allowed as agreed by the Commission in a manner consistent with the objectives of the Convention.

*By including the 30 km buffer zone from the coast, we protect the foraging areas of predators during summer, among other aims (see Domain 1 MPA proposal – PART C. Fig- 9). Note that Adélie foraging areas during incubation and fur seals during summer will use a larger habitat than 30 km (Hinke et al. 2017). We also protect the early stages of fish (larvae/young juveniles) that may be taken as by catch by krill trawlers (as in CM 1/III). We have considered the idea of establishing the 30 km buffer zone only during the predators breeding period (October-March). However, given that the spawning period of most of the coastal Antarctic fish (notothenioids) includes autumn-winter months, that the non-breeding season of whales could varied up to July (Weinstein et al. 2017) and that the seabirds breeding period/season is between October and March, we proposed that the General Protection Zone should apply all year-round.

SOI-Benthic: *managed as General Protection Zone and Special Fishery Management Zone*

- GPZ-Benthic: given by a 30 km buffer around the South Orkney Islands, where only research fishing will be allowed.*
- SFMZ-Benthic: commercial krill fishery will be allowed as agreed by the Commission in a manner consistent with the objectives of the Convention.

*By including the 30 km buffer zone from the coast, we protect the foraging areas of predators during summer, among other aims (see Domain 1 MPA proposal – PART C. Fig. 10). We also protect the early stages of fish (larvae/young juveniles) that may be taken as by catch by krill trawlers (as in CM 1/III). We have considered the idea of establishing the 30 km buffer zone only during the predators breeding period (October-March). However, given that the spawning period of most of the coastal Antarctic fish (notothenioids) includes autumn-winter months, and that the seabirds breeding period/season is between October and March, the General Protection Zone should apply all year-round.

SOI SS AMP: Management to be conducted in accordance with CCAMLR CM 91-03

Domain 1 MPA Model– Area and Boundaries

The Domain 1 MPA model covers an area of approximately 450000 sqkm which is distributed across bioregions in approximately 32% in SWAP, 48% in NWAP and 20% in SOI.

Management zones represent approximately similar areas accounting each for about 50% of total MPA. General Protection Zone in NWAP-Foraging grounds and SOI-Benthic roughly accounts for 20%.

The selection of final boundaries for each zone was done carefully based on geographic features and clear lat/long vertices to improve MPA implementation. Details on boundaries are provided in Annex 2.

Table 1: Sizes of Domain 1 MPA preliminary proposal, discriminated by management component and by zone. Total Domain 1 extension is also included.

Bioregion	Zones	Management	Area approx (km2)
SWAP	SWAP – Emperor	GPZ – Emperor	20959
SWAP	SWAP – Alexander I Is.	GPZ – Alexander I Is.	82356
SWAP	SWAP – Marguerite Bay	GPZ – Marguerite Bay	38389
NWAP	NWAP – Foraging grounds	GPZ – Foraging grounds	76470
		SFMZ – Foraging grounds	138757
SOI	SOI – Canyons	GPZ – Benthic	13419
		SFMZ – Benthic	76795
TOTAL DOMAIN 1 MPA PROPOSAL			**447145**

FISHERY

Domain 1 MPA preliminary proposal includes current and potential fishing grounds for the krill fishery and, as such, it requires special attention. As mentioned before, although a krill fishing cost layer was not included in the Marxan analysis, due to the complexity of spatial and temporal patterns observed in this fishery, we recognize the importance of including krill fishery distribution in the planning of Domain MPA in later stages of the process.

In 2016, it was noted that the Domain 1 spatial planning activity overlaps with the development of other management activities pertinent to this region, such as work on risk analysis for the krill fishery and on Feedback Management Strategy (FBM) (SC- CCAMLR XXXV, para. 5.8). Krill fishing in Domain 1 will be managed as agreed by the Commission in a manner consistent with the objectives of the Convention which may include current CM 51-07 and future strategies as the FBM. Priority areas for conservation identified in this proposal could assist in the development of such strategies by focusing resources. Moreover, data included in Domain 1 MPA process could also serve as baseline information for future strategies.

FISHERY MANAGEMENT OPTIONS – A FEW EXAMPLES

In order to harmonize the MPA process with current and future Management Strategies, we provide a brief list of possible strategies that could be considered for the NWAP-Foraging grounds and SOI-Benthic.

NWAP- Subarea 48.1

1- Risk assessment (WG-FSA-16/47 Rev. 1 and WG-FSA-16/48)
2- Changes in the starting day of the fishery period(WG-EMM-16/16)
3- Coastal buffers: (SC-CCAMLR XXXV-BG/14)
4- Reference areas*: as the high priorities areas for conservation match with the SSMU, we suggest alternating the SSMU using ten-year periods to evaluate the effect of fishery. A ten year period is proposed, as it would allow us to detect trends in predators' populations, as well as including prey life cycle (Krill life cycle of 5 or 8 years). Eventually, after the first 20 years, the periods could be reduced to 5 years. Reference Areas will allow us to evaluate effects caused by either environmental variability or potential negative effects produced by fisheries, especially in zones close to the coastal zone.

***Baseline:** CEMP Sites; breeding and post breeding dispersal; krill surveys; research surveys for *Dissostichus* spp., and all data is available on the Domain 1 e-group. As suggested in SC-CAMLR 2016 paragraph 5.8, datasets made available by the Domain 1 planning group could be used to support work in these areas.

SOI- Subarea 48.2

1. Possible options for the future management of the Antarctic krill fishery in Subarea 48.2 (WG-EMM 16/18).
2. Although commercial fishing of *Dissostichus* spp, is not established in Domain 1, it is important to note that several research programmes to assess *Dissostichus* spp. have been developed by different members, whereas other programmes are currently under review for implementation in the Subarea 48.2 (See CCAMLR Fisheries Report 2016). Considering bottom fishing to target *Dissostichus* spp. is currently permitted by CCAMLR, benthic communities inhabiting these areas might be exposed to disturbance. Previous work has demonstrated the relevance of identifying important benthic areas for conservation in some areas around South Orkney Islands (see WG-EMM-16/35), where seamounts and

shelf-incising canyons are an important feature. In this regard, an improvement of our knowledge about representative benthic habitats and important geomorphic features, especially around the eastern part of the SOI (SOI-Benthic), is very relevant considering that benthic objectives can be overshadowed by pelagic objectives. Benthic surveys (and special attention on VMEs) can provide very useful data to protect these habitats from potential disturbance produced by bottom fishing.

CONCLUDING REMARKS

The Domain 1 MPA preliminary proposal is presented by identifying priority areas for conservation that achieve conservation targets for most of the conservation objectives defined and agreed for Domain 1 (see Domain 1 MPA proposal – PART C).

This preliminary proposal also contemplates krill fishing activities and Climate Change by providing differential management components for the different zones in the model, including the establishment of General Protection Zones - where only research fishing would be allowed, and Special Fishery Management Zones - where commercial fishing would be allowed, as agreed by the Commission in a manner consistent with the objectives of the Convention.

The proposed MPA covers an area of approximately 45,0000 sq km, including the SS SOI MPA, allowing for the protection of 19% of the entire Domain 1. Although its size is near 5 times bigger than SS SOI MPA, it is less than 30% smaller than the recently adopted Ross Sea MPA.

Important coastal areas for birds, mammals, fishes and zooplankton life cycles that could ensure population viability of top predators are included in General Protection Zones of NWAP-Foraging grounds and SOI-Benthic, and are represented by protecting roughly the 20% of the proposed MPA and nearly 4% of all Domain 1.

While the protection sought for Domain 1 was defined and agreed in several international workshops which resulted in the inclusion of several zones, this MPA proposal does not envision protection in disregard of fishing activities. Furthermore, it reinforces protection while allowing the rational use of marine living resources.

RESEARCH STEERING COMMITTEE

Rationale

Regarding the MPA Proposal in Domain 1, Argentina and Chile have thus far completed the first step towards achieving the commitment made in 2016 to present an initial draft of the proposal for Members' consideration.

Domain 1 is an area of interest for many Members for different reasons, such as research, fishing and tourism activities. Within research programs, a large variety of topics are involved, from physics to biological, from small to large processes, from unicellular organisms to top predators. These research efforts involve the national support of a wide number of countries as well as a large diversity of research groups within them.

As has been consistently stressed by both countries, one of the pillars of our proposal is to include the views of all Members. We believe that working within a large network in order to fulfil the needs of an MPA is vital for the further development of this proposal.

Because of the significant number of countries with varied interests and different priorities and views on conservation (ranging from protection of habitats or species, to utilization ecosystem services), achieving consensus may face difficulties. Aside from the most evident concern regarding fisheries, other issues should be taken into account on the road to the conclusion of the final proposal. Conservation priorities for reference areas, protection of species, climate change, sea ice concentration and long term research, among others, should be considered. Thus, a discussion that includes a research and monitoring plan will allow a more effective adjustment on the areas and their study and monitoring in the long term.

We stress that this is a work in progress and, consequently, we propose to create a **RESEARCH STEERING COMMITTEE (RSC)** that, based on this high priority areas for conservation included in the MPA proposal, engage in discussions and develop a Research and Monitoring plan for Domain 1. We envision a feedback process where the MPA protection zones can be agreed based on their importance for conservation including rational use, an adequate monitoring of the ecosystem health and the scientific questions that need answers in the long term.

RSC - Terms of Reference

1. The Committee will be coordinated jointly by Argentina and Chile

2. The Committee will be composed of two representatives of each interested Member. Members should provide their names and contact information by August, 1st, 2017.

3. All communication will be done via an e-group specifically created for this purpose.

4. The RSC work schedule will be agreed during the EMM-2017.

5. If funding is available, a short WS could be held on September 2017.

6. A summary of the discussion held intersessionally could be presented to SC-CAMLR-2017. WE

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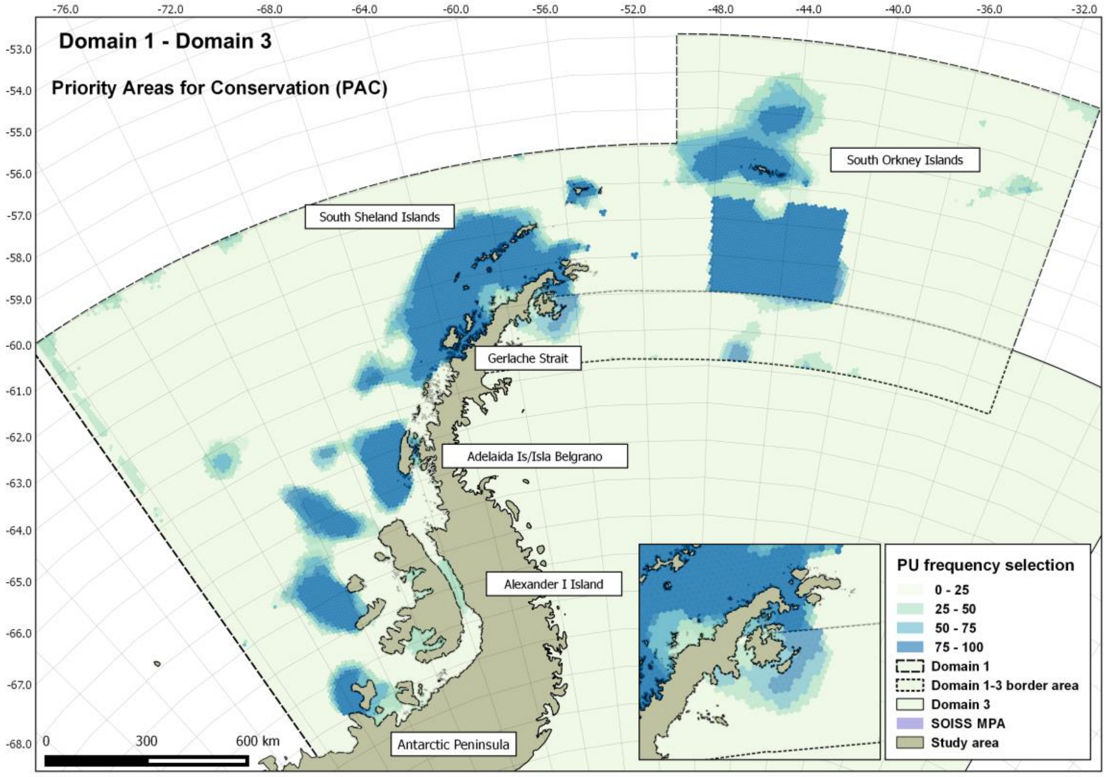
Annex 1: Overlap between Domain 1 and 3 Planning Domains



Annex 2. Table: Coordenates of Domain 1 MPA Preliminary Proposal.

Zone	Longitude	Latitude
SWAP-Emperor	-81.50	-71.80
SWAP-Emperor	-76.40	-71.80
SWAP-Emperor	-76.40	-73.10
SWAP-Emperor	-81.50	-73.10
SWAP-Alexander I Is.	-75.90	-66.70
SWAP-Alexander I Is.	-72.50	-68.60
SWAP-Alexander I Is.	-75.50	-71.10
SWAP-Alexander I Is.	-77.60	-71.10
SWAP-Alexander I Is.	-80.50	-69.40
SWAP-Marguerite Bay	-71.40	-68.60
SWAP-Marguerite Bay	-71.40	-66.30
SWAP-Marguerite Bay	-67.50	-66.30
SWAP-Marguerite Bay	-67.50	-68.60
NWAP-Foraging grounds	-58.70	-63.90
NWAP-Foraging grounds	-63.50	-65.60
NWAP-Foraging grounds	-64.20	-66.10
NWAP-Foraging grounds	-65.10	-66.10
NWAP-Foraging grounds	-66.70	-66.10
NWAP-Foraging grounds	-66.80	-63.50
NWAP-Foraging grounds	-63.00	-61.60
NWAP-Foraging grounds	-58.50	-60.70
NWAP-Foraging grounds	-53.40	-60.70
NWAP-Foraging grounds	-53.40	-62.00
NWAP-Foraging grounds	-54.00	-62.00
NWAP-Foraging grounds	-54.00	-63.90
SOI-Benthic	-49.70	-60.10
SOI-Benthic	-45.10	-58.40
SOI-Benthic	-43.10	-58.40
SOI-Benthic	-43.10	-61.20
SOI-Benthic	-49.70	-61.20