CCAMLR

Commission for the Conservation of Antarctic Marine Living Resources
Commission pour la conservation de la faune et la flore marines de l'Antarctique
Комиссия по сохранению морских живых ресурсов Антарктики
Comisión para la Conservación de los Recursos Vivos Marinos Antárticos

WG-EMM-15/34

20 June 2015

Original: English

WG-EMM

# Report of a domestic workshop to identify U.S. stakeholders' objectives and protection priorities for one or more marine protected areas in Planning Domain 1

G. Watters (USA)

EN

This paper is presented for consideration by CCAMLR and may contain unpublished data, analyses, and/or conclusions subject to change. Data in this paper shall not be cited or used for purposes other than the work of the CAMLR Commission, Scientific Committee or their subsidiary bodies without the permission of the originators and/or owners of the data.

**Report of a domestic workshop to identify U.S. stakeholders' objectives and protection priorities for one or more marine protected areas in Planning Domain 1**

George M. Watters

Antarctic Ecosystem Research Division, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration

**Abstract**

The United States has substantive interests within the boundaries of Planning Domain 1, and, in March 2015, scientists from the U.S. Antarctic Marine Living Resources Program hosted a domestic workshop to develop background information relevant to the establishment of one or more marine protected areas (MPAs) therein. Key products from the workshop include a list of the types of specific objectives that U.S. stakeholders have for MPAs in Domain 1, a map of the areas that U.S. stakeholders consider to be priorities for spatial protection, and estimates of "conservation targets" that can be inferred from these priorities. The list of specific objectives included "protect krill spawning and larval development," "study climate impacts separate from fishing," "preserve the integrity of existing studies," and ten other candidates. Participants at the workshop prioritized protection of the continental shelf and inshore waters along the western coast of the Antarctic Peninsula, from around Alexander Island and the Marguerite Bay northeast to the tip of the peninsula and Joinville Island and including various islands and archipelagos such as the South Shetland Islands. Consistent with these protection priorities, conservation targets were generally highest for objects that occur inshore or over the continental shelf (e.g., the summer foraging habitats of Pygoscelid penguins) and lowest for objects that occur farther offshore (e.g., the marginal ice zone during winter, the winter foraging habitats of chinstrap penguins, and many seamounts).

**Introduction**

The United States has substantive interests within the boundaries of Planning Domain 1. These interests include (but are not necessarily limited to) maintenance of long-term, multidisciplinary research efforts; consumption of products from and direct participation in sustainable fisheries that target Antarctic marine living resources; participation in the Antarctic tourism industry, both as customers and as operators; environmental protection that includes Antarctic species, communities, and ecosystems; and cooperation and collaboration with other Parties to the Antarctic Treaty System. Most, and perhaps all, such interests can be advanced by the establishment of one or more appropriately designed MPAs within Domain 1.

Scientists from the U.S. Antarctic Marine Living Resources (AMLR) Program recently hosted a domestic workshop that aimed to

- familiarize members of the U.S. Delegation to CCAMLR and U.S. stakeholders with key physical and ecological features, ecosystem processes, and human activities in Domain 1;
- identify data gaps that could be filled to facilitate MPA planning in Domain 1; and

- elicit stakeholders' views on and preferences for
  - the specific objectives of one or more MPAs in Domain 1,
  - management approaches to achieve such objectives (*e.g.*, no-take areas versus other management tools),
  - the specific locations to be prioritized for protection,
  - MPA size and duration, and
  - the requirements for future research and monitoring to accompany MPAs.

The workshop was held from March 23-24, 2015 at the Southwest Fisheries Science Center in La Jolla, California. Participants included scientists from the U.S. Government and U.S. universities; representatives from the fishing industry, the tourism industry, and environmental non-governmental organizations; and members of the U.S. Delegation to CCAMLR. All three long-term monitoring programs that are led by U.S. scientists and are currently active in Domain 1 were represented: the U.S. AMLR Program, the Palmer Long-Term Ecological Research (LTER) Program, and the Antarctic Site Inventory.

The La Jolla workshop had two key components. The first involved familiarizing all participants with the ecosystems, ecological processes, and human activities in Domain 1. Scientists who actively work in the planning domain gave a variety of oral presentations that summarized data on the spatial distributions of numerous taxa, from zooplankton and fishes to upper-level predators. Additional presentations described the physical environment and the spatial distributions of fishing, tourism, and research activities in Domain 1. Much of the data summarized in these oral presentations were subsequently submitted as GIS shapefiles to the CCAMLR eGroup on Domain 1 and have been considered by the Second International Workshop on the Identification of Priority Areas for MPA Designation within Domain 1 (held in Buenos Aires from 25-29 May, 2015). The second component of the La Jolla workshop involved identifying specific, candidate objectives for one or more MPAs in Domain 1 and prioritizing areas for protection. This second component also included roundtable discussions on MPA size and duration, the management tools (e.g. no-take areas, gear restrictions, and seasonal closures) that may be required to achieve various MPA objectives, and the future research and monitoring efforts needed to underpin one or more MPAs.

This report summarizes several outcomes related to the second component of the La Jolla workshop. These outcomes include

- a list that characterizes the types of specific objectives that a cross-section of U.S. stakeholders has for MPAs in Domain 1,
- a map identifying the areas that U.S. stakeholders consider to be priorities for spatial protection,
- estimates of the "conservation targets" that the spatial prioritization implies for application of decision support tools like Marxan (Ball et al. 2009), and
- stakeholders' views on topics such as MPA size and duration.

The objectives, maps, and implied conservation targets included in this report do not constitute an MPA proposal and should not be interpreted as such. Rather, this report aims to provide background information which the U.S. Delegation to CCAMLR is likely to use during future collaborations with other Members. This report is not a consensus document, nor does it reflect positions of the U.S.

Government. This report simply serves as a chair's summary of the La Jolla workshop and reflects the perspectives of G. Watters.

**Stakeholder Objectives and Spatial Priorities**

The La Jolla workshop included an exercise designed to identify U.S. stakeholders' spatial priorities for protection. The participants were randomly assigned to one of three groups, and each group was instructed to independently agree and document its specific objectives for an MPA(s) in Domain 1. This exercise relied upon a list of potential objectives that had been developed during earlier roundtable discussion at the workshop, and the groups were allowed to develop new objectives if desired. Each group was provided with a blank, poster-sized map of Planning Domain 1 and twenty pieces of colored paper ranging from red through orange, yellow, and green to blue. Red paper was used to indicate the highest protection priority and blue the lowest priority. Each piece of paper was sized to equal approximately 5% of the area of Domain 1. The groups were instructed to glue the all of the colored pieces of paper to their blank maps in an effort to achieve the specific objectives they had agreed at the start of the exercise. The colored pieces of paper could be cut into whatever sizes and shapes suited the desires of the group. A GIS was made available for consultation so that features and habitats prioritized for protection could be accurately located on the blank maps.

In total, the three groups listed 13 specific objectives for MPAs in Planning Domain 1. These candidate objectives included

- "protect krill spawning and larval development,"
- "mitigate potential competition between krill predators and the krill fishery,"
- "foster resilience and provide refugia to threats from climate change,"
- "study climate impacts separate from fishing,"
- "infer appropriate periods of MPA duration,"
- "recover depleted populations or communities,"
- "protect communities dependent on sea ice,"
- "preserve the integrity of existing studies,"
- "protect benthic communities,"
- "protect migration routes,"
- "minimize ship-ship and ship-whale interactions,"
- "protect seamounts," and
- "protect nearshore fish spawning habitats."

Although several of these candidates were shared by all three groups, the sets of objectives independently listed by each group were not exactly the same. Participants agreed that no-take MPAs, applied to all fisheries, are required to "study climate impacts separate from fishing," "foster resilience and provide refugia to threats from climate change," and, in some cases, "preserve the integrity of existing studies." Limiting fishing activities to specific types of gears and target species might be sufficient to "protect krill spawning and larval development," "recover depleted populations or communities," "protect communities dependent on sea ice," "protect benthic communities," "protect

seamounts," and "protect nearshore fish spawning habitats." Limitations on vessel speed might "minimize ship-ship and ship-whale interactions."

The spatial prioritizations of all three groups were broadly similar (Figure 1). In general, U.S. stakeholders prioritized protection of the continental shelf and inshore waters along the western coast of the Antarctic Peninsula, from around Alexander Island and the Marguerite Bay northeast to the tip of the peninsula and Joinville Island and including various islands and archipelagos such as the South Shetland Islands. These areas largely coincide with the Palmer LTER and U.S. AMLR study areas, and their prioritization is consistent with the stakeholders' aspiration to "preserve the integrity of existing studies. Protection of areas far offshore, in parts of the Bellingshausen, Scotia, and Weddell Seas, was not a priority. The average protection priorities of U.S. stakeholders are illustrated in Figure 2.

The areas of highest priority to U.S. stakeholders are poorly protected by the set of ASPAs, ASMAs, and MPAs that currently exists within Domain 1. The coastal focus of existing ASPAs and ASMAs aligns with the priorities of U.S. stakeholders (Figure 2), but these ASPAs and ASMAs are too small to provide a level of protection that would be likely to meet stakeholders' objectives (Table 1). In contrast, the South Orkney Islands Southern Shelf (SOISS) MPA is large relative to the ASPAs and ASMAs within Domain 1, but the SOISS MPA only overlaps areas that are of intermediate priority to U.S. stakeholders (Table 1 and Figure 2).

Overlays (e.g., Figure 3) of U.S. stakeholders' average protection priorities onto maps illustrating the spatial distributions of various "conservation objects" (*sensu* Arata et al. 2014) were used to make inferences about the percentages of these objects that U.S. stakeholders might wish to protect. These percentages, termed "conservation targets" (also *sensu* Arata et al. 2014), are typically used within decision support tools like Marxan to algorithmically identify candidate MPAs. Establishing such targets without reference to stakeholders' spatial priorities can be problematic because stakeholders do not necessarily think all of the pixels mapping the spatial distribution of any given conservation object are exchangeable. For example, simply protecting 25% of a conservation object may not be agreeable to stakeholders unless that 25% overlays a particular location. The approach applied here allows alternative MPAs developed through the use of decision support tools like Marxan to be compared with a map that illustrates stakeholder priorities.

Consistent with U.S. stakeholders' protection priorities, conservation targets inferred from the spatial intersection of these priorities and various conservation objects were generally highest for objects that occur inshore or over the continental shelf (e.g., the summer foraging habitats of Pygoscelid penguins) and lowest for objects that occur farther offshore (e.g., the marginal ice zone during winter, the winter foraging habitats of chinstrap penguins, and many seamounts) (Table 2). The highest targets were inferred for two small canyons cutting across the continental shelf north of Livingston Island and the Gerlache Strait; U.S. stakeholders were nearly unanimous in their desire to protect these areas. While identification of additional canyons in Domain 1 may decrease the protection priority of the small canyons north of Livingston Island, U.S. stakeholders voiced a strong desire to protect the Gerlache Strait, and this aspiration will almost certainly be maintained throughout the MPA planning process. The Gerlache Strait is an inshore nursery for larval krill (Huntley and Brinton 1991) that is heavily utilized by several species of seabirds and marine mammals (see the GIS files submitted to the eGroup on Domain 1). The Gerlache Strait is also heavily utilized by tour operators (Lynch et al. 2010), and the krill

fishery has recently operated on the eastern side of the strait (also see the GIS files submitted to the eGroup).

U.S. stakeholders listed several specific MPA objectives that were not clearly linked to the highest inferred conservation targets. For example, participants indicated a desire to "protect krill spawning and larval development," but the inferred conservation targets for offshore nursery areas (e.g., a nursery area in the Bellingshausen Sea on the western edge of Domain 1) were relatively low (Table 2; note, however, that inferred targets for krill nurseries on the continental shelf, e.g., the Gerlache Strait and areas where Circumpolar Deep Water intrudes onto the shelf were relatively high). Participants also stated their preference to "protect seamounts," but the inferred conservation target for seamounts was relatively low (Table 2). Broadly speaking, discrepancies between some objectives and conservation targets may have resulted from 1) objectives that were poorly worded or overly generalized, 2) an unstated but implicit prioritization of the objectives, or 3) stakeholder perceptions about current and future threats (or lack thereof) to the ecosystem.

The areas that U.S. stakeholders prioritized for protection intersect important fishing grounds (e.g., Figure 4). U.S. stakeholders prioritized areas currently used by the krill fishery more than areas historically used for finfish fishing, but more than 30% of both types of fishing activity (indexed with catch and effort) occurred within the top 20% of stakeholder priorities (Table 3). The relationship between the protection priorities of U.S. stakeholders and fishing activity was nonlinear, and both types of fishing activity were almost completely covered by the top 50% of stakeholder priorities. Consistent with the finding that U.S. stakeholders prioritized known predator foraging habitats, the relationship between stakeholders' spatial priorities and krill-fishing activity was most acute for areas where krill fishing was observed to overlap with the foraging distributions of krill-dependent predators (Table 3). While trying to protect the priority areas of U.S. stakeholders and maintain the current footprint of fishing activities may result in conflict, it is worth noting that fishing has never or rarely occurred in large areas were prioritized for protection (Figure 4). Thus, it might be possible to reach a satisfactory compromise between protection and fishing interests.

**Other Issues**

Three topics that were briefly considered during the La Jolla workshop seem to require further discussion: MPA size, MPA duration, and requirements for future research and monitoring. On the first topic, participants felt that the size of any given MPA should ultimately be determined by what is needed to achieve the specific objectives of that MPA. On the second topic, participants noted that the generation times and productivities of the plants and animals that are intended to be protected, the periodicity and trends in environmental and ecological drivers that force the ecosystem, the characteristics of alternative ecosystem states, and the likelihood that the ecosystem will flip states during a given period of time are all scientifically relevant to discussions on MPA duration. It was acknowledged that finite periods of duration may be warranted for MPAs that are designed to rebuild populations and communities because such MPAs may not be required after rebuilding is complete. It was also suggested that, in cases where the specific objective of an MPA is to learn about the impacts of climate change or fishing, there may be potential to tradeoff long, multi-decadal periods of duration for well-designed spatial comparisons of ecosystem structure and function (possibly between fished areas and no-take areas) that occur over relatively shorter periods of time. Finally, on the third topic,

participants at the La Jolla workshop concluded that the combined, international, and multidisciplinary research and monitoring efforts already being conducted within Domain 1 provide a strong foundation upon which future Research and Monitoring Plans (*sensu* CM 91-04) can be built. A substantial amount of baseline data from which future changes can be monitored and assessed have already been collected. This baseline can be strengthened with additional research on ecosystem structure and function during the austral winter and on processes that occur under the ice. A gap analysis, conducted after the Commission agrees specific objectives of one or more MPAs in Domain 1, could indicate requirements for additional research and monitoring.

**Conclusions**

U.S. stakeholders have a range of interests in Domain 1, and participants at the La Jolla workshop generally seemed to support the establishment of one or more MPAs therein. Despite interests that might appear to be divergent, stakeholders agreed upon several specific objectives for MPAs in Domain 1. These objectives can be achieved using a variety of management approaches (including no-take provisions that apply to all fisheries and limitations on specific fishing gears) and translate to a set of spatial protection priorities that emphasizes protection of inshore and continental shelf waters along the western Antarctic Peninsula. While the spatial protection priorities of U.S. stakeholders overlap with the spatial distribution of fishing activity to some degree, there also appears to be substantial scope for finding a satisfactory compromise between protection and fishing interests in Domain 1. Participants at the La Jolla workshop agreed that the size of an MPA should be determined by the spatial requirements needed to achieve its specific objectives; that several scientific issues are relevant to the duration of MPAs; and that existing, international research and monitoring efforts in Domain 1 provide a useful baseline for assessing future changes.

**Acknowledgements**

Several individuals from the U.S. AMLR Program made significant contributions to hosting and facilitating the La Jolla workshop or were crucial to generating useful products from it. I would especially like to thank A. Dahood, J. Hinke, M.A. Kim, E. McLanahan, P. Penhale, and J. Walsh.

**References**

Arata, J., C. Gaymer, F. Squeo, E. Marschoff, E. Barrera-Oro, and M. Santos. 2014. Progress report on the development of MPAs in Domain 1. WG-EMM-14/40.

Ball, I.R., H.P. Possingham, and M. Watts. 2009. Marxan and relatives: software for spatial conservation prioritisation. Chapter 14: Pages 185-195 *in* Spatial conservation prioritisation: quantitative methods and computational tools. *Eds.* Moilanen, A., K.A. Wilson, and H.P. Possingham. Oxford University Press, Oxford, UK.

Huntley, M. and E. Brinton. 1991. Mesoscale variation in growth and early development of *Euphausia superba* Dana in the western Bransfield Strait region. *Deep-Sea Research*. 38(8/9):1213-1240.

Lynch, H.J., K. Crosbie, W.F. Fagan, and R. Naveen. 2010. Spatial patterns of tour ship traffic in the Antarctic Peninsula region. *Antarctic Science*. 22(2):123-130.

Table 1. Percent coverage of U.S. stakeholders' average spatial priorities by existing ASPAs, ASMAs, and MPAs in Domain 1 (see Figure 2).

| Average Priority | ASPAs | ASMAs | MPAs |
|---|---|---|---|
| 1 | < 1 | 4 | 0 |
| 2 | 1 | 1 | 0 |
| 3 | 1 | < 1 | 0 |
| 4 | < 1 | <1 | 0 |
| 5 | 0 | 0 | 1 |
| 6 | 0 | 0 | 0 |
| 7 | 0 | 0 | 1 |
| 8 | 0 | 0 | < 1 |
| 9 | 0 | 0 | 3 |
| 10 | 0 | 0 | 0 |
| 11 | 0 | 0 | 28 |
| 12 | 0 | 0 | 5 |
| 13 | 0 | 0 | 7 |
| 14 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 |

Table 2. Percent coverage (rounded to the nearest integer) of bioregions, ecosystem process areas, foraging habitats, etc. computed from the overlaps of various "conservation objects" (represented as GIS layers and considered *sensu* WG-EMM-14/40) with the average spatial protection priorities of U.S. stakeholders who participated in the La Jolla workshop. In some cases, it was not clear how the conservation objects should be identified, thus identifiers in this table (e.g., 5d and 7a) may need revision.

| | Cumulative % of Domain 1 prioritized for spatial protection by U.S. stakeholders | | | | |
|---|---|---|---|---|---|
| Conservation object *sensu* WG-EMM-14/40 | 5% | 10% | 15% | 20% | 50% |
| 1a. benthic ecoregions† | 5 | 18 | 14 | 19 | 37 |
| 1b. benthic environment types† | 9 | 34 | 31 | 39 | 51 |
| 1c. benthic zones separated by 0° C isotherm at seafloor*† | 2 | 7 | 11 | 15 | 42 |
| 2b. pelagic environment types† | 12 | 22 | 27 | 39 | 63 |
| 3a. large-scale canyons | 0 | 0 | 3 | 19 | 100 |
| 3b. small-scale canyons | 100 | 100 | 100 | 100 | 100 |
| 3c. benthic areas under ice shelves | 0 | 1 | 1 | 12 | 55 |
| 4a. highly productive surface areas | 10 | 30 | 40 | 47 | 83 |
| 4e. December marginal ice zone (MIZ) | 5 | 28 | 41 | 44 | 63 |
| 4e. February MIZ* | 0 | 11 | 17 | 21 | 100 |
| 4f. polynyas | 3 | 14 | 14 | 14 | 100 |
| 5a. Adélie penguin summer foraging buffer | 9 | 45 | 60 | 72 | 100 |
| 5a. chinstrap penguin summer foraging buffer | 20 | 51 | 69 | 85 | 100 |
| 5a. gentoo penguin summer foraging buffer | 28 | 55 | 81 | 92 | 100 |
| 5a. macaroni penguin summer foraging buffer* | 20 | 40 | 52 | 97 | 100 |
| 5a. emperor penguin foraging buffer* | 0 | 0 | 9 | 9 | 100 |
| 5a. Antarctic fur seal summer foraging buffer* | 9 | 29 | 57 | 86 | 100 |
| 5b. post-larval Antarctic krill distribution (top 30%) | 10 | 51 | 60 | 69 | 97 |
| 5b. larval Antarctic krill distribution (top 30%) | 11 | 23 | 32 | 47 | 96 |
| 5b. crystal krill distribution (top 30%)* | 26 | 86 | 94 | 95 | 100 |
| 5b. *T. macrura* distribution (top 30%)* | 10 | 32 | 42 | 56 | 96 |
| 5c. July MIZ | 3 | 10 | 15 | 22 | 38 |
| 5c. August MIZ | 2 | 4 | 7 | 12 | 27 |
| 5c. Adélie penguin winter foraging area (top 25%, PTT-based) | 0 | 36 | 85 | 92 | 100 |
| 5c. chinstrap penguin winter foraging area (top 25%, PTT-based) | 3 | 8 | 13 | 23 | 69 |
| 5c. chinstrap penguin winter foraging area (SST-based)* | 0 | 0 | 0 | 0 | 4 |
| 5c. gentoo penguin winter foraging area (top 25%, PTT-based) | 33 | 78 | 98 | 100 | 100 |
| 5c. Antarctic fur seal winter foraging area (top 25%, PTT-based) | 4 | 14 | 21 | 30 | 75 |
| 5c. leopard seal winter foraging area (top 25%, PTT-based) | 28 | 49 | 73 | 93 | 100 |
| 5c. Weddell seal winter foraging area (top 25%, PTT-based) | 16 | 46 | 72 | 85 | 100 |
| 5d. ice seal habitat | 10 | 41 | 54 | 65 | 100 |
| 5d. elephant seal foraging habitat (top 25%, PTT-based)* | 16 | 42 | 56 | 66 | 100 |
| 5d. humpback whale habitat (top 25%, PTT-based) | 21 | 77 | 90 | 97 | 100 |
| 5d. Type A killer whale habitat (top 25%, PTT-based) | 10 | 33 | 45 | 59 | 80 |
| 5d. Type B1 killer whale habitat (top 25%, PTT-based) | 11 | 78 | 100 | 100 | 100 |
| 5d. Type B2 killer whale habitat (top 25%, PTT-based) | 12 | 49 | 76 | 90 | 100 |
| 5d. minke whale habitat (top 25%, PTT-based) | 14 | 44 | 52 | 56 | 59 |
| 6a. fish spawning and nursery grounds (0-150m) | 16 | 48 | 75 | 83 | 99 |
| 6a. fish spawning and nursery grounds (0-500m) | 6 | 26 | 55 | 65 | 97 |
| 7a. nursery for krill from Bellingshausen Sea* | 1 | 5 | 13 | 22 | 97 |
| 7a. nursery for krill from western Scotia Sea* | 1 | 3 | 11 | 18 | 62 |
| 7a. nursery for krill in Gerlache Strait* | 100 | 100 | 100 | 100 | 100 |
| 7a. nursery for krill from NW Weddell Sea* | 0 | 2 | 18 | 21 | 67 |
| 7b. CDW* | 10 | 44 | 63 | 75 | 100 |
| 8a. submarine volcano | 0 | 0 | 0 | 100 | 100 |
| 8b. seamounts | 0 | 0 | 1 | 5 | 24 |
| 9a. VMEs | 0 | 25 | 51 | 71 | 100 |

*Conservation objects that were defined during the 2014/15 intersessional period (with data and GIS files contributed to the Domain 1 eGroup in advance of the Buenos Aires workshop).

†Conservation objects that include multiple components; the reported percentage coverage is the mean coverage across components. Thus, individual components may have 0% coverage despite reporting a mean that is > 0%, and the reported values may not increase monotonically with increasing spatial protection.

Table 3. Overlap of U.S. stakeholders' average spatial protection priorities and indices of fishing activity. Data on fishing activity were from the CCAMLR Database and are available on the eGroup on Domain 1.

| | Cumulative % of Domain 1 prioritized for spatial protection by U.S. stakeholders | | | | |
|---|---|---|---|---|---|
| Index of fishing activity | 5% | 10% | 15% | 20% | 50% |
| Percent of krill caught (t) during 1980-2014 | 16 | 32 | 42 | 48 | 94 |
| Percent of krill caught (t) during 2006-2014 | 12 | 42 | 52 | 55 | 100 |
| Percent of krill fishing effort (hrs fished) during 1980-2014 | 12 | 27 | 36 | 42 | 90 |
| Percent of krill fishing effort (hrs fished) during 2006-2014 | 13 | 43 | 52 | 56 | 100 |
| Percent of area where krill fishing and predators have been observed to overlap | 26 | 74 | 89 | 95 | 100 |
| Percent of finfish caught (t) | 0 | 0 | 7 | 34 | 99 |
| Percent of finfish fishing effort (sets or hauls) | 1 | 4 | 14 | 39 | 98 |

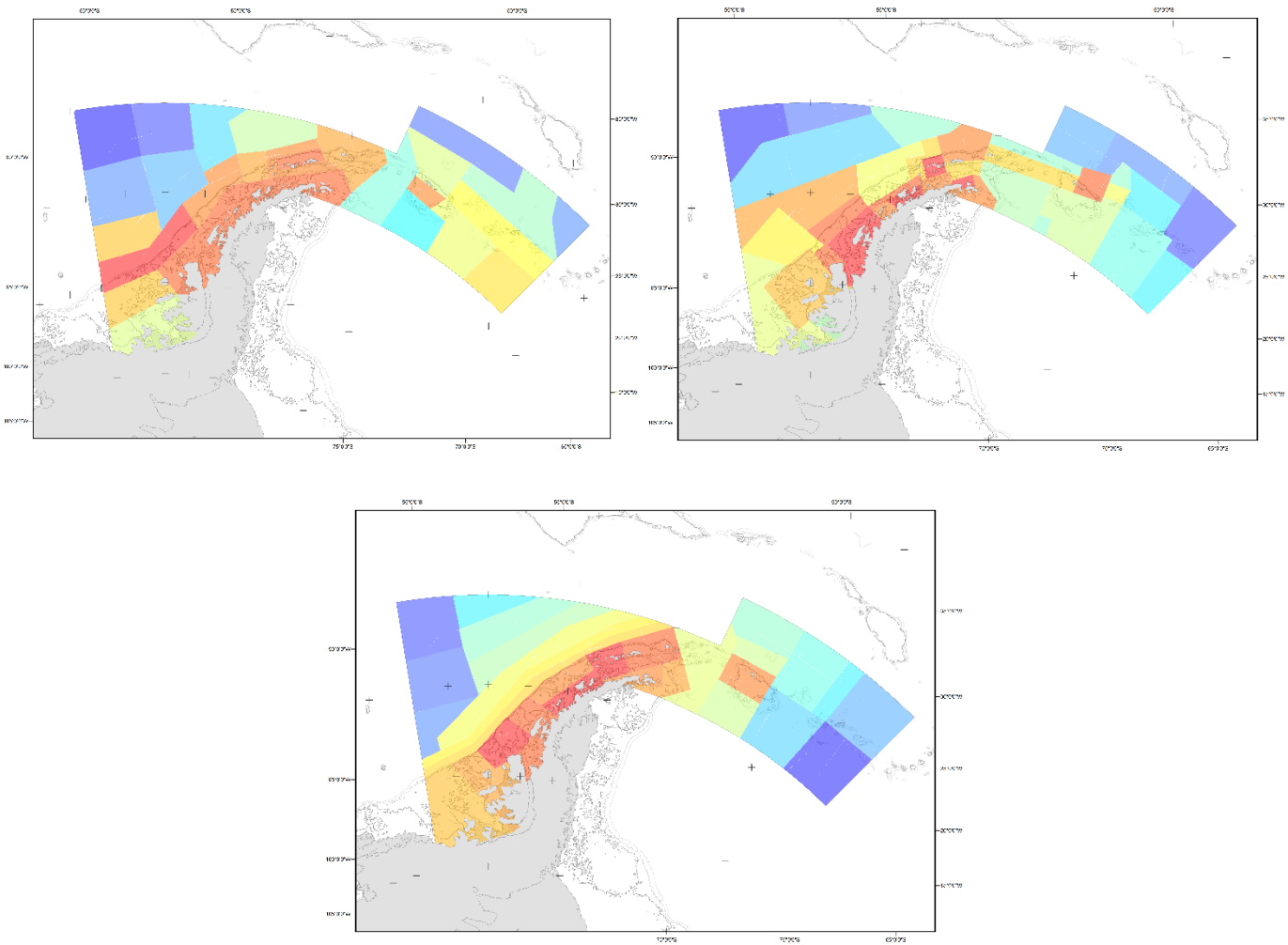

Figure 1. Spatial protection priorities in Planning Domain 1, as identified by three groups of participants in the La Jolla workshop (each panel illustrates the priorities of one group). Priorities are color coded (highest priorities in red, lowest priorities in blue), with each priority area (unique color on the map) intended to cover approximately 5% of the planning domain. The black crosses are reference graticles located every 5° latitude and longitude, and depth contours are 500, 1000, and 1500 m. These maps are not MPA proposals.

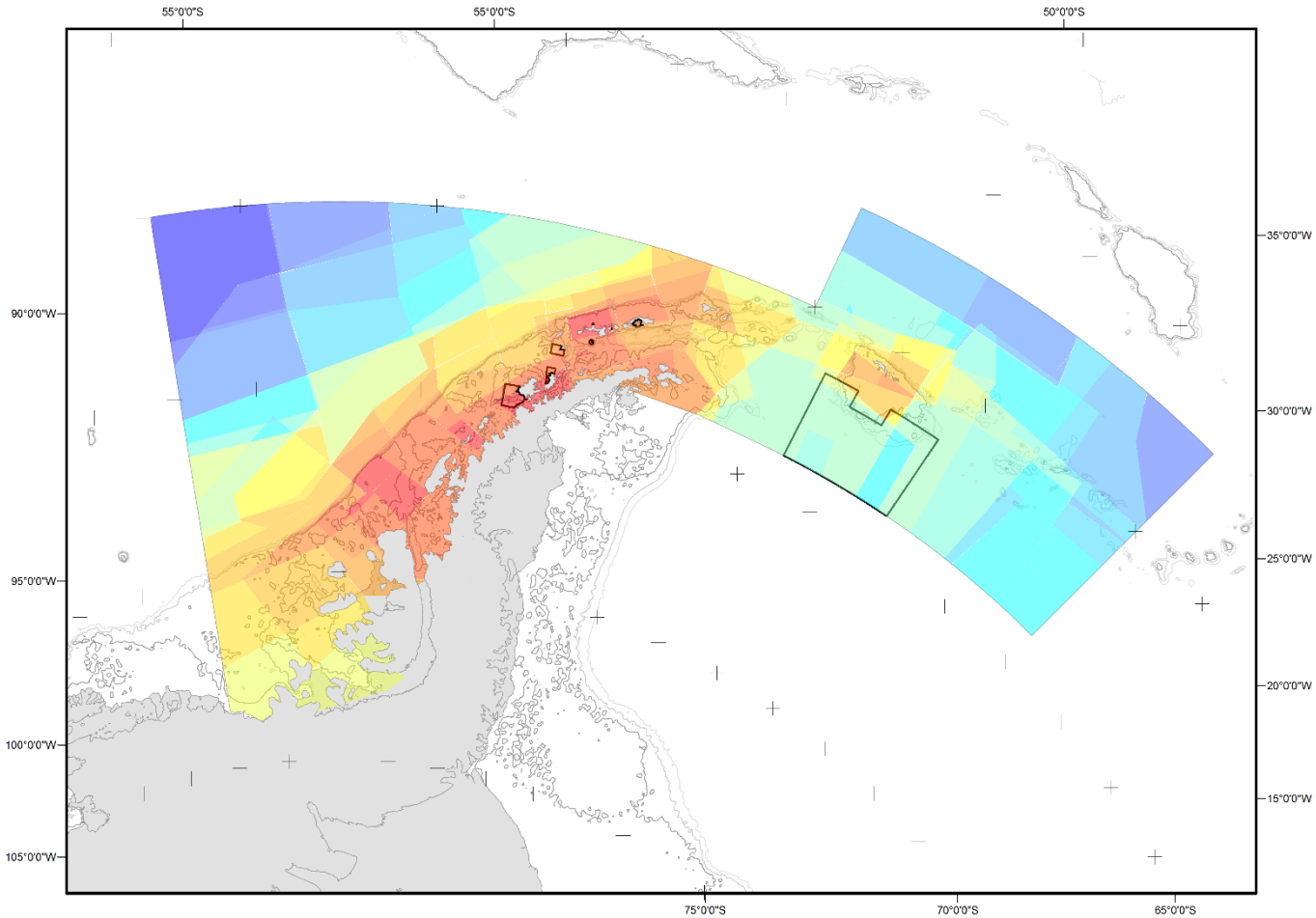


Figure 2. Average, spatial protection priorities in Planning Domain 1. Color coding for spatial priorities is described in Figure 1. Areas outlined in black identify existing ASPAs, ASMAs, and the South Orkney Islands Southern Shelf MPA. The black crosses are reference graticles located every 5° latitude and longitude, and depth contours are 500, 1000, and 1500 m. This map is not an MPA proposal.

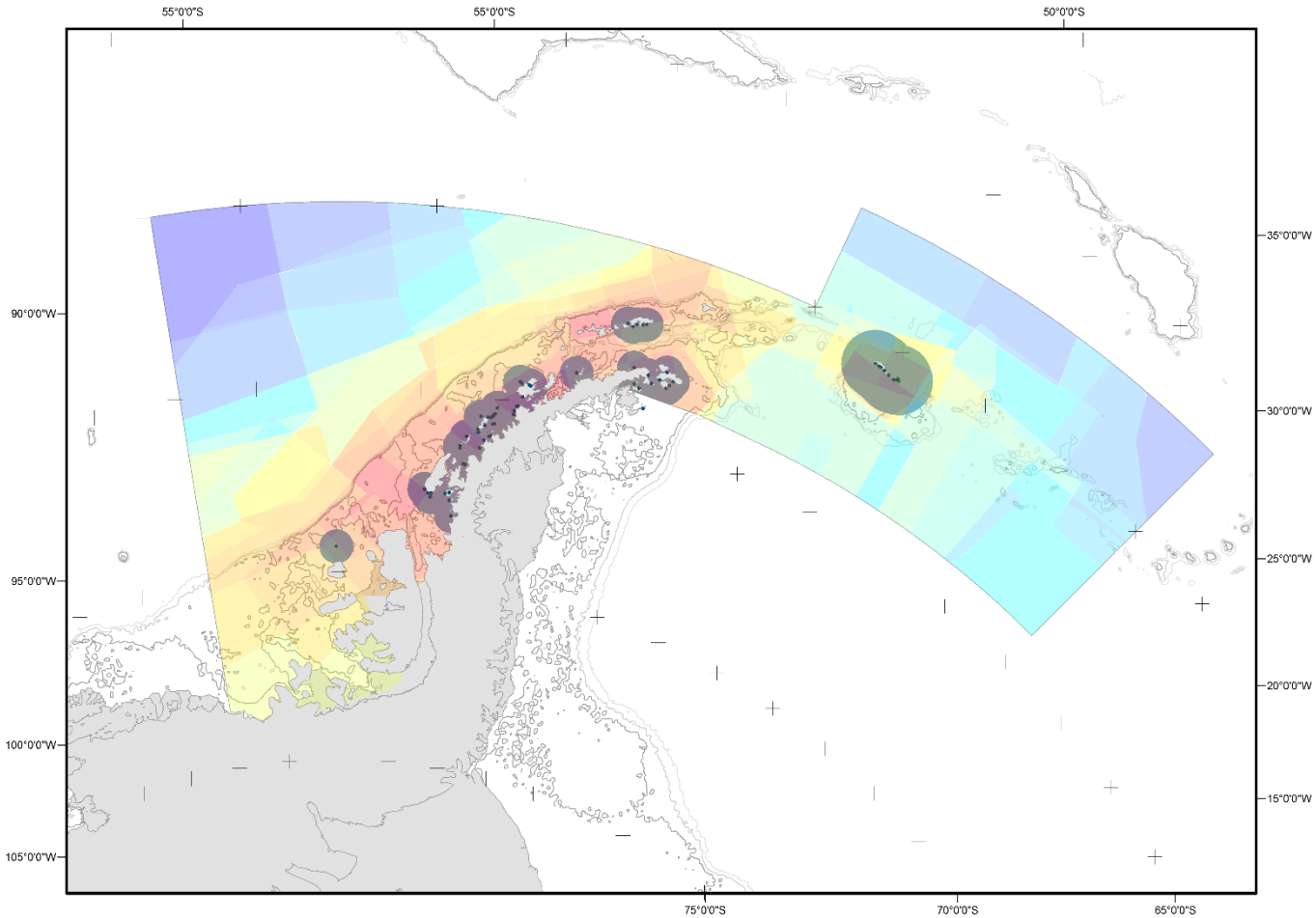


Figure 3. Example overlay of U.S. stakeholders' average spatial protection priorities and foraging buffers (blue circles) drawn around breeding colonies (blue points) of Adélie penguins. This type of overlay was used to compute the values reported in Table 1. Color coding for spatial priorities is described in Figure 1 (although transparency is increased here to visualize the overlay). Black crosses and depth contours are also the same as in Figure 1. This map is not an MPA proposal.

Figure 4 redacted to comply with CCAMLR Rules for Data Access and Use

Figure 4. Example overlay of U.S. stakeholders' average spatial protection priorities and recent (2006-2014) catches by the krill fishery. This type of overlay was used to compute the values reported in Table 2. Color coding for spatial priorities is described in Figure 1 (although transparency is increased here to visualize the overlay). Black crosses and depth contours are also the same as in Figure 1. This map is not an MPA proposal.