In Brief: If large marine reserves can be designated in the Ross Sea, East Antarctica and other areas, scientists will have access to crucial scientific research potential about how healthy ecosystems function. By reducing and eliminating other stressors such as fishing in those areas, the Southern Ocean’s marine life will have a better chance of adapting to a changing environment. Although marine protected areas (MPAs) and marine reserves cannot mitigate climate change and ocean acidification, they constitute a powerful tool that can be incorporated into an effective strategy to study and learn how to best respond to climate change.

Some regions of Antarctica have already been drastically altered by climate change. The acidity of the Southern Ocean is increasing through absorption of increasing quantities of CO₂, posing additional dangers, and scientists have already identified the Southern Ocean as the first region that is likely to experience widespread acidification because it is already relatively undersaturated in aragonite, a form of calcium carbonate. In addition, there are worrying indications of the impacts of black carbon (formed through the incomplete combustion of fossil fuels), in the Antarctic.

The substantial benefits that MPAs and marine reserves can confer in this respect include:

- Provide vital study areas where the effects of climate change and ocean acidification can be researched and differentiated from the effects of natural variability
- Help build ecosystem resilience as healthy ecosystems are better able to adapt to environmental changes. Both the size of protected areas and their connectivity are important factors in determining the level of ecosystem resilience and the ability of the protected ecosystem to adapt.

In recognition of these benefits, two of the six objectives in the General Framework for the Establishment of CCAMLR MPAs are:

- “the establishment of scientific reference areas for monitoring natural variability and long-term change or for monitoring the effects of harvesting and other human activities on Antarctic marine living resources and on the ecosystems of which they form part”; and
- “the protection of areas to maintain resilience or the ability to adapt to the effects of climate change”.

CCAMLR has agreed to urgently incorporate climate change considerations and the impacts of ocean acidification into its management decisions, noting the need to “implement as appropriate, improvements to current monitoring programs of harvested species and dependent and related species so as to provide robust and timely indicators of climate change impacts”. 
REFERENCE AREAS FOR SCIENCE

One major benefit of MPAs and marine reserves in the context of climate change and ocean acidification is their potential to be used as reference areas. Such reference areas can allow scientists to understand the impacts of climate change and ocean acidification without the results being confounded by the impacts of other human activities.7

Antarctica has evolved for millennia without a permanent human population. Some areas today remain relatively free from human interference and impact. Areas with little to no human impact provide scientists the chance to understand how species and ecosystems respond to environmental change and to differentiate between natural variability and changes brought on by a warming planet. By eliminating or limiting certain types of human activities, MPAs and reserves can reduce the number of variables that scientists must consider.

IMPROVING RESILIENCE AND ADAPTATION

The second main benefit of marine reserves and MPAs is their potential to increase ecosystem resilience of species and ecosystems to climate change and ocean acidification by reducing stress from other activities. Climate change and ocean acidification will continue to impact the environmental conditions in MPAs, but if other ecosystem stressors – fishing, pollution, and resource extraction, among others – are limited, species will be more able to withstand environmental changes.

For example, the South Sandwich Islands support globally significant populations of penguins, particularly chinstrap penguins, and are considered the ancestral home of this species. Protecting the breeding and foraging grounds of chinstrap penguin colonies, which appear to be declining across the Antarctic Peninsula and Scotia Sea region, perhaps due to the effects of climate change, is of utmost importance.8 Protection should encompass major chinstrap feeding grounds to facilitate their resilience to the impacts of climate change.

MPAs and no-take marine reserves must be large enough to encompass and protect key ecological processes and the life history of the animals that live there.9,10 This is especially true in adequately addressing the problems brought by climate change. Support for MPAs of ecologically significant size in the Southern Ocean is justified by the large scale of oceanic processes and species’ movements and evidence that larval dispersal distances increase in correlation to latitude. Therefore the higher the latitude, the larger the areas need to be set aside for protection.11

A network of large MPAs and marine reserves that connects ocean processes across space and time can be the most effective and powerful tool to ensure long-term resilience of the Southern Ocean. Importantly, such a network of MPAs may be our only hope at both understanding and helping to improve resilience against the effects of climate change in marine environments.12 A single MPA or no-take marine reserve will protect areas of local importance, but a network has the scope to ensure better resilience in the entire Southern Ocean ecosystem.

Replication within the network is also important for long-term resilience. Having multiple no-take marine reserves and MPAs protecting similar habitat types provides insurance against human-induced or natural disasters, including climate change.13 These types of networks have already proved successful in nourishing social, economic and environmental factors in other large marine ecosystems, such as the Great Barrier Reef in Australia.14
CLIMATE REFUGIA

Areas that are warming the slowest can serve as “refugia” – the last suitable habitats for species that depend on ice and cold waters. The Ross Sea will be the last part of the Southern Ocean with year-round sea ice according to Intergovernmental Panel on Climate Change (IPCC) predictions. The sea ice is predicted to continue to expand over the next few decades, stabilise but then decline thereafter.

In the medium term, sea ice is expected to remain much longer in the Ross Sea than other areas in the Southern Ocean, and perhaps anywhere on the planet. Consequently, the Ross Sea region will become a “refugium” for ice-dependent species as well as an important area for the study of changes in the ice and how different species and communities adapt or fail to adapt to changes in sea ice and ocean temperature.

CONCLUSION:

The unique and pristine ecosystems around Antarctica are under ever-increasing pressure. CCAMLR has an unprecedented opportunity to establish large-scale ocean protection for the Ross Sea and East Antarctica this year. The AOA calls on CCAMLR delegates and world leaders to step up to this challenge and designate the Ross Sea and East Antarctica MPAs as a lasting legacy.
AOA Briefing #3: Climate Change & Ocean Acidification: Benefits of Marine Reserves & Marine Protected Areas

About the Antarctic Ocean Alliance

The Antarctic Ocean Alliance is a coalition of more than 30 leading environmental organisations and high-profile individuals working together to achieve large-scale protection for key Antarctic ocean ecosystems. Alliance members include the Pew Environment Group, Greenpeace, WWF, the Antarctic and Southern Ocean Coalition (ASOC), Whale and Dolphin Conservation (WDC), Humane Society International, Mission Blue (US), International Fund for Animal Welfare (IFAW), Oceans 5 (US), Deep Wave (Germany), The Last Ocean, Greenovation Hub (China), the Korean Federation for Environmental Movement (KFEM), Forest & Bird (NZ), ECO (NZ) and associate partners the Natural Resources Defense Council (NRDC), Oceana, TerraMar Project, the International Polar Foundation (UK), Plant a Fish, the International Programme on the State of the Oceans (IPSO), the Ocean Project, Bloom Association (France), OceanCare (Switzerland), Eco-Sys Action, Ocean Planet (Australia) and Corail Vivant (New Caledonia). AOA Ambassadors include actors Leonardo DiCaprio, Edward Norton, Oceanographer Dr. Sylvia Earle, entrepreneur Sir Richard Branson, Chinese entrepreneur and explorer Wang Jing and Korean actor Yoo Ji-Tae.

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