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# MPA News poll: Amid a changing climate and ocean, what can MPA managers do?

Ten years ago, MPA News asked practitioners a question: In this era of changing climate, what can you do to ensure your sites remain relevant over time? We decided it was time to revisit that question.

MPAs are generally designed to protect the habitats and biodiversity *of today.* Where there is a coral reef, for example, or where there is a particular species of interest, we design an MPA around it. But as the ocean warms, and as those habitats and species shift and are otherwise impacted, these changes will have significant effects on MPAs.

It stands to reason that most practitioners would like their sites to remain relevant 50 or 100 years from now. How can they best do that?

It is a challenging question. As our understanding improves of the multiple impacts of climate change — including ocean warming, sea level rise, coral bleaching, acidification, pole-ward shifts of habitats and species, the possibility of species extinctions — the question grows ever more important.

This month we revisited the same question with a new set of practitioners. Their responses are below.

## You cannot hold back the tide

**By Wendy Foden**, Chair, IUCN Species Survival Commission's Climate Change Specialist Group. Email: fodenw@gmail.com (Wendy is co-editor of IUCN SSC Guidelines for Assessing Species' Vulnerability to Climate Change.)

You cannot hold back the tide. We are now locked into climate-related changes that will continue to run their course over the coming decades, so managing our systems to try to keep them the same will fail. We need to embrace the changes and take best advantage of the opportunities they bring.

An important early step is for managers to assess how, how much, and in what time frames their MPAs are changing. This helps to work out the key climate change vulnerabilities, including to biodiversity, infrastructure, and associated human communities.

With these realities in mind, managers and planners should re-evaluate MPA goals and adjust them such that they are aiming for managing the best possible outcomes under change.

"Climate smart" conservation strategies help to meet these, and involve reducing exposure to the change, reducing sensitivity, and increasing adaptive capacity. Biodiversity, infrastructure, and associated human communities should each be considered. Vulnerability assessments provide essential guidance on how this can be done, and great new adaptation resources are now emerging.* Each MPA's requirements will be unique; there can be few times in marine conservation history where MPA managers and planners faced such a challenge to be creative and innovative!

An important consideration is integrated management of land surface and coastal marine areas. Climate change impacts inland (e.g., changing river flow or pollution) may be a key source of MPA vulnerability, and rising sea levels can make a huge difference to a protected area by changing the coastal configuration and estuaries.

Other important conservation aspects include ensuring connectivity along gradients (e.g., temperature, salinity) to facilitate natural adaptation via range shifts. For priority species and sites, intensive management strategies and *ex situ* conservation may be appropriate.

Climate change conservation is a new field so some of the actions we try are bound to be ineffective or even maladaptive – it's to be expected. This highlights how important it is to monitor the effectiveness of our actions and to share the outcomes within our local and global communities. That way we can learn, as quickly as possible, how best to tackle this big new challenge.

* For example: https://portals.iucn.org/library/sites/library/files/documents/PAG-024.pdf and http://iucnccsg.com/wp-content/uploads/2016/08/CCVA-Guidelines-complete-lowres_linked.pdf

## The Arctic is undergoing a phase change, and MPAs need to account for it

**By Martin Sommerkorn**, Head of Conservation, WWF Arctic Programme, Norway. Email: msommerkorn@wwf.no

The pace and scale of climate change in the Arctic is unique because the Arctic is warming at approximately twice the global average. The region is undergoing a phase change from a marine ecosystem dominated by ice, to one characterized by open water for a substantial part of the year.

MPAs in the Arctic need to account for this change in two important respects. The first is to use models that project the location of resilient ice habitat, and focus on conserving as much of that habitat as possible — especially areas of that habitat that are proven productivity hotspots, like the sea ice marginal zone. The second approach is to prioritize protection of resilient features in the marine Arctic that are drivers of productivity, diversity, and biological interactions, such as seamounts and river deltas. While these may not preserve the current suite of biodiversity, it is likely that they will remain drivers of biodiversity. This means that even if current species are largely supplanted by more southerly species, the ecosystem benefits of these features will likely persist far into the future.

Lastly, Arctic nations must combine their efforts at MPA planning to create a coherent representative network that allows for connectivity. That connectivity can encompass migratory routes, allow for intra-species biodiversity, and facilitate range shifts — or, in other words, support adaptation to change at the biome scale.

## Adopt proactive approaches when prioritizing areas for conservation

**By Rafael Magris**, Chico Mendes Institute for Biodiversity Conservation - ICMBio / Brazilian Ministry of Environment. Email: rafael.magris@my.jcu.edu.au (Rafael was lead author of a 2014 study in the journal Biological Conservation, "Integrating connectivity and climate change into marine conservation planning". For a free copy of that study or other studies he mentions in his response here, please email him.)

Given the potential of climate change to cause alteration of habitats and species distribution, this threat has become a major concern of practitioners when planning MPAs.

One way of tackling this issue is to adopt proactive approaches when prioritizing areas for conservation. This can be done, for example, by locating and protecting climate change refugia that are identified based not only on the historic environment but also on future ocean conditions. By taking a much broader temporal perspective when planning MPA placement, practitioners can predict shifts in disturbances over time and address future states of the environment with temporally static MPA boundaries (see this 2015 paper for a detailed example).

Another way of addressing the effects of climate change is to design networks of MPAs, i.e., an array of individual MPAs that are ecologically connected. Although connectivity is a global priority for conservation, many planners have neglected this aspect when establishing new MPAs. Optimizing the formation of MPA networks could either allow the movement of organisms between newly unsuitable habitats and suitable ones in a changing environment, or help accelerate recovery from healthy to damaged areas in the aftermath of disturbances. A recent study demonstrates an MPA design approach that optimizes several connectivity benefits, including the relevant ones in times of climate change.

Although addressing uncontrollable threats that operate at large scales through local management remains elusive, there is a wide range of approaches that would potentially make conservation actions

effective now and in the future.

## Establishing an MPA as a sentinel site for ocean acidification

**By Jenny Waddell**, Research Coordinator, Olympic Coast National Marine Sanctuary, US. Email: jenny.waddell@noaa.gov

Managers today need to think carefully about projected changes to MPA resources in order to establish ecological baselines and initiate studies that are able to detect change over time. At the Olympic Coast National Marine Sanctuary, we commissioned a report (Miller et al. 2013) that describes potential future scenarios, specifically at OCNMS. Based on anticipated climate variability, we can prepare to manage for change and uncertainty. That will include adaptive management — allowing us to reconsider sanctuary goals and strategies as new information becomes available or as climate perturbations unfold.

Given that ocean acidification (OA) on the Olympic Coast is projected to increase 2.5 times faster than the global average, we are also working with multiple partners to establish OCNMS as a sentinel site for ocean acidification. The OA sentinel site will enhance resource management efforts through a collaborative approach that integrates science and monitoring with other critical elements of sentinel sites, including education, outreach and awareness, robust partnerships, defined management applications, and collaborative governance. In this way, OA provides a lens and a framework for our understanding of how resources are changing on the Olympic Coast.

Finally, we feel it is critical to nurture community champions and equip them with knowledge and information to broaden public support and characterize the role of MPAs. Enlisting non-scientists to convey important messages about resources that people care about — and about the threats they face — should help us address science barriers and other obstacles to public understanding and engagement. [Editor's note: For an example of how OCNMS partners with the indigenous Quinault Indian Nation on community-based harvesting of razor clams — a species that is particularly susceptible to ocean acidification — see this video.]

## MPAs can ensure that a well-functioning ecosystem is maintained

**By John Baxter**, Principal Adviser – Marine, Scottish Natural Heritage, Scotland. Email: john.baxter@snh.gov.uk (John co-edited the landmark 2016 report from IUCN Explaining Ocean Warming: Causes, scale, effects and consequences.)

In the short to medium term, it is inevitable that climate change will continue to have increasingly significant impacts on the marine environment. MPAs have an important role to play in helping to alleviate these impacts over and above simply reducing non-climate stressors.

A well-designed network of MPAs can be a mechanism for many species to have a secure route for retreat in the face of a warming sea by providing "safe" refuges to move to. MPAs can also act as sentinel sites where other pressures are managed, to help identify the first signs of climate change impact, thus enabling an early response to be put in place where this is possible.

It is also important to recognize that change is inevitable and it should be assessed appropriately. The loss of one species that is replaced by another should not necessarily be seen as a bad thing if the new species performs the same ecological function. MPAs have the capacity to ensure that a well-functioning ecosystem is maintained that will continue to deliver essential ecosystem services necessary for life.

## Box: Responses from 10 years ago

When MPA News asked practitioners the same question 10 years ago ("Amid a changing climate and ocean, what can MPA managers do?"), we received a broad array of responses: on managing for ecological and social resilience, on operating MPAs as showcases for sustainable living, on dynamic reserves, and more. To see all the responses, go to the December 2006 issue of MPA News.

## Box: Could engineering-based solutions save the Great Barrier Reef from warming?

The Great Barrier Reef Marine Park is currently experiencing a mass coral bleaching event for the second year in a row This is the first time the site has not had years between mass bleaching events to recover, and it has added to concerns about the health of the ecosystem going forward.

Those concerns have led to suggestions of at least two engineering-based strategies to protect the Great Barrier Reef from future ocean warming. The effectiveness of the suggested solutions remains unclear, and neither has been adopted by Australian officials. MPA News mentions them here to illustrate that engineering-based solutions to climate change are starting to emerge in the MPA field:

- Cloud brightening — This would involve spraying tiny salt particles, generated from seawater, toward coastal clouds. The effect would be to induce additional droplet formation, expanding the total surface area of the clouds and reflecting solar energy back toward space. The technology remains in its infancy although several research groups — including at the Sydney Institute of Marine Science and the University of Sydney School of Geosciences — are working on it.
- Pumping cold water onto the reef — This idea would involve pumping cooler water from a depth of 40 meters to the surface, using the deeper waters to counteract ocean warming on selected reefs of the MPA. It has been proposed as a highly localized solution to bleaching by some tourism industry stakeholders and the Reef and Rainforest Research Centre. Scientists and other experts are skeptical of how useful it will be for the MPA as a whole which covers hundreds of thousands of square kilometers.

## Box: Previous coverage of climate change and MPAs, from *MPA News*

New Report on Ocean Warming Highlights the Role of MPAs in Combating Climate Change

How MPAs can help mitigate impacts of climate change via coastal blue carbon, "fish carbon", and more

Following Copenhagen, Publications and Other Resources Available on Climate Change

MPA Perspective: Monitoring for Resilience to Climate Change in Coral MPAs

MPA Perspective: Climate Change and the U.S. National System of MPAs - Why Places Are Important

As Ocean Warms, Will Great Barrier Reef Migrate Southward? (And If So, Should the Great Barrier Reef Marine Park Follow It?)