30X30 A BLUEPRINT FOR OCEAN PROTECTION

How we can protect 30% of our oceans by 2030

UNIVERSITY OF OXFORD
UNIVERSITY of York
GREENPEACE

Acknowledgements

30x30: A Blueprint for Ocean Protection builds on a scientific study by a team of experts which was led by Professor Callum Roberts to design a marine protected area network for the high seas. We acknowledge the sharing of data from Atlas of Marine Protection, Global Fishing Watch, Birdlife International and L. Watling, and thank K. Boerder for her assistance with accessing and interpreting data. We would also like to thank all the sources who made their data freely available.

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Giant Pacific octopus
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KEY FINDINGS

- The high seas encompass 43% of the Earth's surface, and 70% of the living space on the planet including land and sea. These huge spaces are home to a complex marine world, with richness and diversity of life to rival coastal waters and land.
- High seas marine life drives the ocean's biological pump, capturing carbon at the surface and storing it deep below – without this essential service, our atmosphere would contain 50% more carbon dioxide and the world would be uninhabitably hot.
- The high seas face growing exploitation from a handful of mainly rich nations: fishing and the emerging deep seabed mining industry join wider threats from climate change, acidification, plastic and other pollution and more.
- Ocean sanctuaries are a key tool for protecting habitats and species, rebuilding ocean biodiversity, helping ocean ecosystems recover and maintaining vital ecosystem services.
- By initiating an international legally binding instrument to enable the protection of marine life and habitats outside national jurisdiction, the United Nations has an opportunity to put in place robust structures to create and govern ocean sanctuaries on the high seas.
- Scientists are calling for at least 30% of the world's oceans to be protected as ocean sanctuaries, and this study charts how this 30% figure could be achieved to protect the full spectrum of marine life on the high seas.
- The study is based on biological, oceanographic, biogeographical and socio-economic data, such as the distributions of sharks, whales, seamounts, trenches, hydrothermal vents, oceanic fronts, upwellings, biogeographic zones, commercial fishing pressure, mining claims etc.
- The protected area network design process builds in resilience to wider environmental change and uncertainty with a bet hedging approach to habitat selection, large coverage to promote connectivity and refuges of last resort, and the use of sea surface temperature data to identify places likely to change more slowly or adapt more readily under rising temperature stress.
- Areas intensively used by high seas fishing fleets were avoided to reduce possible disruption to fishing activity. An interim moratorium on seabed mining is proposed to ensure that options are left open as a network of protection is built.
- The findings in this report show that it is entirely feasible to design an ecologically representative, planet-wide network of high seas protected areas to address the crisis facing our oceans and enable their recovery. The need is immediate and the means readily available. All that is required is the political will.

Great white shark

EXECUTIVE SUMMARY

Humpback whale, Indian Ocean
© Paul Hilton/Greenpeace

FAR BEYOND THE EDGE OF OUR LAND-BOUND WORLD LIE AREAS BEYOND NATIONAL JURISDICTION, COMMONLY KNOWN AS THE HIGH SEAS.* FOR MOST PEOPLE, FOR MOST OF HISTORY, THE HIGH SEAS HAVE BEEN INVISIBLE, POPULATED BY THE IMAGINATION WITH MONSTROUS FISH, WRATHFUL GODS OR PRECIPITOUS PLUMMETS INTO THE IMMENSITY OF SPACE. OVER CENTURIES OF EXPLORATION BY ADVENTURERS, HUNTERS, TRADERS AND SCIENTISTS, THAT IMAGINED REALM OF FEAR AND DANGER HAS BEEN EXPLOITED, MAPPED AND PROBED, YIELDING UP SECRETS AND BANISHING TERRORS.

The high seas form a vast global commons that covers 61% of the area of the ocean and 73% of its volume. They encompass an astonishing 43% of the Earth's surface and occupy 70% of the living space on our planet, including land and sea. These international waters are home to a stunning wealth of marine life and ecosystems, and by virtue of their enormous expanse, are essential to the healthy functioning of Planet Earth. But in recent decades that life has dwindled under the rising impact of multiple human stresses, prompting an historic effort by the United Nations to increase protection and reform management.

* The term 'high seas' in this study is used to refer to 'areas beyond national jurisdiction' (ABNJ). ABNJ are composed of the high seas (waters beyond the zones of national jurisdiction) and the Area (the seabed, ocean floor and subsoil thereof beyond the limits of national jurisdiction). This means our study considers all habitats from the seabed to surface waters.

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"WITHOUT THESE CREATURES, THE ATMOSPHERE WOULD CONTAIN AN ESTIMATED 50% GREATER CONCENTRATION OF THE GREENHOUSE GAS CARBON DIOXIDE AND THE WORLD WOULD BE FAR HOTTER."

Why the high seas matter

For most of us, our only experience of the high seas is a vast canvas of blue seen from the window of a plane. The monotony is interrupted here or there by the crawling dot of a container ship or the patterned white crests of storm-driven waves. But it is the ultramarine emptiness that asserts itself most strongly upon the psyche, a point reflected in the blank blocks of blue that colour the high seas in maps.

This apparent uniformity conceals a more complex submarine world with richness and diversity to rival that of coast and land. In the sunlit upper layers of the high seas there are places, including oceanic fronts and upwelling areas, where currents drag nutrients to the surface causing great plankton blooms. These explosions of plankton growth, which may cover thousands of square kilometres and are easily visible from space, fuel oceanic food webs.

The vast scale of the high seas and the patchiness of feeding grounds and suitable breeding areas means that many marine animals travel incredible distances. Whales, elephant seals, tunas, billfish, eels, sharks, turtles, penguins and albatross are among the great nomads of the high seas, some criss-crossing entire ocean basins, congregating at oceanic hotspots and then moving on. The whalers of old were first to discover these teeming concentrations of life, hunting sperm whales across the equatorial Pacific upwelling, right whales in the turbulent transition between warm south Atlantic and cold Southern Ocean, and humpback whales in the Coral Sea. Modern satellite tracking of seabirds, sharks, seals and turtles has added detail and depth to our understanding, picking out oceanic highways and flyways, oases and deserts.

Life in the sunlit surface layer sustains a twilight and midnight world that extends to the floor of the abyss, four to six thousand metres down, and then further still into trenches deeper than the Himalayas are tall. Just below the productive surface, the twilight zone is home to a bizarre menagerie which undertakes the greatest migration on Earth. Every night, under cover of darkness, a huge variety of creatures move upward from depths of several hundred metres to feast on plankton or prey upon other animals in the productive surface layer, then retreat to the depths as morning nears. They include lanternfish with flashlight patterned skins, bioluminescent jellyfish, blood red squid as big as tuna or grape-sized with bodies like glass. Despite the lack of sunlight, perhaps 90% of the world's fish by weight inhabit these twilit depths. Their daily migrations – feeding at the surface, pooping deep down – contribute to a phenomenon known as the biological pump, removing carbon from the atmosphere and transferring it to the deep sea where it may be locked away. Without these creatures, the atmosphere would contain an estimated 50% greater concentration of the greenhouse gas CO_2 and the world would be far hotter.

In the midnight world deeper down, the water chills to a few degrees above freezing and pressures rise hundreds of times higher than that of the atmosphere. Despite the extreme conditions, creatures eke a meagre living there from the downward drizzle of organic matter, or flourish in unexpected abundance around plumes of water hundreds of degrees hotter than boiling point. In the frigid darkness, life is glacial and fish can live for hundreds of years and corals exceed a thousand. For most of history, this fragile world lay unseen, far beyond the reach of human influence or harm. But now, even the remotest places in the sea and its deepest depths are under threat, as activities such as bottom trawling destroy habitats before we have a chance to explore and understand them.

Lion's mane jellyfish, Arctic Ocean
© Alexander Semenov

Deep-sea trawling in the Tasman Sea
© Roger Grace/Greenpeace

High seas under threat

People have long pursued fame, power or riches at the edges of the known world, revelling in the absence of laws restraining their plunder. On land, most frontiers have long been settled, tamed and their freedoms curtailed by law. But beyond the reach of national control, the world's last frontier – the high seas and deep sea – is still a place where weak laws and poor governance allow plunder to continue almost unchecked. Here a handful of mainly rich nations exploit marine life for profit under a freedom granted by the United Nations Convention on the Law of the Sea (UNCLOS). That same convention, however, entails duties which have largely been ignored: to conserve living marine resources and protect and preserve the environment, including rare or fragile ecosystems and habitats.

As a consequence of management neglect allied with opportunity and greed, high seas and deep-sea marine life has suffered. Many of our most iconic species, like albatrosses, turtles and sharks have undergone dramatic declines in the space of a few decades. Deep sea habitats like cold-water corals and sponge fields, sometimes centuries old, have been smashed by heavy fishing gear being dragged along the seabed. Even species meant to be under close management have declined, highlighting the failure of the organisations charged to oversee their exploitation to deliver even on this narrow mandate. For example, the Pacific bluefin tuna has collapsed to less than 3% of its historic abundance, yet still, even in this dangerously depleted state, continues to be fished. Resources that belong to the whole world are being squandered.

Fishing is the longest-standing and still one of the most severe of human threats to high seas life, alongside global warming, ocean acidification, deoxygenation, shipping, noise, plastic and chemical pollution, and deep seabed mining. Together, they have put marine life under an increasing barrage of stresses that cannot be addressed in isolation, nor adequately managed by the bodies charged with governance of the high seas and deep ocean.

"THE GROWING THREATS AND CONCERN OVER INEFFECTIVE AND FRAGMENTED GOVERNANCE HAVE PAVED THE WAY FOR A ONCE-IN-A-GENERATION OPPORTUNITY TO SAFEGUARD LIFE IN INTERNATIONAL WATERS."

Bluefin tuna
© Gavin Newman/
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Arctic tern
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Global Ocean Treaty

Recognising the ongoing decline of biodiversity, the rising tide of impacts and the enduring absence of effective governance leading to a fragmented approach, countries of the world under the United Nations have convened an Intergovernmental Conference on the Protection of Biodiversity Beyond National Jurisdiction. Its aim is to develop an international legally binding instrument to enable the protection of marine life and habitats outside national jurisdiction. The first of four meetings was held in September 2018, and the process is expected to end in 2020.

Issues for negotiation include the need for comprehensive environmental impact assessments for activities on the high seas, capacity building for management and conservation, the international sharing of benefits from marine genetic resources and the use of area-based management tools, including marine protected areas (MPAs). With regard to the latter, in its deliberations the UN Intergovernmental Conference must consider how to develop mechanisms for conservation that enable the world to meet international obligations under UNCLOS to protect wildlife of the high seas and deep sea. It must also create a mechanism to fill a gaping hole in the provisions of the UN Convention on Biological Diversity (CBD). The CBD is intended to protect the world's wildlife but can only be applied by nations in their own territories or on vessels carrying their flag. That leaves nearly half of the surface of Earth virtually unprotected.

Importance of ocean sanctuaries

The growing threats and concern over ineffective and fragmented governance have paved the way for a once-in-a-generation opportunity to safeguard life in international waters. This report explores the potential and application of MPAs in the high seas and deep sea and provides context and support for negotiations at the UN Intergovernmental Conference.

The value of MPAs and, in particular, fully protected marine reserves (ocean sanctuaries) as a key tool in protecting habitats and species, rebuilding ocean biodiversity, helping ocean ecosystems recover and maintaining vital ecosystem services, is widely acknowledged and explicitly reflected in the UN Sustainable Development Goal 14 and Aichi Target 11 under the CBD Strategic Plan for Biodiversity 2011–2020. Scientists are calling for full protection of 30% of the ocean by 2030, a call endorsed by a resolution of the International Union for the Conservation of Nature (IUCN) World Conservation Congress in 2016. A successful outcome of negotiations at the UN Intergovernmental Conference is essential for the designation, effective management and enforcement of a network of high seas protected areas.

The study

To inform discussions and scope the idea of marine protected area network building in the high seas, a systematic conservation planning exercise was undertaken by a group of scientists led by experts from the University of York in the UK. The research summarised below is described in detail in the technical section of this report.

To safeguard the full spectrum of marine life, MPAs must be established in networks that represent all the habitats and species present in a region. While individual MPAs can be established based only on local information, systematic planning using computers is required to make network design possible. This is because the number of possible designs for a protected area network quickly increases to something impossibly complex for the human mind to grasp as numbers of conservation features and locations grow. Fortunately, there are well-tested computer-assisted methods for systematic conservation planning, an approach we adopt here.

Methods

We employed a widely used program for MPA network design, called Marxan, to explore options for high seas protection. This method aims to represent a defined proportion of the spatial extent of all the conservation features that are included (e.g. species or habitat distributions or proxies thereof, such as environmental conditions like depth and sea surface temperature) while minimising network size and socio-economic costs.

To develop the network, we divided the high seas into nearly 25,000 planning units, each 100x100km (10,000km^2). We then gathered up-to-date, globally distributed biological, oceanographic, biogeographical and socio-economic data, such as the distributions of sharks, whales, seamounts, trenches, hydrothermal vents, oceanic fronts, upwellings, biogeographic zones, commercial fishing pressure, mining claims etc. and mapped them in a Geographic Information System. Each planning unit was assigned a value relating to the overall extent of each conservation feature that overlapped it and input to Marxan. We ran the program hundreds of times to develop network designs that for any given set of inputs achieved the targets set while minimising costs.

We explored two target levels for protection, 30% and 50% coverage of each of 458 conservation features. These figures were chosen because they correspond to widely discussed ambitions for future global conservation targets following expiry of the Sustainable Development Goal 14 and CBD target for 10% ocean protection by 2020. Places already receiving protection were locked into runs, and places slated for deep-sea mining were locked out of some runs.

By generating hundreds of well-optimised network designs from which to choose, Marxan helps identify those which most efficiently meet the targets set, while enabling planners to incorporate constraints and stakeholder inputs. The resulting designs are in no way definitive, but simply illustrate some of the options available. Factors not captured within input data layers, such as additional socio-economic considerations or expert knowledge, will affect designs. Marxan is a decision-support tool, not a decision-making tool.

Figure 1 shows the most efficient network designs produced from 200 runs of Marxan for the 30% and 50% protection scenarios. These networks lock in existing high seas MPAs designated in the Southern Ocean and North Atlantic, as well as Vulnerable Marine Ecosystems closed to fishing by Regional Fisheries Management Organisations (RFMOs), and Areas of Particular Environmental Interest established in the Pacific Ocean by the International Seabed Authority to protect representative habitats from deep-sea mining. We also applied a 'cost' to limit selection of areas intensively used by high seas fishing fleets, so reducing possible disruption to fishing activity, which in turn requires significant improvement in its management by RFMOs.

> "WHILE HUMANKIND AT LARGE WILL BENEFIT FROM EFFECTIVE MARINE PROTECTION, IT IS PRIMARILY A HANDFUL OF WEALTHY NATIONS THAT ARE CURRENTLY REAPING THE BENEFITS DERIVED FROM EXPLOITING HIGH SEAS RESOURCES."

Significant features of the networks

The results produced well-distributed candidate MPA networks that extend from pole to pole and across the full extent of the oceans, incorporating the complete range of habitats, species and environmental conditions specified. While the designs demonstrate the practicality of creating networks based on existing information, they are not specific proposals for protection.

In setting target levels for coverage, we followed the World Conservation Congress resolution of 2016, which states that MPA networks "should include at least 30% of each marine habitat". As our results show, however, in practice it is impossible to achieve this goal with only 30% of the high seas protected: networks that met the 30% goal covered in the range of 35 to 40% of the high seas, while those that met the 50% target covered 55 to 60%.

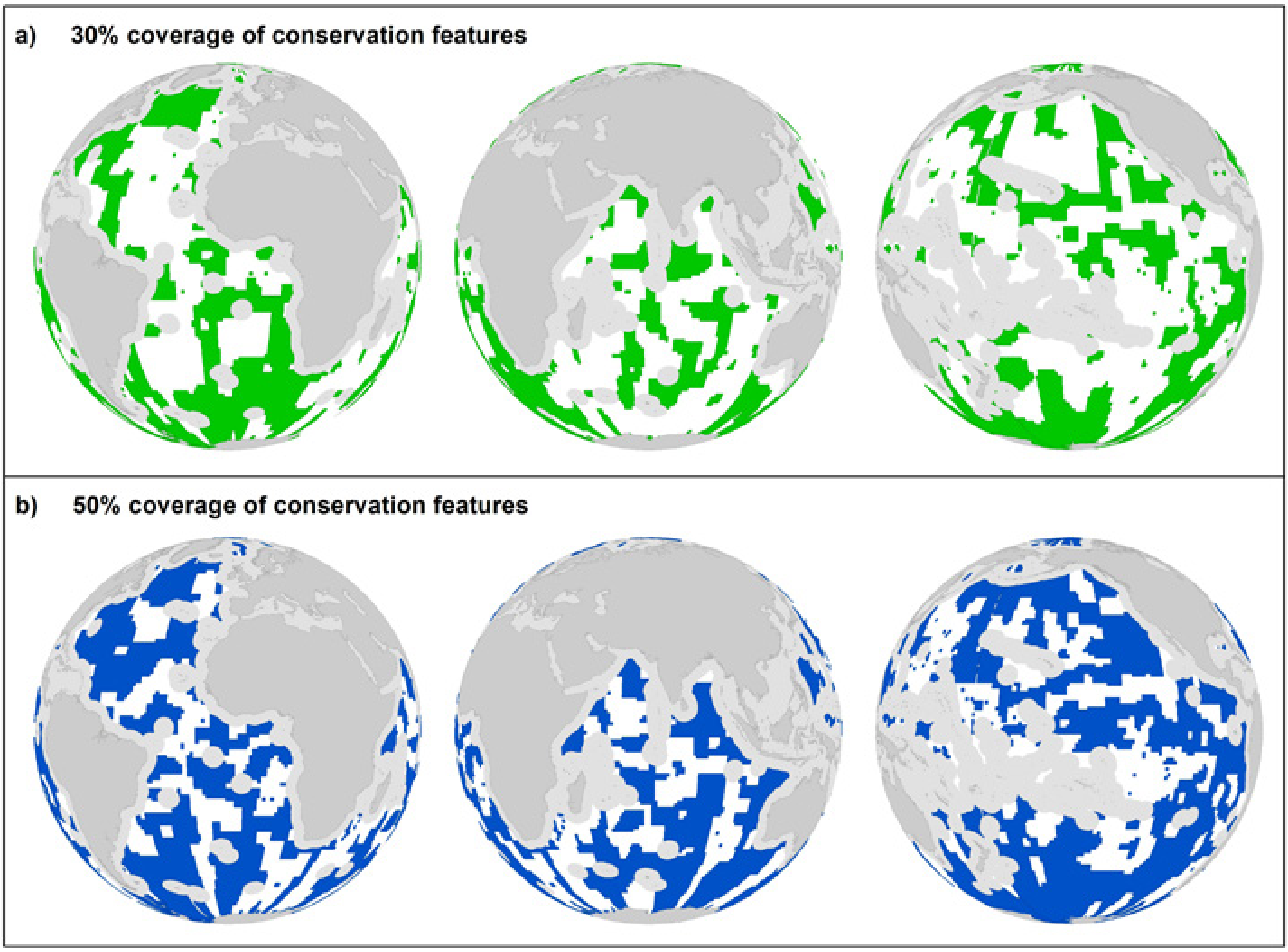


***Figure 1:** Example MPA network designs for (a) 30% and (b) 50% coverage of each included conservation feature with existing management units locked in/out, based on the 'best' solutions identified by Marxan.*

The pursuit of these ambitious but scientifically justified coverage targets produced a novel outcome. The prevailing conservation paradigm on land and in coastal regions is one in which protected areas represent islands of sanctuary in a land or seascape of human influence and threat. Our high seas networks are different in that they produce interconnected nets of protection with embedded zones of human use and impact. In many places these protective nets span ocean basins and are well suited to safeguard the highly mobile and migratory species that roam the high seas. This reversal of conservation practice should also be seen in light of the fact that while humankind at large will benefit from effective marine protection, it is primarily a handful of wealthy nations that are currently reaping the benefits derived from exploiting high seas resources.

Protection on this large scale also confers other benefits. Crucially, it affords resilience to rapidly changing environmental conditions. The world today is changing faster and in more ways than in all of human history. This is causing species shifts in range and depth distributions making ecosystem restructuring and unforeseen outcomes highly probable. Designing protected area networks around present conditions therefore risks future failure.

Protected area network designs must continue to provide their protective function no matter what the future holds. In the face of uncertain future conditions, investors build portfolios to spread risks. MPA networks must do the same. Our network designs deal with environmental change and uncertainty in three ways: (1) by portfolio building (i.e. representing a range of habitats, places and conditions across the world's oceans) as a bet hedging/risk reduction approach, (2) through large coverage which promotes connectivity, stepping stones, corridors for travel and refuges of last resort, and (3) with the novel use of historical sea surface temperature data. In this new approach to climate change resilience, we identified two kinds of areas for extra protection: places with relatively high natural temperature variability, which represent ecosystems that may be inherently resilient to future change because species are adapted to fluctuating conditions, and places with low variability, where change may be slower and ecosystems have more time to adapt. Collectively, these network design principles increase the chances of species and ecosystems surviving and adapting to global change.

Accommodating exploitation

High seas fisheries account for only 4.2% of annual marine capture fisheries and human exploitation of the high seas is limited to wealthy countries and industrial corporations. Nonetheless, some high seas fisheries, such as those for pelagic tunas, are of global significance. The establishment of a network of ocean sanctuaries will displace fishing effort, but the impacts of high seas effort displacement are likely to be less than in coastal zones because fleets already travel very long distances to fishing grounds and rerouting may not increase travel time or costs. However, displacement may move fishers from higher- to lower-yielding areas. To reduce possible negative socio-economic impacts, fishing effort, using publicly available data on trawl, purse-seine and longline fishing from globalfishingwatch.org was built in as a cost in the development of the example networks. The resulting network designs only displaced around 20% or 30% of existing fishing effort, demonstrating that networks representative of biodiversity can be built with limited economic impact. Many of the costs of establishment will in any case be offset by gains from protection, such as fish stock rebuilding and improved ecosystem health.

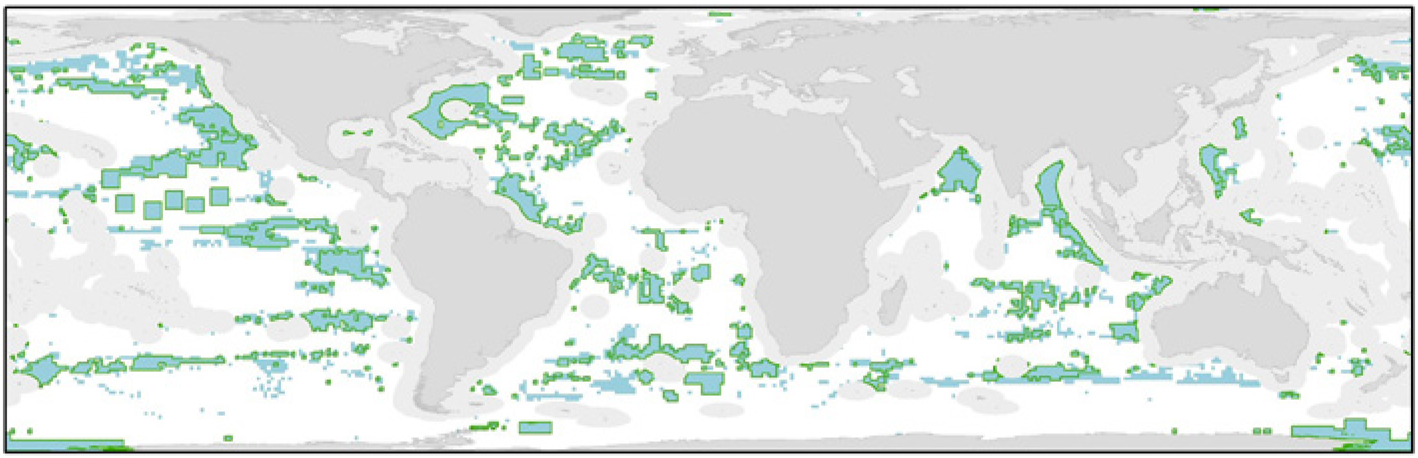
Deep seabed mining is an emerging industry which will inevitably damage vulnerable deep-ocean ecosystems. Huge swathes of the seabed are being licensed for mineral exploration, many of them, as our study shows, in areas with high biodiversity value. Excluding them from potential MPA networks may seriously impact our ability to represent wild nature and ecosystem function beyond national jurisdiction and could therefore undermine efforts to protect biodiversity. An interim moratorium on mining would be appropriate to ensure that all options for protection remain open as a high seas MPA network is built.

A composite approach to network design

Some well-known hotspots for wildlife, such as the Costa Rica Dome upwelling region or the White Shark Café in the Eastern Pacific, did not always come up in the network examples generated by our analyses. This was principally because our data layers indicated presence of species or features, not the intensity of use by those species. Places known to be critically important wildlife aggregation sites argue for a composite selection approach to be developed that combines bottom-up site selection based on local knowledge and stakeholder input with high-level, coordinated systematic planning.

The systematic planning approach used here complements bottom-up knowledge, drawing attention to areas that may have been overlooked but are important within network designs. Figure 2 shows planning units selected to be part of MPA networks in more than 75% of runs of the program, indicating a high value for meeting the conservation targets we set within the constraints imposed. These places warrant targeted research to better understand their biodiversity value and could form kernels around which MPAs can be formed.

***Figure 2:** Areas of importance (>75% selection frequency of each planning unit) for 30% (outlined green areas) and 50% (solid blue areas) coverage of all conservation features with management units locked in/out. Results are based on 200 runs of Marxan for each scenario.*



Ghost fishing nets in the Great Pacific Garbage Patch
© Justin Hofman/ Greenpeace

Conclusion

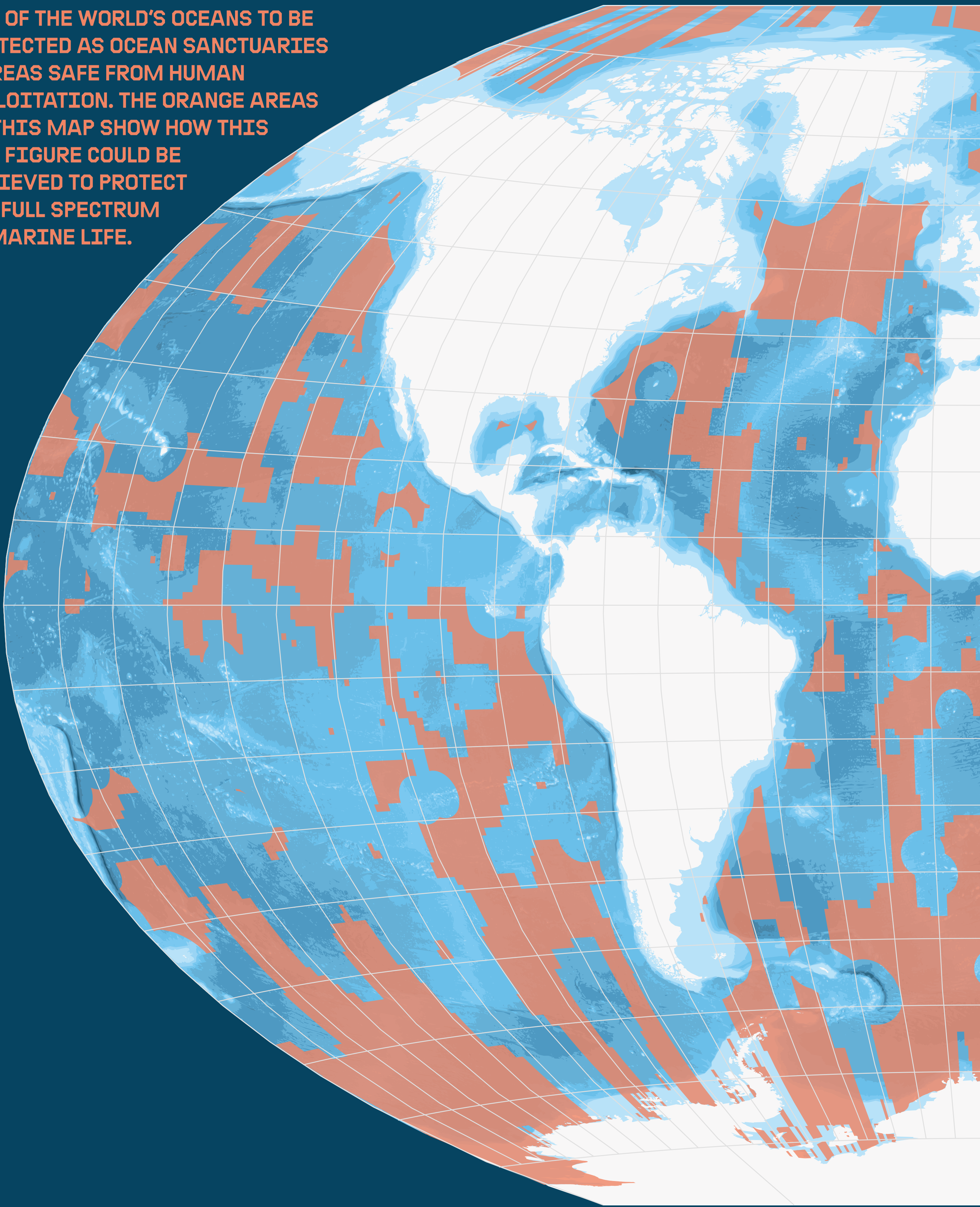
Increasing human pressures exerted on the high seas have led to a swift and alarming decline of wildlife and degradation of habitats. Not only are these pressures detrimental to the wellbeing of ocean life, they compromise the ability of the high seas to deliver key ecosystem services that sustain us all, a problem that will be further exacerbated by global change. To avert the looming crisis we must implement effective protection at a commensurate scale and with urgency.

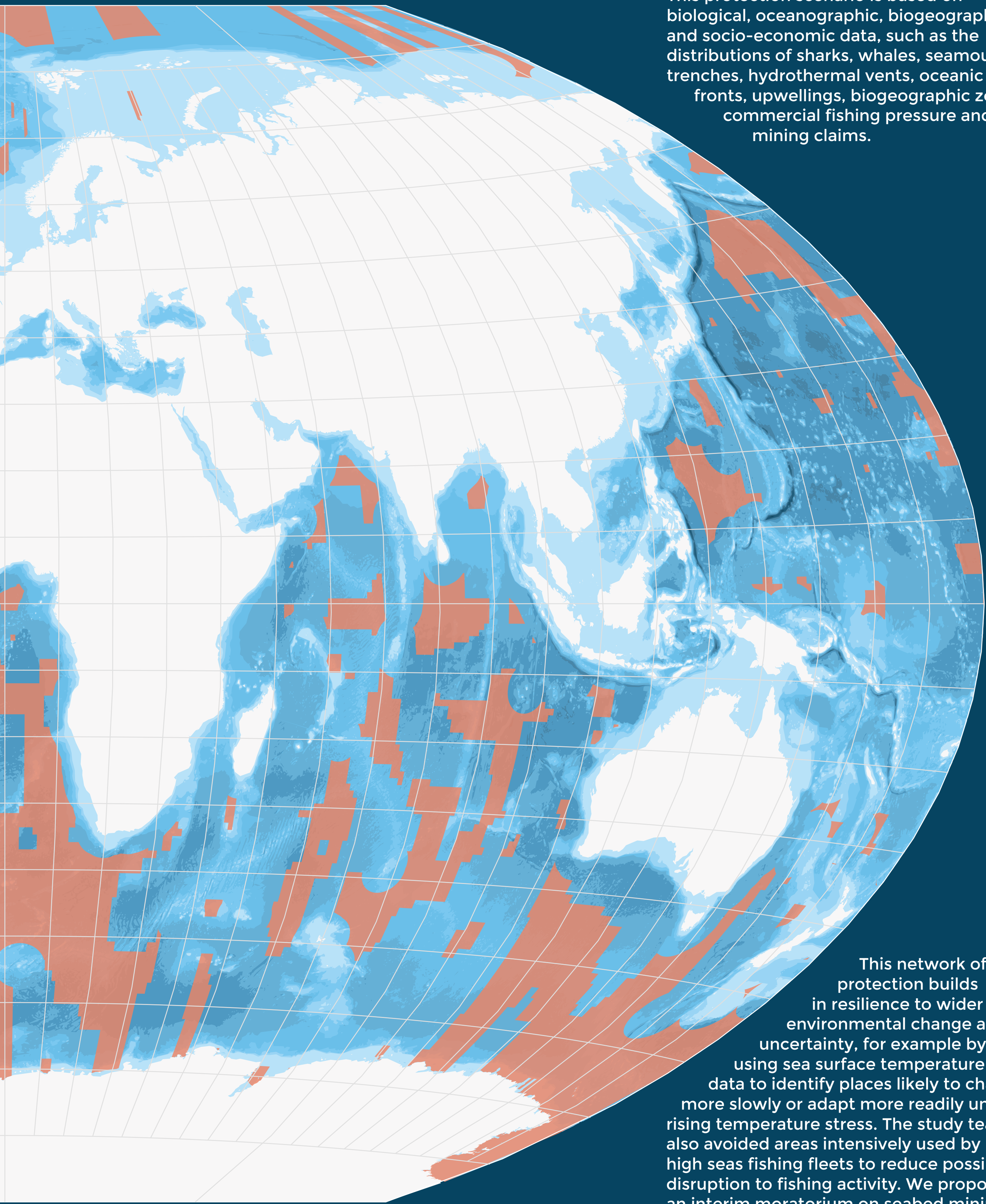
"TO AVERT THE LOOMING CRISIS WE MUST IMPLEMENT EFFECTIVE PROTECTION AT A COMMENSURATE SCALE AND WITH URGENCY."

Our analyses show that it is possible to use the increasingly sophisticated and spatially well-resolved data available to design an ecologically representative, planet-wide network of high seas protected areas. Systematic conservation planning offers a key tool to inform planning decisions in a cost-effective, transparent and defensible way. However, the complexity of the task and the necessities of cost-efficiency point to the need for a global mechanism whereby governments are collectively responsible for designating ocean sanctuaries and putting in concrete measures to protect them. That body will need to work with existing global and regional governance structures and other stakeholders in a composite approach that combines site-specific nominations with systematic planning to deliver holistic protection to the wildlife of international waters.

WHAT 30% OCEAN PROTECTION COULD LOOK LIKE

SCIENTISTS ARE CALLING FOR AT LEAST 30% OF THE WORLD'S OCEANS TO BE PROTECTED AS OCEAN SANCTUARIES – AREAS SAFE FROM HUMAN EXPLOITATION. THE ORANGE AREAS ON THIS MAP SHOW HOW THIS 30% FIGURE COULD BE ACHIEVED TO PROTECT THE FULL SPECTRUM OF MARINE LIFE.





This protection scenario is based on biological, oceanographic, biogeographical and socio-economic data, such as the distributions of sharks, whales, seamounts, trenches, hydrothermal vents, oceanic fronts, upwellings, biogeographic zones, commercial fishing pressure and mining claims.

This network of protection builds in resilience to wider environmental change and uncertainty, for example by using sea surface temperature data to identify places likely to change more slowly or adapt more readily under rising temperature stress. The study team also avoided areas intensively used by high seas fishing fleets to reduce possible disruption to fishing activity. We propose an interim moratorium on seabed mining to ensure that options are left open as a network of protection is built.

30X30

A BLUEPRINT FOR OCEAN PROTECTION

How we can protect 30% of our oceans by 2030

The high seas form a vast global commons that covers **61%** of the area of the ocean and **73%** of its volume. They encompass an astonishing **43%** of the Earth's surface and occupy **70%** of the living space on our planet, including land and sea. These international waters are home to a stunning wealth of marine life and ecosystems, and by virtue of their enormous expanse, are essential to the healthy functioning of planet Earth. But in recent decades that life has dwindled under the rising impact of multiple human stresses, prompting an historic effort by the United Nations to increase protection and reform management.

Ocean sanctuaries are a key tool for protecting habitats and species, rebuilding ocean biodiversity, helping ocean ecosystems recover and maintaining vital ecosystem services. The report shows that it is entirely feasible to design an ecologically representative, planet-wide network of high seas protected areas to address the crisis facing our oceans and enable their recovery. The need is immediate and the means readily available. All that is required is the political will.

This is an executive summary of the full report which can be read here: greenpeace.org/30x30

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