TWAP
TRANSBOUNDARY WATERS ASSESSMENT PROGRAMME

The Open Ocean

Status and Trends

SUMMARY FOR POLICY MAKERS

VOLUME 5: OPEN OCEAN

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Administrative Boundaries

Source of administrative boundaries used throughout the assessment: The Global Administrative Unit Layers (GAUL) dataset implemented by FAO within the CountrySTAT and Agricultural Market Information System (AMIS) projects.

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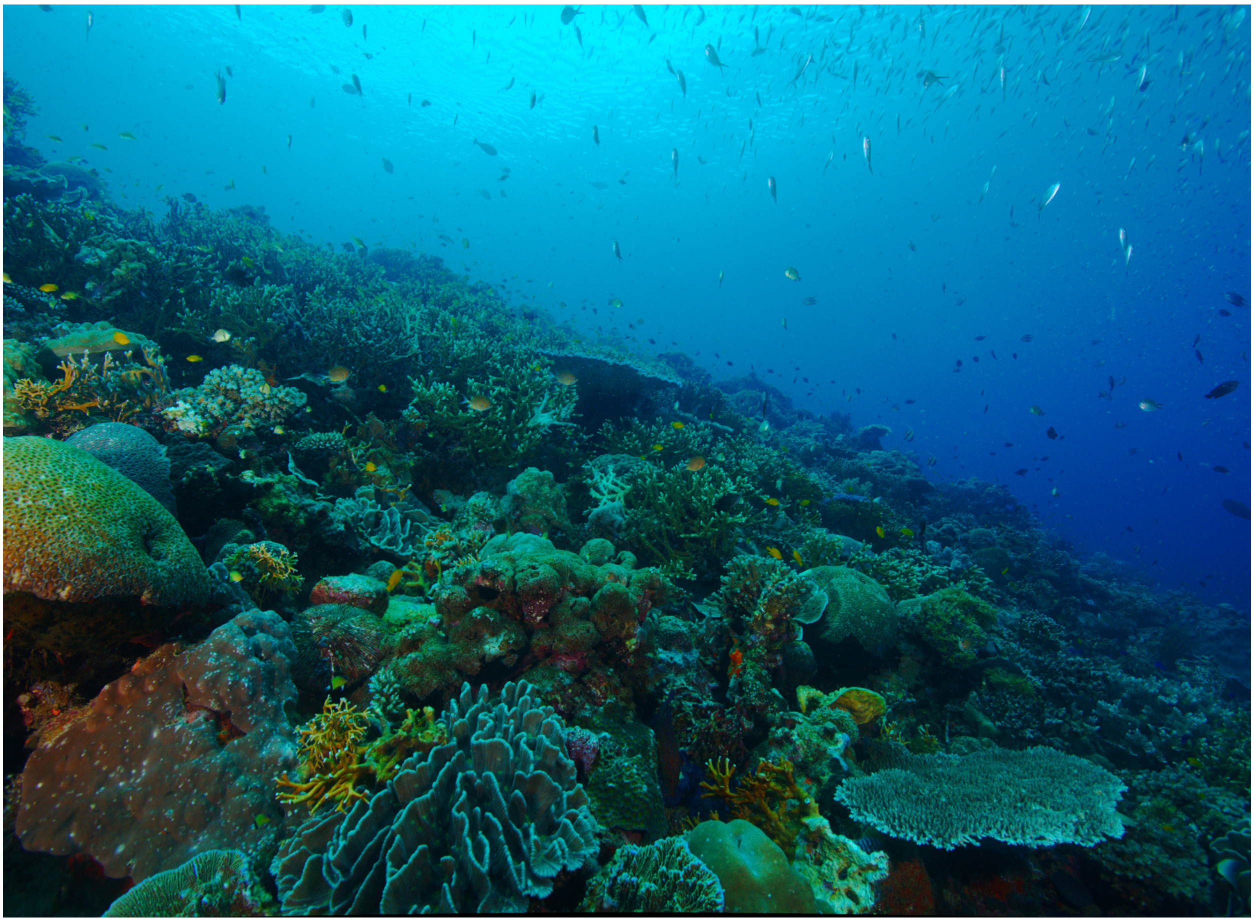
Summary for Policy Makers

The *Open Ocean Assessment* provides a baseline review of issues linking human well-being with the status of the open ocean through the themes of governance, climate change, ocean ecosystems, fisheries, pollution, and integrated assessment of the human-ocean nexus. It uses indices and indicators where data exist, in many cases with future projections due to global climate change, complemented by expert scientific assessment of numerous low certainty but potentially high impact issues where global ocean monitoring is inadequate.

Key Messages and Recommendations

1. **Urgent attention is needed to sustainably manage the open ocean ecosystems and their services.** The open ocean is the largest transboundary water space on Earth, covering about half of the entire surface of the planet, but also has impact on the entire global ocean. The open ocean's physical, chemical and biological characteristics are directly and indirectly threatened by human activity, especially via the effects of climate change. Damage to the open ocean will have severe consequences for marine ecosystems and services, and in turn human wellbeing.
2. **Understanding the impact of climate-ocean-human interconnections will help inform and improve sustainable development decisions.** The state of the open ocean is influenced by climate. Likewise, climate is influenced by the ocean. This feedback loop is out of balance, with stressors from human activities causing a decline in the health of marine ecosystems and negatively affecting ecosystem services and human wellbeing.
3. **Improving human development is a key way to reduce human risk to sea level rise at the coast,** by reducing vulnerability and boosting adaptive capacity. The risk comes from the hazard of sea level rise which will continue under all emissions scenarios, and human exposure and vulnerability.
4. **Unabated greenhouse gas emissions require immediate regulation to avoid severe consequences.** If greenhouse gas emissions continue unabated, IPCC projections from now to 2050 indicate a continued decline in the health of marine ecosystems and their associated services. This will have negative consequences for human wellbeing.
5. **The sustained and incrementally improved monitoring of key ocean and climate variables within the Framework for Ocean Observations, GOOS and GCOS is critical.** It is important that the open ocean's physical, chemical and biological characteristics are regularly monitored. This will provide essential trend data to properly inform decisions to manage the health of the open ocean ecosystems, with a view to maintaining viable ecosystem services and being able to measure and project human risk.
6. **Improved regulation is essential in reducing the over-exploitation of fish stocks and the impacts of climate change on them.** Fish stocks in the open ocean are vulnerable to over-exploitation from direct human impact. In addition, the indirect human impacts of climate change lead to declining fish stock health and shifting migratory patterns.
7. **Improved regulation is required to minimize the sources and impact of pollution on marine ecosystem health and human wellbeing.** There are multiple sources of pollution in the open ocean (including land, shipping and atmospheric) which have potentially massive impact on the health of marine ecosystems, and in turn, humans.
8. **Improved global transboundary ocean governance is needed to mitigate even local damage to ocean ecosystems within national waters.** Stressors such as climate change, whose mitigation solutions require global and regional governance and cannot be addressed by national action alone, dominate cumulative human impact on these local and coastal ecosystems.

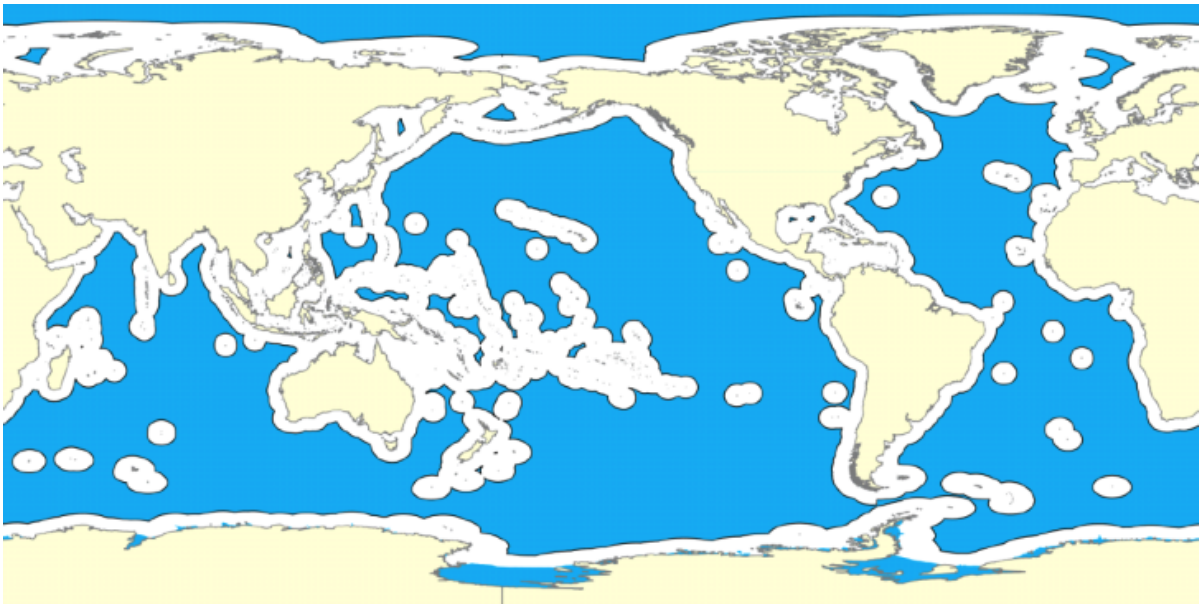
9. **Governance arrangements for the open ocean should connect to those for areas under national jurisdiction at the regional level.** Numerous governance arrangements (ranging from local, to regional, to global) exist for the open ocean and areas beyond national jurisdiction. These are often complex, with many gaps (especially for biodiversity) and/or regulations are not enforced. There is no co-ordination body actively addressing these challenges at global and regional levels. These arrangements should work on common principles.
10. **The TWAP Open Ocean assessment method provides a holistic overview of the state of open ocean ecosystems and their inter-connections with human wellbeing. It can be used to create a system of monitoring goals within the Sustainable Development Goals (SDG) framework and to support future rounds of the World Ocean Assessment.** This assessment is the first to look at the state of open ocean ecosystems and inter-connections with human wellbeing holistically using a method describing the relationship between human and natural systems from the point of view of ecosystem services. This has allowed an identification of data sources and gaps, and natural points of intervention for management. The methodology compliments the UN Regular Process, and the results also corroborate with World Ocean Assessment Summary (2015).
11. **An ongoing and robust scientific support enterprise is essential in providing confidence to policy and decision-makers that resources are being appropriately allocated.** The open ocean is under-observed and under-explored, and there is still more to be understood about its immediate and future impact on human society. However, a lack of certainty cannot prevent policy and decision-makers from acting. The results of this assessment reveal key issues that require immediate attention and action. As research and monitoring improve, strategies for managing these issues can then be refined in the light of increased scientific understanding.



The open ocean

The 'open ocean' is the largest areas of global commons, vital to life on the planet, and under the legal jurisdiction of no single nation but the common stewardship of all in 'areas beyond national jurisdiction' (ABNJ). This area is made up of the ocean beyond exclusive economic zones (EEZs). From a scientific perspective, the open ocean includes all areas beyond the shallow continental shelf break. Due to the strong connections between the open ocean and coastal areas, a global ocean perspective is often taken. Where indicators are shared with the Large Marine Ecosystems, this assessment has focused on ABNJ.

Areas Beyond National Jurisdiction (ABNJ) are blue. The white areas depict exclusive economic zones (EEZs) (or 'areas within national jurisdiction').



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Assessment indicators for an under-monitored open ocean

The Transboundary Waters Assessment Programme (TWAP) was initiated by the Global Environment Facility (GEF) to create the first baseline assessment of all the planet's transboundary water resources. The *Open Ocean Assessment* is one of five assessments of transboundary water systems (see *www.geftwap.org*).

The *Open Ocean Assessment* is focused on 6 themes broadly aligned with governance arrangements covering areas beyond national jurisdiction, including governance of issues requiring global transboundary solutions. It provides a baseline indication of the state of the open ocean and its ecosystems and services, their connection to human wellbeing including global connections to the coast; and where possible, projected future state at 2030, 2050, and/or 2100. This assessment involved data assembly, index and indicator development, and theme reviews by experts - assessing the indicators where possible and assessing scientific literature where sustained global monitoring does not exist.

The table below identifies the expert assessments, indices and indicators (including projections) used in the assessment. It also identifies the implied sustained monitoring requirement and present-day readiness of monitoring systems such as the natural system-focused Global Ocean Observing System (GOOS) to systematically capture the information needed to update this assessment in the future (based on the readiness scale of the *Framework for Ocean Observing* ranging from: concept, pilot, to mature). Even for mature portions of observing systems (i.e. the physics of ocean climate), sustained financial and institutional support as well as capacity for and coverage of global observations and information delivery remains patchy and fragile.

THEME	Expert Assessment	INDEX / INDICATOR (Baseline)	INDEX / INDICATOR (Projected to 2030, 2050, and/or 2100)	Sustained monitoring requirement for assessment *includes both natural system and human data*	Readiness of sustained observations *(concept, pilot, mature, from least to most ready)*
Governance	Existence of Open Ocean Governance Arrangements			Monitoring of governance arrangements covering ABNJ	concept
Climate	Climate and Ocean interactions	Ocean warming	Ocean warming	Physical / biogeochemical ocean variables	mature / pilot
		Deoxygenation	Deoxygenation (to 2090)	Oxygen	pilot
		Aragonite saturation state	Aragonite saturation state	Carbonate system	mature
			Sea Level Rise Risk Index (to 2100)	Sea level, temperature, cryosphere	mature / pilot
				human exposure and vulnerability to sea level	mature
Ecosystems, habitats and biodiversity	Ocean Acidification Risk	Primary productivity		ocean colour in situ validation	mature pilot
		Phytoplankton		phytoplankton	concept
		Zooplankton		zooplankton	pilot
		Coral reefs (tropical ecosystem)	Coral reefs (tropical ecosystem)	coral health	pilot
		Pteropods (polar ecosystem)	Pteropods (polar ecosystem)	zooplankton	pilot
		Biodiversity (based on OBIS records)		Biodiversity (species records)	concept
Fisheries	Sustainability of fisheries	Marine Trophic Index	Fish Catch Potential	fish catch data by taxonomic group and trophic level	mature
		Fishing in Balance Index		fish catch data by taxonomic group and trophic level over time	mature
		Bottom Impacting Gear		method of fish catch	mature
		Demersal Fishing		method of fish catch	mature
		Tuna trends 1950 to 2010		fish catch data	mature
Pollution	Pollution (general)	Plastics		time series of ocean contaminants from strategically selected sites	concept

Narrative of selected results

The results for all indicators and expert assessments are too many to show here, and can be explored in more detail on the *Open Ocean Assessment* web site *(onesharedocean.org/open_ocean)*. A narrative of selected key messages follows here.

A changing open ocean climate

The ocean's dominant role in climate of storing and distributing heat and moisture means it will drive changes of rainfall and drought over land. Sea level rise from heat expansion and melting land ice threatens coastal ecosystems and human habitat. Ocean climate changes through temperature, acidification, and deoxygenation have direct impact on ocean ecosystems.

Projected climate change scenarios

The **Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report 2014** (AR5) provides the most up-to-date comprehensive assessment of scientific information on climate change and the ocean and an overview of impacts already observed or expected from a range of climate change scenarios. The *Open Ocean Assessment* uses projections of the future state of the open ocean using the scenarios outlined in the **IPCC 5th Assessment Report (2014),** for 2030 and 2050, and when intermediate output was not available, for 2100.

Representative Concentration Pathways (RCP) are tools used by researchers to test the consequences different greenhouse gas emission scenarios, based on global political choices. There is a range of scenarios but this Assessment uses two:

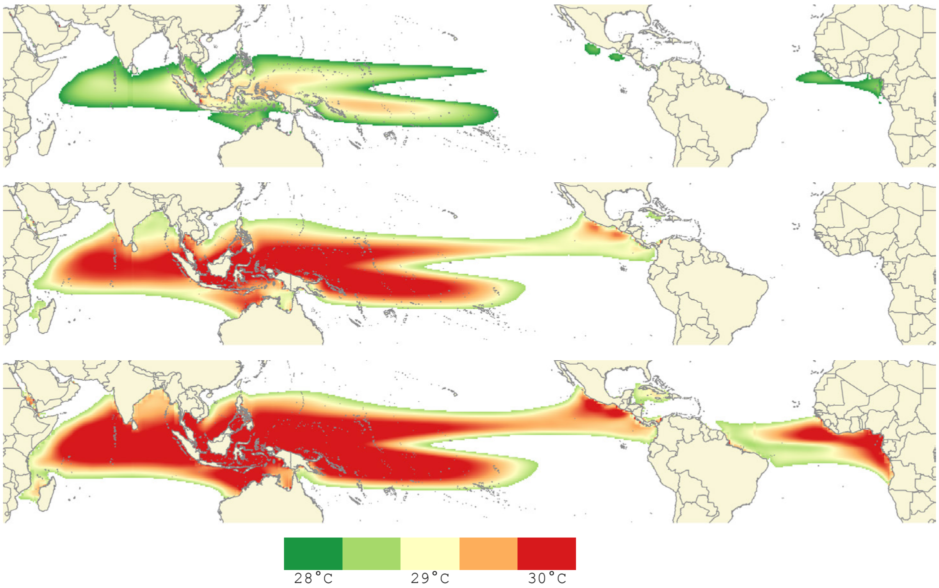
- **RCP8.5 'Business As Usual'** ***(BAU)*** – where nothing changes from the current situation, there is continuing growth of greenhouse gas concentrations in the atmosphere.
- **RCP4.5 ' two degree stabilization scenario' or 'Moderate Mitigation'** ***(MM)*** – where there is a continued rapid initial growth of greenhouse gas concentrations, but stabilizing concentrations from 2070 onward. Parties to the Paris Agreement of the UNFCCC adopted in December 2015 have agreed to hold "the increase in global average temperature to well below 2 °C above pre-industrial levels"

The ocean is warming

Ocean warming dominates the energy stored in the climate system in the last 40-50 years and accounts for approximately 93% of the excess heat accumulated between 1971 and 2010.

The area of regions with very warm water (>28°C), engines of tropical circulation and rainfall patterns, will increase substantially by 2050 under both the "Moderate Mitigation" and "Business As Usual" scenarios, with impacts on regional climate and ecosystems.

The open ocean 'warm pool' (>28°C) now (top), in 2050 under 'Moderate Mitigation' (middle) and under 'Business as Usual' (bottom) scenarios.

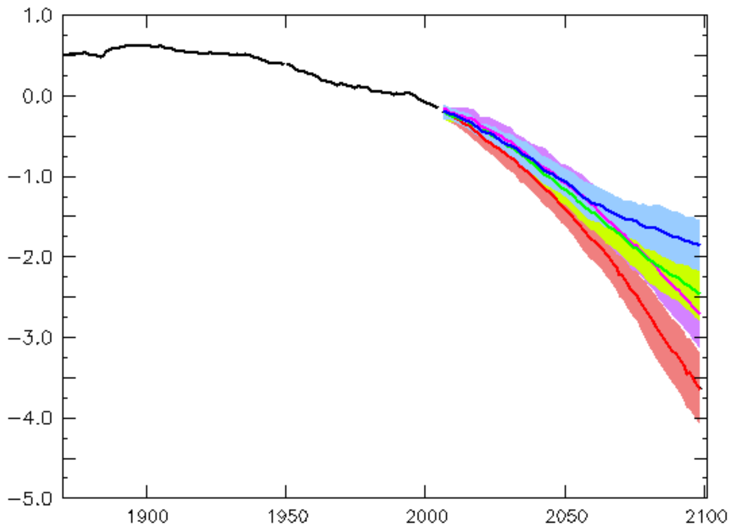


Ocean oxygen is decreasing

One of the major climate stressors of open ocean ecosystems is deoxygenation. The concentration of dissolved oxygen (O_2) is a major determinant of the distribution and abundance of marine species globally. Open ocean deoxygenation has already been recorded in nearly all ocean basins during the second half of the 20th century. Increased temperatures are responsible for approximately 15 % of the observed change, and the remaining 85 % is due to reduced O_2 supply from increased ocean stratification and increased deep-sea microbial respiration.

The North Pacific, the North Atlantic, the Southern Ocean, the subtropical South Pacific and South Indian oceans will all undergo deoxygenation by the end of the century (BAU scenario).

Observed (black line) and projected O_2 concentration change (per cent) relative to mean concentration in the 1990s. The black line shows historical simulations tuned with available observations. Colored lines represent four RCP scenarios: RCP 2.6 – blue, RCP 4.5 'Moderate Mitigation' – green, RCP 6.0 – lavender and RCP 8.5 'Business as Usual' – red.

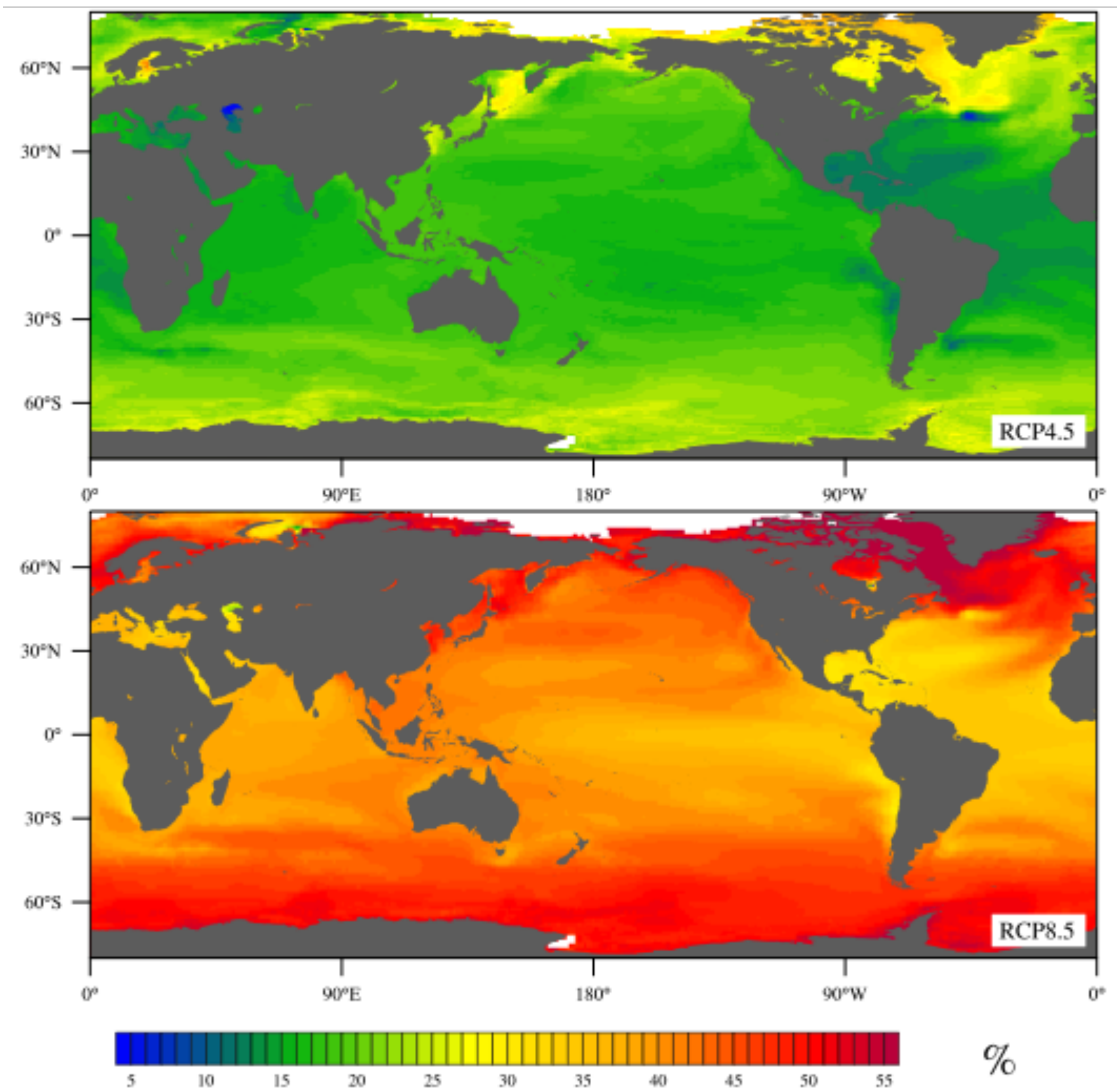


The ocean is acidifying

The ocean represents a net sink for the atmospheric carbon dioxide, absorbing an estimated 30% of anthropogenic emissions. A consequence of this is an acidification of near surface layers of the order of 0.1 pH units (about 30% more acidic) in the last century.

For the "Moderate Mitigation" scenario: global oceanic pH is expected to decrease a further 0.12 units by 2099, with this change on the logarithmic pH scale representing an increase in acidity of about 30%. For the "Business as Usual" scenario: the pH decrease is projected to be 0.32 units by 2099, representing a doubling in acidity.

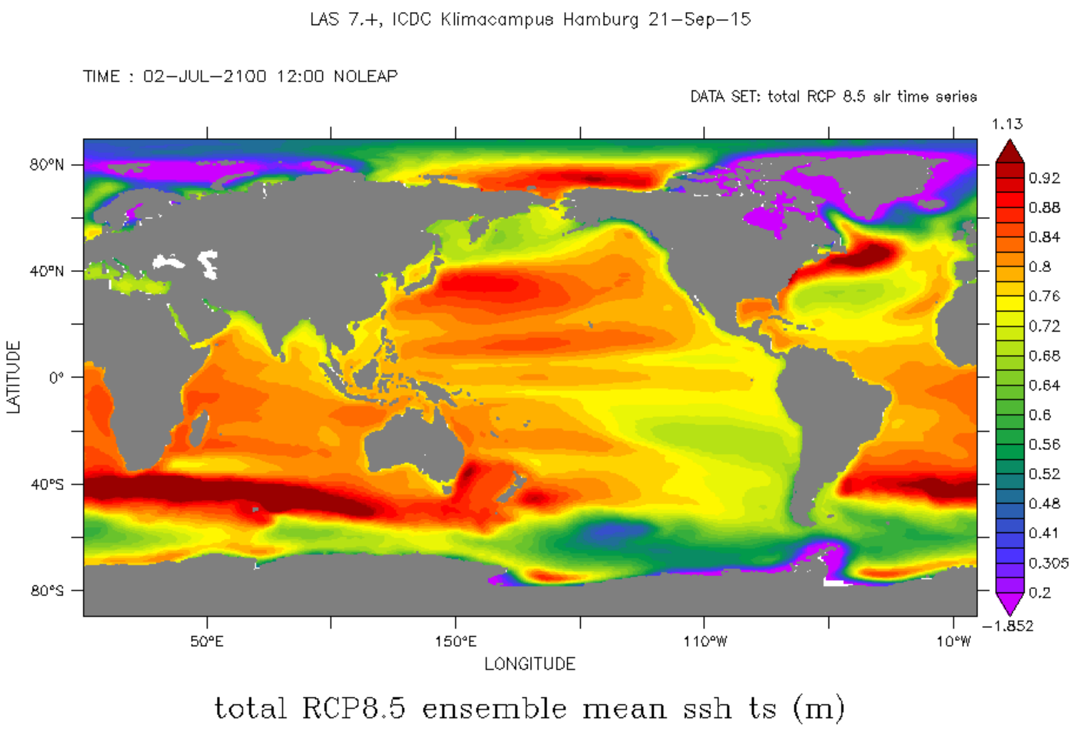
Projected percent change in aragonite saturation state (an ocean acidification indicator) in by 2100 under 'Moderate Mitigation' (top) and 'Business as Usual' (bottom) scenarios.



Sea level is rising

In the last 30 years, tide gauges and satellite altimetry measures reveal a global sea level rise of approximately 3mm/year (the 20th century average was 1.7mm/year), integrating the effects of expansion from warming and additional ocean mass from melting land ice. Important regional effects are observed with sea level variations going from negative values over the Eastern Pacific to about four times the mean global value in the Indonesia-Philippines area. In a warming earth, sea level will most likely rise for over 95% of the global ocean with areas near glaciers and ice sheets very likely to experience sea level fall (because land rises with the reduced weight of melting ice) by 2100. Greenhouse gases in the last 200 years have committed us to millennia of sea level rise. The pace and magnitude at which seas will permanently flood and reconfigure present-day coastal ecosystems will have profound consequences on human societies.

Projected sea level rise under the 'Business as Usual' scenario in 2100, showing the strong regional variation in the hazard.



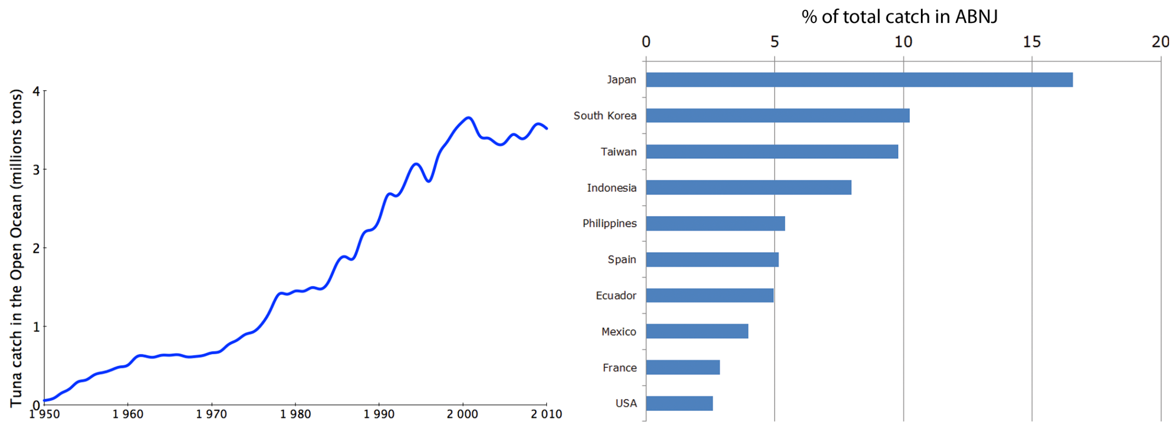
Human impact on the open ocean growing

Fisheries exploitation is relentless, and inequitably distributed

The world catch of tuna in the open ocean, taken beyond the exclusive economic zones of maritime countries, has increased from about 125 000 tons per year in the early 1950s to about 3.5 million tons from 2000 to 2010. It is not likely to increase much further. Most of this catch, consisting of skipjack, yellowfin, bigeye and albacore tuna is traditionally taken by Japan, South Korea and Taiwan, but other countries have been attempting to increase their share.

As the current states of tuna stocks in the open ocean and the effects of ocean warming preclude substantial further increase in catches, there will be increased competition among the subsided fleets of developed countries with distant-fishing fleets, and between established fleets and new entrants. Of these new entrants, three are developing countries (Indonesia, the Philippines and Mexico) appearing among the 10 countries with the largest tuna catch in the open ocean.

Tuna catch in Areas Beyond National Jurisdiction has increased enormously since 1950 (left). Over the period 2000-2010, the top ten countries (right) were fishing 70% of tuna in ABNJ.

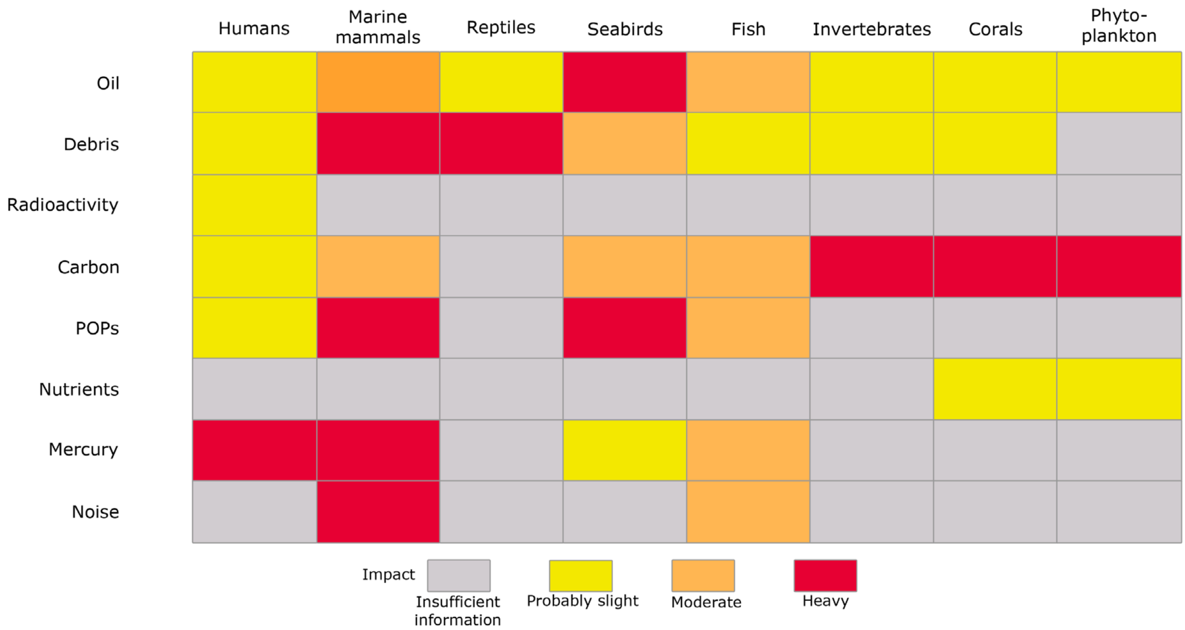


Pollution poses threats to ecosystems

A review identifies issues affecting the open ocean that represent significant risks to ocean ecosystems, both now and in future. These are changes, directly or indirectly associated with human activities, threatening the integrity, biodiversity, productivity or sustainability of ocean sectors on large spatial scales.

Atmospheric inputs of CO_2 and nitrogen as well as solid debris (e.g plastics and netting) in the water column and on the seabed are a major concern. Pollution from the exploration/extraction of minerals and hydrocarbons from the deep-ocean seabed is a rapidly emerging threat. Contaminants are a real threat, but trends are unknown – a longer-term data time-series is needed. Greater investment in contaminant trend monitoring is urgently required.

Open ocean contaminants (rows) and their impact on different species and ecosystems (columns). While there is insufficient information about a number of the impacts, heavy impacts can be identified.



Cumulative human impact strong in many open ocean areas

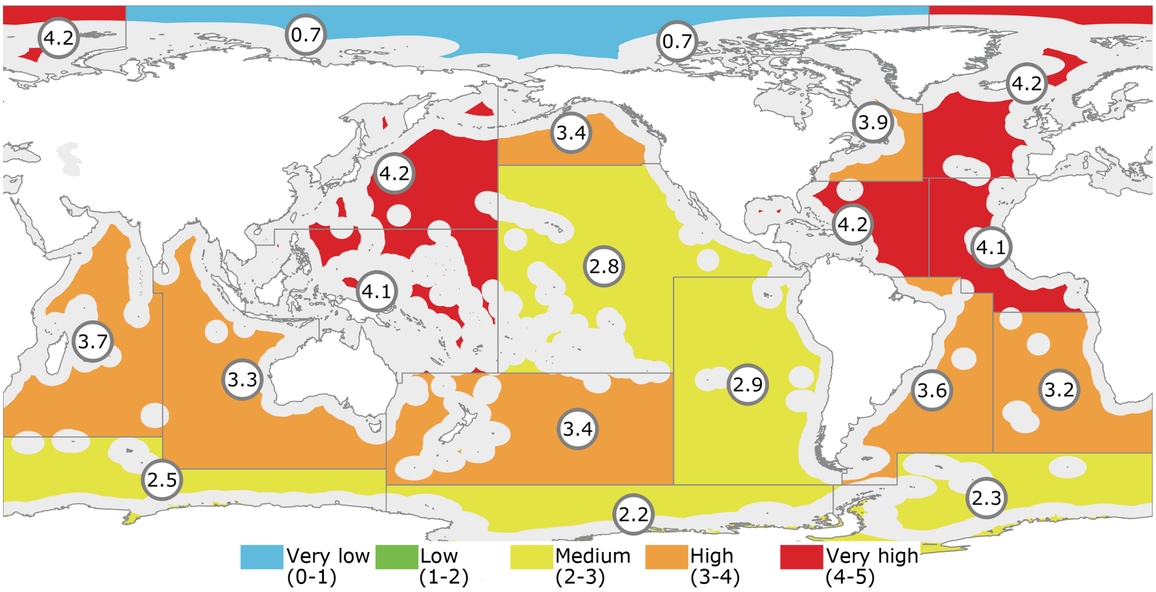
Assessing and mapping the cumulative impact of human activities on marine ecosystems provides a unique perspective and understanding of the condition of marine regions, and of the relative contribution of different human stressors to creating that condition.

Stressors affecting open ocean regions largely fall into three main categories: climate change, commercial fishing, and commercial activity (such as shipping).

Stressors associated with climate change, most notably ocean acidification and increasing frequency of anomalously high sea surface temperatures, are the top stressors for nearly every high seas region.

The most heavily human-impacted High Seas regions are the northern and central Atlantic and the northwest and western central Pacific. The least impacted region is the Arctic.

Cumulative human impact on ocean ecosystems in areas beyond national jurisdiction. This can be directly compared to the LME Assessment.



Climate change projected to create critical hazard

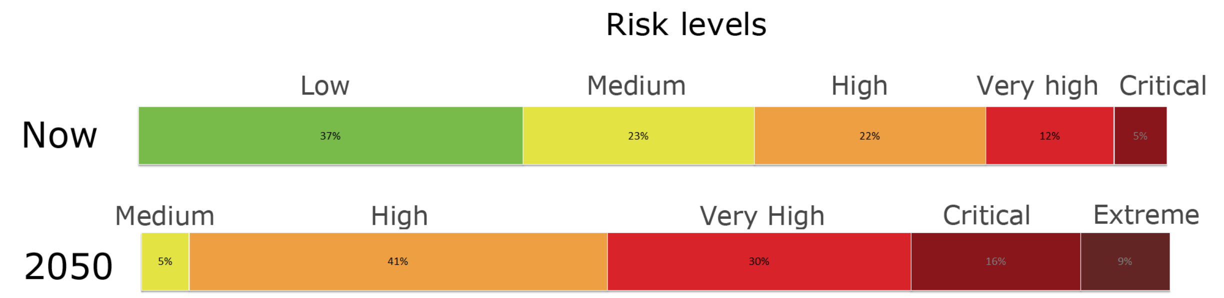
Coral reefs at risk

Despite their value to humans for food, livelihood, recreation and coastal protection, coral reefs face severe local and global threats. At present, over 60% of the world's coral reefs are threatened by local activities, with over one quarter at high or very high threat. When the influence of warming seas and ocean acidification for the current decade are considered, the percentage of reefs rated as threatened increases slightly, but the proportion of reefs *at high, very high* or *critical* threat levels increases to 37%.

Threat to coral reefs will increase in the coming decades due to continued greenhouse gas emissions driving ocean warming and acidification. Using projections of ocean warming and acidification, estimates suggest that in the 2030s about 90% of the world's coral reefs will be threatened, and by the 2050s virtually all reefs will be threatened by the combined (integrated) pressures from local and global hazards. The proportion of integrated threat coming from global sources (warming and acidification) is estimated to be 20 % in the current decade, 40-45% in the 2030s, and between 55 and 65% in the 2050s.

Future emissions of greenhouse gases will greatly influence the severity of that threat. Under the "Business as Usual" scenario, 95% of reefs are projected to be in areas rated as under at least *high* threat (with 55% in the *very high, critical* or *extreme* categories). Under the "Moderate Mitigation" scenario, projections suggest 55% of reefs are under at least *high* threat (with 35% in the *very high, critical* or *extreme* categories).

Risk levels to shallow water coral reefs from local and climate stressors, now and in 2050 under the 'Business as Usual' scenario. A new 'Extreme' risk category had to be added to the analysis.

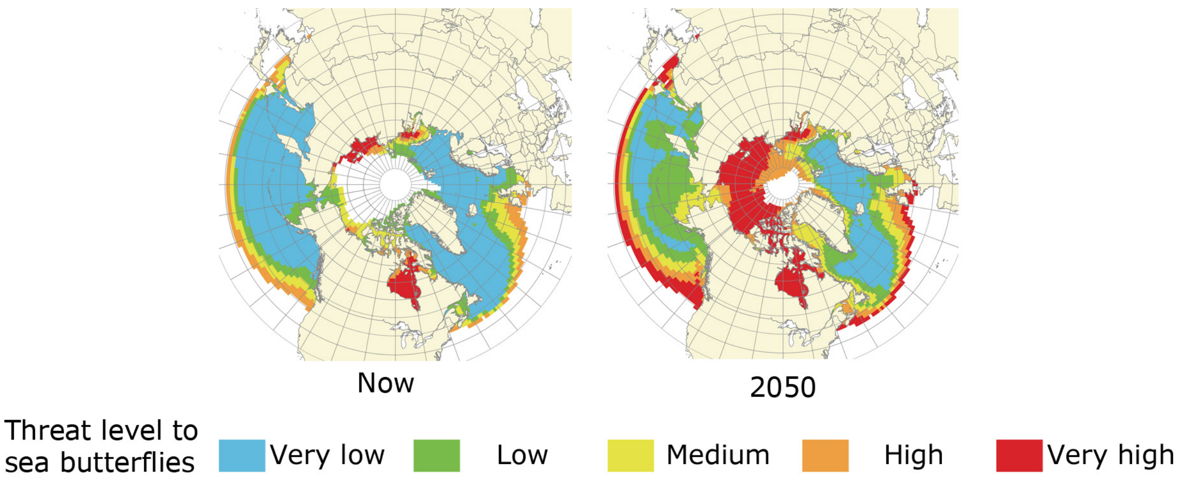


Habitats are being squeezed

Pteropods, or 'sea butterflies', are tiny snails that play a critical role in various ecosystems as prey for a variety of predators. There is a great concern about the potential impact of global change – and particularly ocean acidification – on these organisms, as their shells are sensitive to changes in ocean chemistry.

Global change is a very serious threat for high latitude pteropods, as by 2050 under the 'Business as Usual' scenario, they likely will not be able to thrive in most of the Arctic Ocean and some regions of the Southern Ocean.

The area of habitat of polar pteropods, an abundant zooplankton species at the base of the food chain, will shrink over time.



Fish catch potential reducing

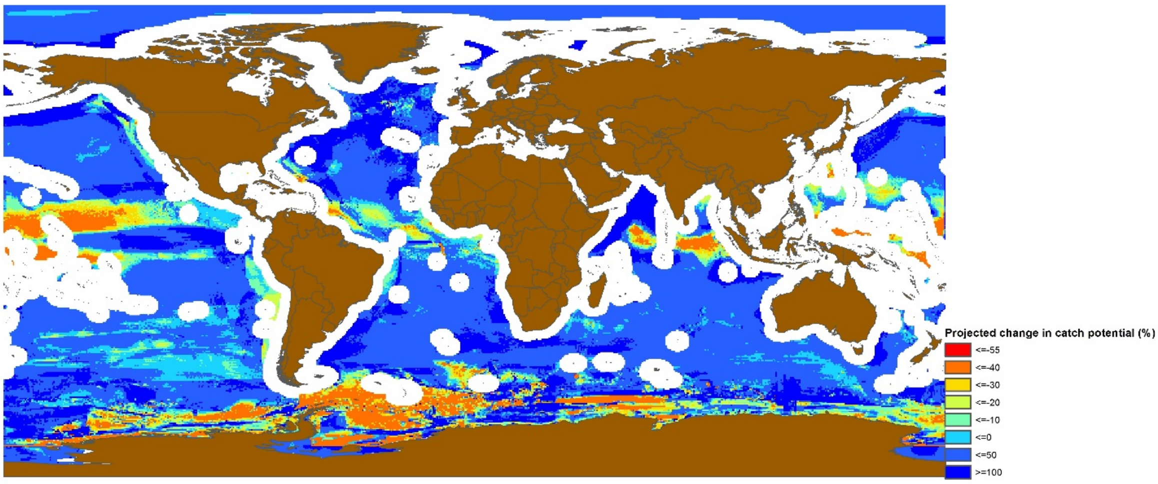
Marine fisheries productivity is likely to be affected by the alteration of ocean conditions including water temperature, ocean currents and coastal upwelling, as a result of climate change.

The open ocean will be increasingly impacted by climate change, as will coastal areas of the ocean. These changes are here modeled using a bioclimate envelope model capable of reproducing and amplifying the observed poleward migration of fishes exploited by fisheries. The results are an overall predicted reduction of 20 % of the potential catch of the open ocean to 2030 and 34 % to 2050.

The strongest declines of potential catch should occur in two places:

- the inter-tropical belt, because increasing stratification will depress primary and secondary production and because no fish will replace those tropical fish that migrate poleward, and
- Antarctica, because the life cycle of the currently abundant krill (*Euphausia superba*) is tied to shelf ice that is expected to melt away.

Change in projected fish catch potential under a business as usual climate scenario in the 2050s.



Direct sea level rise risk to communities

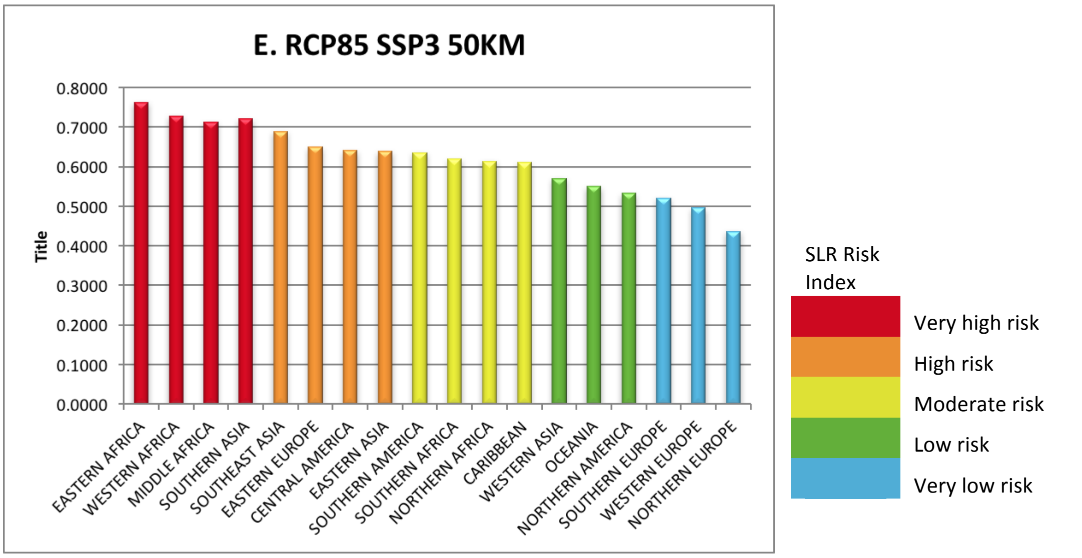
The risk of future risk of sea level rise (SLR) in 2100 was estimated within a framework of hazard, exposure and vulnerability using internally consistent future development scenarios (or pathways) for 139 coastal countries over the time period 2010-2100.

While sea levels (hazard), total land area and people living in the 50 km coast (exposure) and vulnerability (HDI gap) contribute equally to risk, vulnerability influences risk very significantly with 80% correlation across development pathways.

- Countries that will experience highest sea levels (highest degree of hazard), on average across scenarios are: the USA, Canada, Russia, South Africa and Mozambique (tied), Japan, Australia and New Zealand (tied), Madagascar and Mauritius, in decreasing order.
- Averaged across the five future scenarios, the countries with the highest degree of exposure are: USA, Indonesia, China, Brazil, Viet Nam, Nigeria, Bangladesh, Egypt and Australia, in decreasing order.
- Using the HDI Gap as vulnerability metric, the most vulnerable countries, on average across the five scenarios are: Somalia, Mozambique, Sierra Leone, Liberia, Madagascar, Guinea-Bissau, Solomon Islands, Eritrea, Papua New Guinea and Benin, in decreasing order.

- The ten countries most threatened by SLR indicated by the SLR Risk Index, on average and across the five reference projection pathways (in decreasing order) are: Somalia, Mozambique, Madagascar, Angola, Liberia, Sierra Leone, Papua New Guinea, Senegal, Guinea-Bissau and Mauritania. Seven of these coastal states are identified among the most vulnerable.

The relative regional risk to sea level rise in 2100 under the 'Business as Usual' (RCP8.5) emissions scenario and the 'Stalled Development' (SSP3) socioeconomic pathway.



Governance of the open ocean

Global governance scales are needed to solve the majority of local risk posed by ocean ecosystems degradation

In order to ask the question "where are humans most at risk from transboundary water decision-making?" with respect the ocean ecosystem degradation, we analyzed *risk* as based on the *hazard* (ocean ecosystem degradation), *exposure* (population at risk, taking a human-centered view), and *vulnerability* (based on the human adaptive capacity to deal with degraded ocean ecosystem services). For this analysis, the indices used were:

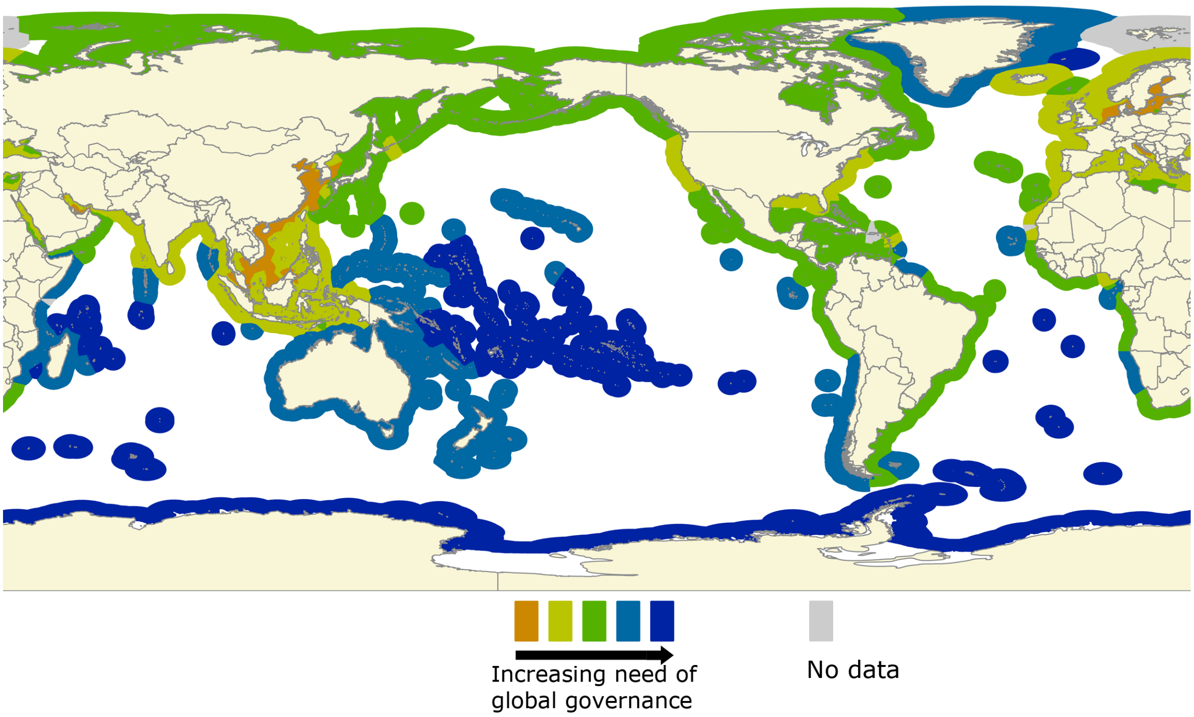
- for *hazard* the Cumulative Human Impact of 19 stressors on ocean ecosystems, in EEZ fragments as a proxy for local ocean ecosystem service degradation,
- for *exposure* the coastal population (<10 km from coast) of a country using data developed for the Sea Level Rise Risk Index, and
- for *vulnerability* the Human Development Index (HDI) of a country as a proxy for adaptive capacity (high HDI considered as least vulnerable).

A Delphi exercise determined the governance scale needed to tackle each of the stressors. For example, the ocean ecosystem stress posed by artisanal fishing, where the fishers rarely cross national boundaries, can be largely mitigated through national and local governance action. On the other hand, increased climate change as a stress on ocean ecosystems requires global governance solutions as a framework for regional and national action to be effective.

Environmental stressors needing global scale governance solutions dominate almost everywhere on the planet over those that can be dealt with primarily nationally. The portion of cumulative human impact needing global governance solutions is higher than the impact needing regional and national governance responses, for almost all countries of the world. This is especially true for EEZ fragments with low locally-driven stressors, like Antarctica and small oceanic islands.

No area of the world ocean under national jurisdiction can avoid a focus on the global governance of the oceans, as the impacts of ocean ecosystem degradation are eminently global in nature, and need coordinated global governance action to mitigate.

Map showing the ratio of risk in each EEZ fragment (defined by national coast or island) posed by human stressors on ocean ecosystems that can be managed through local governance to those that must be managed by transboundary global governance solutions to be effective. Indian and Pacific islands are particularly dependent on global governance solutions to mitigate local risk and can make relatively little difference acting only locally on stressors. Nearly all countries have a strong dependence on global governance to mitigate local risk.



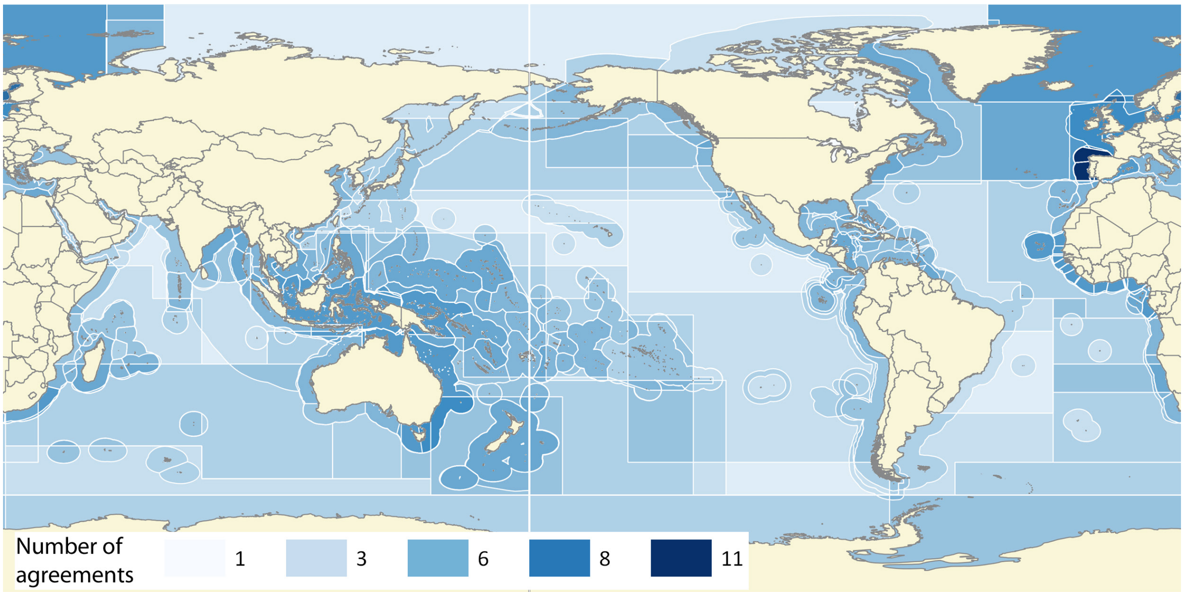
Significant gaps in coverage of issues for areas beyond national jurisdiction

In this assessment, more than 100 international agreements were considered, comprising the global ocean governance architecture for the key issues in areas beyond national jurisdiction: fisheries, pollution, biodiversity, and climate change.

It also examined the extent to which provision exists for practices that reflect 'good governance' in the policy processes associated with individual agreements.

Global governance architecture is fragmented, poorly integrated, and has significant gaps. There is clearly considerable room for improvement in integration at the global and regional levels. There are also significant gaps in coverage of issues, especially biodiversity. The governance assessment provides indications of where interventions are needed, and proposes an overall structure to make ocean governance architecture more approachable.

There are over 100 agreements for ocean governance covering areas beyond national jurisdiction.



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Existing 'global-regional, issue-based networks' and regional agreements ripe for integration

There are existing 'global-regional, issue-based networks' and regional agreements for which integration at the global level should be a priority.

The perspective of the single global ocean governance structure as comprising 'global-regional issue-based networks' and 'regional clusters' provides a framework that may help understand the very complex, disordered and fragmented set of arrangements for the ocean.

Assessment of completeness of the policy cycle in the agreements covering ABNJ in regional clusters.

Agreements are individually evaluated against the 7 policy stages.

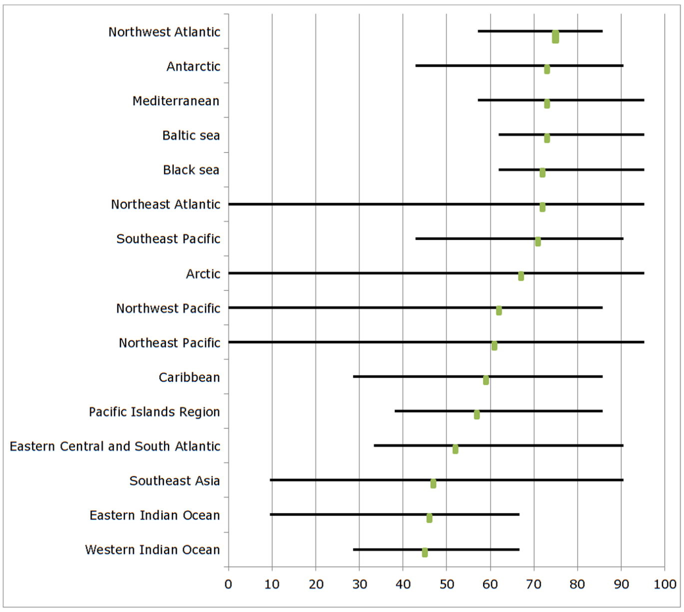
7 policy stages

- Provision of policy advice
- Policy decision-making
- Provision of management advice
- Management decision-making
- Management implementation
- Management review
- Data and information management

Each stage receives a score from 1 to 3

A policy cycle is 'complete' with a total of 21 points

Average 'completeness' for all regions: 45% to 75%.
Inside a region, the 'completeness' per agreement is highly variable.



Online resources

If you wish to learn more about the *Open Ocean Assessment*, particular indicators and/or conduct your own data searches, the full *Open Ocean Technical Assessment Report* and associated data is available on the *onesharedocean.org/open_ocean* web site.

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The water systems of the world – aquifers, lakes, rivers, Large Marine Ecosystems (LMEs), and the open ocean – sustain the biosphere and underpin the health and socioeconomic wellbeing of the world's population. Much of the open ocean constitutes an area beyond national jurisdiction, the common heritage of all. The ocean contains 99% of the habitable volume of our planet. It is warming, deoxygenating, and acidifying rapidly due to global climate change, posing risks to ocean ecosystems and human wellbeing.

Recognizing the value of transboundary water systems, and the reality that many of them continue to be overexploited and degraded, and managed in fragmented ways, the Global Environment Facility (GEF) initiated the Transboundary Waters Assessment Programme (TWAP) Full Size Project in 2012. The Programme aims to provide a baseline assessment to identify and evaluate changes in these water systems caused by human activities and natural processes, as well as the possible consequences of these changes for the human populations that depend on them. The institutional partnerships forged in this assessment are expected to seed future transboundary assessments.

The final results of the GEF TWAP are presented in six volumes:

Volume 1 – ***Transboundary Aquifers and Groundwater Systems of Small Island Developing States: Status and Trends***
Volume 2 – ***Transboundary Lakes and Reservoirs: Status and Trends***
Volume 3 – ***Transboundary River Basins: Status and Trends***
Volume 4 – ***Large Marine Ecosystems: Status and Trends***
Volume 5 – ***The Open Ocean: Status and Trends***
Volume 6 – ***Transboundary Water Systems: Crosscutting Status and Trends***

A ***Summary for Policy Makers*** accompanies each volume.

This document – Volume 5 Summary for Policymakers – highlights the key messages and recommendations from a baseline assessment of issues linking human well-being with the status of the open ocean through the themes of governance, climate change, ocean ecosystems, fisheries, pollution, and integrated assessment of the human-ocean nexus. It provides a narrative of selected results from the open ocean indices and indicators.

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