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REPORT

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2015



REVIVING THE OCEAN ECONOMY

The case for action - 2015

in association with

The University Of Queensland AUSTRALIA

gciQ Global Change Institute

BCG The Boston Consulting Group

Front cover
A fisherman shows some of his catch in Mafamede, Mozambique, part of the Primeiras and Segundas Environmental Protection Area.
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The **Global Change Institute** (www.gci.uq.edu.au) is an Australian-based research institute that is focused on evidence-based solutions to global challenges such as food security, clean energy, sustainable water, and healthy oceans. Professor Hoegh-Guldberg also undertakes research on coral reef ecosystems and their response to rapid environmental change, which is supported primarily by the Australian Research Council (Canberra), National Oceanic and Atmospheric Administration (Washington, D.C.), Catlin Group (London), and Great Barrier Reef Foundation (Brisbane). He did not receive salary for writing this report.

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WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

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This report is available at: ocean.panda.org

CONTENTS

PREFACE 5

EXECUTIVE SUMMARY 7

Ocean economic value is tied to assets that are in decline 7

Eight steps to restore the "shared wealth fund" of the ocean 8

PART ONE THE IMPORTANCE OF OCEAN ASSETS FOR HUMAN WELL-BEING 11

Ocean ecosystems are critically important for feeding and supporting humanity 16

PART TWO HOW HUMANITY IS DESTROYING THE OCEAN'S PRODUCTIVE ASSETS 21

Accumulating risks are challenging ecosystems and people 22

The ocean is warming and acidifying rapidly 23

Ocean asset depletion: two divergent pathways, one decision 29

PART THREE TIME TO HIT THE RESET BUTTON: EIGHT ACTIONS TO SECURE OUR OCEAN ASSETS 31

ACTION 1 Ensure ocean recovery features strongly in the UN Post-2015 Agenda, including the Sustainable Development Goals 34

ACTION 2 Take global action to avoid dangerous climate change and further damage to the ocean 36

ACTION 3 Conserve and effectively manage 10 per cent of representative coastal and marine areas by 2020, increasing coverage to 30 per cent by 2030 38

ACTION 4 Rebuild fish stocks to ecologically sustainable harvest levels 40

ACTION 5 Drive new global cooperation and investment for the ocean 42

ACTION 6 Reinvent public/private partnerships 44

ACTION 7 Build transparent accounting of the value of ocean assets to improve decision-making 46

ACTION 8 Share knowledge more effectively and drive institutional collaboration 48

THE TOP THREE ACTIONS FOR 2015 51

CONCLUSION 53

LITERATURE CITED 54

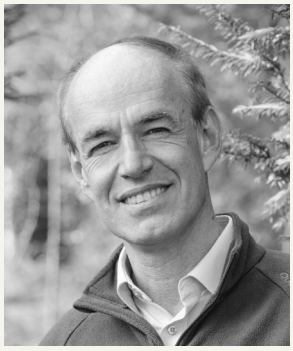


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Mangrove restoration. Mangroves store carbon and provide over 100 million people with a variety of goods and services, such as fisheries and forest products, clean water, and protection against erosion and extreme weather events. The rate of deforestation of the planet's mangroves is three to five times greater than even the average global forest loss.

PREFACE

Without a healthy ocean, our future prosperity – indeed, life on Earth as we know it – is in jeopardy.



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Marco Lambertini
Director General
WWF International

It may be because of its mysterious nature and appearance of infinity that the ocean has been subject to relentless exploitation. While the consequences have been largely neglected, many have been working for decades to protect the ocean's species and places. Together, scientists, communities, governments and organizations like WWF have had some important successes: rescuing fisheries from the brink of collapse, saving species from imminent threat and sparing critical habitats from destruction.

Yet these successes have not kept pace with the growing pressures on our ocean. This invaluable resource that feeds, employs and inspires us, and makes our planet habitable, is showing serious signs of failing health.

The threats to the ocean are well documented. Even the solutions are fairly well known. It is political and corporate will that remain elusive. We continue to take the ocean for granted, perhaps because the poor communities that are most dependent on ocean resources lack power and influence, and turtles do not vote.

Policymakers and corporate executives have not had a mechanism to account for the real costs of exploiting ocean resources. So, while they may have some knowledge of declining fish stocks, coral bleaching or mangrove deforestation, the implications and the scale of the impact on our well-being and prosperity have not sunk in.

This report clearly spells out what we all stand to lose if the mismanagement of ocean assets continues. Recognizing that science alone is an insufficient motivator, we have combined the evidence of serious environmental degradation with an economic case for urgent action.

Working with the eminent scientist Professor Ove Hoegh-Guldberg and in collaboration with leading business consultancy The Boston Consulting Group, WWF looked at the implications that leaders should consider based on current policies and practices. The results illustrate the economic case for ocean conservation in stark terms. The economic value of coastal and oceanic environments is valued conservatively at US$2.5 trillion each year, and the overall value of the ocean as an asset is 10 times that.

We are focusing on the economic value of the ocean because we recognize that 2015 provides a special opportunity. Awareness of the dire state of our ocean and the need for a change in our relationship with the marine environment has started to break through. Leaders from outside the environment sector are calling for better protection and management of this vital shared asset. This year also brings unprecedented decision points for meaningful commitments on sustainable development and climate, with major implications for the ocean.

We believe this new economic analysis, coupled with the scientific evidence, makes an undeniable case to move urgently beyond rhetoric to action. Our report identifies eight actions that humanity can and must take if we are to avoid destroying our ocean's assets, and start rebuilding its capacity to sustain us. These eight actions can be taken today with immediate, "no regret" benefits for ecosystems, people and industry. Failure to act means further squandering our assets, and running down the economic engine that supports countless people worldwide.

If the response to conservationists' pleas about the plight of coral reefs, tuna and other ocean assets has been, "So what?" then here is the US$24 trillion answer.



© naturepl.com / David Fleetham / WWF

Brown striped snapper *(Xenocys jessiae)*, Galápagos Islands, Ecuador.

EXECUTIVE SUMMARY

Earth is distinguished from all other known planets by the presence of a warm, salty ocean that covers more than two-thirds of its surface. Its value to our planet is incalculable, but has been brought into sharp focus by the fact that the future of humanity is dependent on the health of the ocean, and its ability to deliver goods and services.

CALL TO ACTION

The evidence is clear: the ocean is a major contributor to the global economy, but its asset base is being rapidly eroded. To restore the ocean's productive capacity before it is too late, the world must take urgent action. This report charts a clear course for reviving the ocean economy. The tools to solve the problem are proven: now the world needs leadership. The first priority must be for all countries to commit to ramping up the effective conservation of coastal and marine habitat in their juridictions, and to support a global agreement on sustainable development at the United Nations that reflects this resolve and shared responsibility. 2015 is the crucial year to forge this global effort and to see action to reduce the worst impacts of climate change. These actions in particular will help to revive the ocean and its powerhouse economy.

This report includes an analysis of the raw economic value of the ocean, and foreshadows the losses we will incur if we continue on our current destructive trajectory. We believe the figures are a vast underestimate, and the economic assets at risk in the ocean are even more substantial than those presented here. The annual "gross marine product" (GMP) – equivalent to a country's annual gross domestic product – is at least US$2.5 trillion; the total "asset" base of the ocean is at least US$24 trillion.

US$24TN

THE VALUE OF KEY OCEAN ASSETS IS CONSERVATIVELY ESTIMATED TO BE AT LEAST US$24 TRILLION

Underpinning this value are direct outputs (fishing, aquaculture), services enabled (tourism, education), trade and transportation (coastal and oceanic shipping) and adjacent benefits (carbon sequestration, biotechnology).

Putting it into an international context, if the ocean were a country it would have the seventh largest economy in the world. Outputs that are not generated by the ocean per se, such as those from offshore oil and gas or wind energy, were excluded from these estimates, as were assets for which data is not yet available. The analysis did not include valuable intangibles such as the ocean's role in climate regulation, the production of oxygen, temperature stabilization of our planet, or the spiritual and cultural services the ocean provides. The fact that these additional values are not included in this analysis means that the actual value of the ocean is much higher.

Ocean economic value is tied to assets that are in decline

As this report shows, more than two-thirds of the annual base economic value of the ocean is produced by assets that rely directly on healthy ocean conditions. Given the

2/3

MORE THAN TWO-THIRDS OF THE GLOBAL GROSS MARINE PRODUCT RELIES ON A HEALTHY OCEAN

strong evidence that major ocean assets have been in steep decline for decades in some cases, the ocean economy is already faltering and not delivering anything like its full potential. This comes at a time when the need for food and resources from the ocean is increasing rapidly.

The ocean is changing faster than at any other point in tens of millions of years. There is a real chance that we may push many ocean systems beyond the point of no return, seriously constraining options for our children and for generations to come. In some cases, such as ocean acidification, it will take tens of thousands of years (or hundreds of generations of people) for the ocean to repair itself; in the case of species extinction, the impacts will be permanent: there is no going back.

The growth in human population means restoring the ocean economy and its core assets is a matter of global urgency, but the list of ocean systems under heavy pressure is already long and growing. Many fisheries are in serious decline, and while there has been some progress, many unsustainable practices continue. These problems are exacerbated by the destruction and clearing of habitat, particularly in coastal areas, and by pollution.

IT IS TIME TO PUSH THE RESET BUTTON BEFORE WE DRIVE OUR SHARED WEALTH FUND TO COLLAPSE

Eight steps to restore the "shared wealth fund" of the ocean

If we consider the analogy of the ocean as a "shared wealth fund", our principal capital is being eroded at a rate that undermines the ocean's value for future generations. It is time to push the reset button before we drive our shared wealth fund to collapse.

The good news is that rapid action on a number of key issues will deliver real change and benefits for ocean systems and the people who depend on them. Some of the benefits could be reinstated in a relatively short period of time. Central to this is conserving habitat that is critical to the restoration of healthy and productive natural systems: the core assets of the ocean.

The opportunity is to galvanize an international movement that will take on this challenge. Leaders must prioritize the ocean and take the eight decisive actions that are outlined here for a better future for communities, ecosystems and businesses.

The eight actions proposed are achievable and logical, and many are mutually reinforcing. They are best taken at the same time; however we recommend that the first three actions be prioritized for 2015.

ACTION 1 Governments must embrace the Sustainable Development Goals, with their strong targets and indicators for the ocean, and commit to coherent policy, financing, trade and technology frameworks to restore and protect ocean ecosystems as part of the UN Post-2015 Agenda process.

ACTION 2 Leaders must address the serious problems of ocean warming and acidification. We must listen to science and make the deep cuts in emissions that will prevent further increases in dangerous climate change. It is vital that the world signs on to an ambitious international agreement in Paris in December 2015 (COP21) that will allow the rapid decarbonization of our economies and societies.

ACTION 3 Coastal countries must deliver against the agreed target for at least 10 per cent of coastal and marine areas to be conserved and effectively managed by 2020, with an increase to 30 per cent by 2030. This is not just about the extent of area protected; it is about establishing ecologically coherent, representative networks of marine protected areas that help ensure the strongest outcomes for biodiversity, food security and livelihoods.

ACTION 4 Habitat protection and fisheries management must go hand in hand. Institutional arrangements for managing the ocean should reflect the fact that an integrated approach for ecologically managed fisheries must focus on ecosystem resilience and function, as well as economic and social well-being.

ACTION 5 Global crises require global solutions. Given the transboundary nature of the ocean, we need appropriate international mechanisms for negotiation and collaboration to ensure its sustainable management. Formation of a "Blue Alliance" of concerned maritime states will provide leadership and build the case for a rapid and comprehensive set of actions on behalf of the ocean. Such a coalition could cultivate international will and foster the shared global responsibility and informed decision-making that are crucial when it comes to ocean resources. It will also be important to establish a global fund to support countries that have fewer resources and are more vulnerable to the impacts of ocean degradation.

ACTION 6 Appropriately structured public-private partnerships that take into account the well-being of communities, ecosystems and business have the potential to revolutionize how sectors work together sustainably. Enabling a network of such cross-sectoral partnerships (public, private and community) to share ideas, solutions and blueprints for sustainable practices will ensure that even the least developed countries will have access to the necessary resources.

ACTION 7 Communities and countries must develop complete, transparent and public accounting of the benefits, goods and services that the ocean provides. Valuing the ocean's assets is vitally important to helping inform effective decision-making.

ACTION 8 There is a need for an international platform to support and share ocean knowledge through which problems can be understood, and solutions and methodologies evaluated and applied. Such a platform must be interdisciplinary and informed by biological, social and economic data. This platform will build capacity and improve access to critical information and expertise.

These eight actions offer a clear plan for reviving the ocean economy. This year, 2015, is particularly important and opportune to forge global leadership and investment for the ocean. In 2015, two historic international agreements could be struck with provisions that have the potential to arrest the decline in ocean health, and shift toward a trajectory of ocean restoration. The year also marks an important opportunity for countries to harness the growing momentum on ocean conservation and sustainable use, and collectively make clear commitments on habitat conservation.

This report acknowledges and builds on the work of other institutions engaged in ocean conservation including the Global Partnership for Oceans convened by the World Bank, the Global Ocean Commission and others.





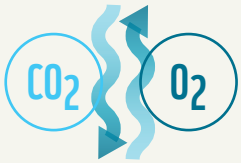
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PART ONE

THE IMPORTANCE OF OCEAN ASSETS FOR HUMAN WELL-BEING

The ocean is a fundamental part of the Earth's systems that support us.

The ocean produces half the oxygen we breathe, and absorbs 30 per cent of the anthropogenic emissions of carbon dioxide (CO_2) and around 93 per cent of the added heat arising from human-driven changes to the atmosphere (1).



THE OCEAN PRODUCES HALF THE OXYGEN WE BREATHE, AND ABSORBS 30 PER CENT OF CARBON DIOXIDE EMISSIONS

The ocean is home to a largely uncatalogued diversity of life, from single-celled organisms to our planet's largest creature, the blue whale. These species are intertwined in a complex food web within which humans play an increasing role.

The ocean's services to humanity are very significant. Around 3 billion people obtain almost 20 per cent of their animal protein from fish (2), and the majority of the planet's fish comes from the ocean. In some countries, as much as half of the animal protein consumed is fish (3). Fishing activities span the small-scale and daily gathering of marine life through to industrial-scale fishing where vessels can capture and process thousands of tonnes of seafood on a single voyage. The demand for protein from the sea has increased dramatically as human populations have grown. At the same time, agricultural systems are failing to keep up with the expanding demand for food (4).

For these reasons, the ocean is being increasingly viewed as an important part of the solution to global poverty and hunger. This will only occur, however, if we work to protect the ocean's capacity to provide ecosystem goods and services. Beyond food, these include things like tourism, coastal protection and many other benefits. Using seven asset categories, the total asset base for the ocean is estimated to be at least US$24 trillion (Box 2/Figure 1). It is important to note that the conservative economic analysis presented here is focussed on the economic contribution of the ocean itself, and associated coastal values. Oil and gas reserves are not included in this analysis because they lie – often far – below the Earth's surface (the seafloor in this case) and so are not "produced" by the ocean per se. (Using similar logic, offshore wind energy has also been excluded from the analysis). The Boston Consulting Group's assumptions and methodology for this analysis are available at: ocean.panda.org

US$2.5TN

THE ANNUAL GROSS MARINE PRODUCT TOTALS US$2.5 TRILLION

The renewable economic activities associated with the ocean are undeniably important for many countries, especially those with significant coastal and island regions. The ocean generates hundreds of millions of jobs in tourism, fishing, energy, shipping, biotechnology and many other sectors (5). The annual "gross marine product" totals at least US$2.5 trillion, which when ranked among national GDPs makes the ocean the world's seventh largest economy (Box 2/Figure 2).

These estimates of the value of ocean assets and annual dividends represent a bare minimum given that not all ocean assets and activities can be evaluated in the classic economic analysis presented here (Box 2). The absence of costs for intangibles and non-market products strongly suggests that these estimates, while impressively large, are gross underestimates of the total asset value of the ocean. Intangible benefits include the role that the ocean plays in atmospheric regulation, carbon storage and planetary temperature control (Box 1). Less comprehensively documented economic activities, such as small-scale fisheries, can be enormously important to human well-being, but often fly under the radar of formal markets and classic economic analyses.

BOX 1 A CAUTIONARY NOTE: VALUING THE INVALUABLE

The economic analysis presented here estimates the value of marine ecosystems in terms of the value of marketed goods and services produced by industries that are directly associated with the marine ecosystems in question. It represents a classical economic analysis of how ocean ecosystems support economic activity and associated benefits for people and industry. While the estimates of economic value are compellingly large in this case, they underestimate the value of the goods and services provided and fall significantly short of the total economic value of ecosystems like coral reefs or temperate salt marshes. Non-market values may include ecosystem services such as water filtration by mangroves, seagrass and wetlands, and the value generated by ecosystems in terms of human culture and lifestyle. While it is very difficult to put a precise dollar value on these benefits, it is indisputable that these important "intangibles" are indeed of enormous value to people and industries (a). Pioneering work has established strong foundations for this wider valuation of goods and services, including for the ocean (b).



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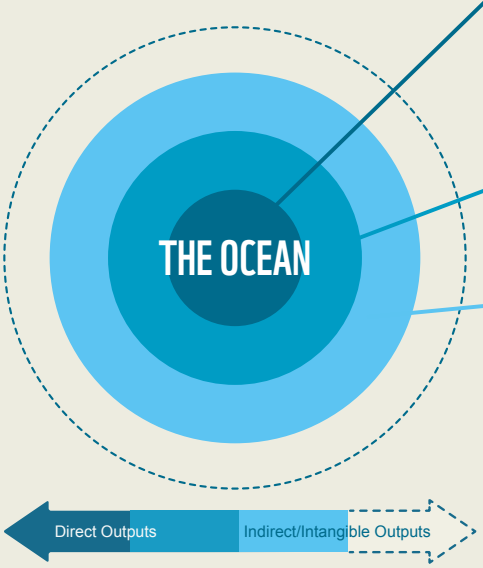
These intangible goods, services and non-market activities provide significant additional value. There is, however, no comprehensive approach that can fully account for the value of the ecosystem services from the ocean that make life on our planet possible.

It is also crucial to take into account the stark reality that the key assets that support ocean economic productivity have been eroding for decades already, and hence the ocean is very likely to already be producing far less than it potentially could. While there are areas where effective ocean resource management is occurring, the broader picture is one of widespread mismanagement and often escalating decline.

BOX 2 OCEAN ASSET VALUES

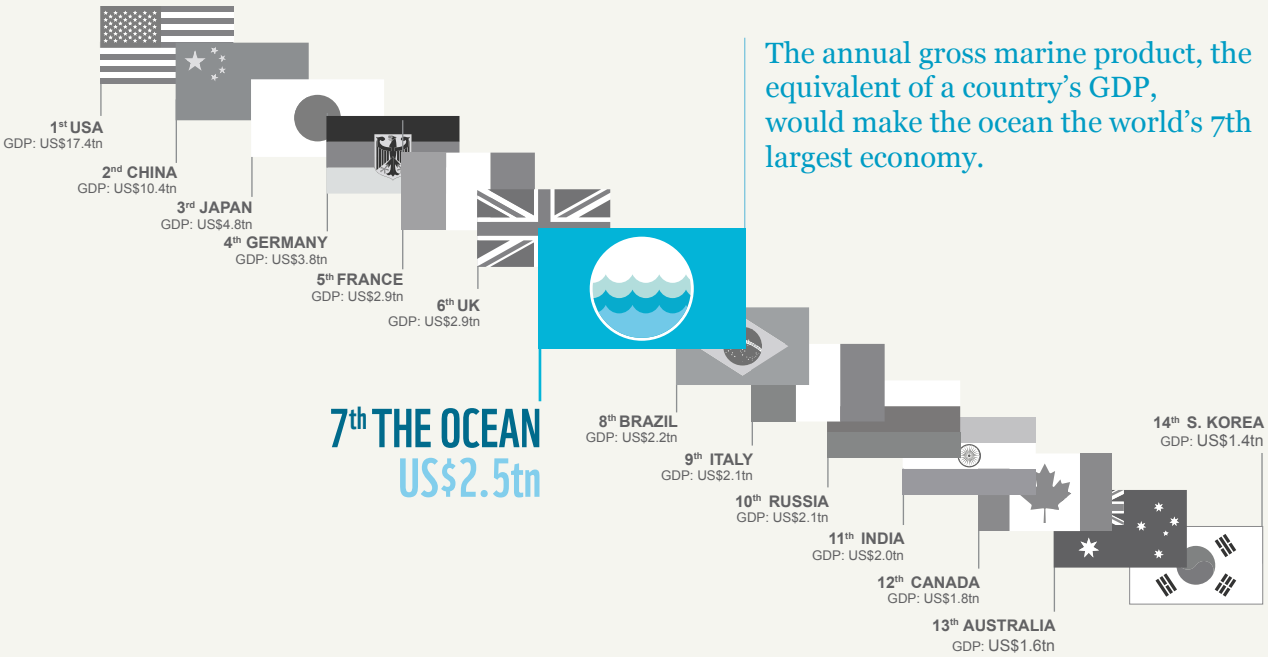
FIGURE 1 - GLOBAL OCEAN ASSET VALUE

The ocean provides wide-ranging value, from food and tourism to coastal protection and much more.

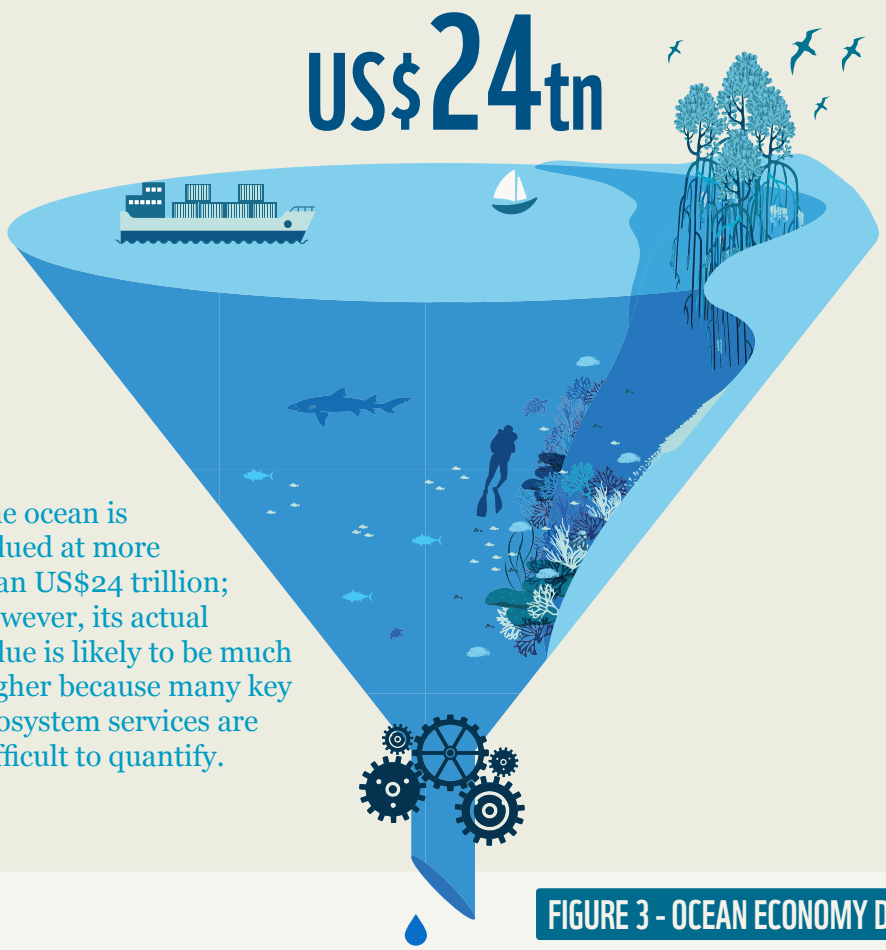


OCEAN-RELATED ACTIVITIES AND ASSETS	TOTAL VALUE
Direct output of the ocean from: Marine fisheries, Mangroves, Coral reefs, Seagrass	US$6.9tn
Trade and transport: Shipping lanes	US$5.2tn
Adjacent assets: Productive coastline	US$7.8tn
Carbon absorption	US$4.3tn

FIGURE 2 - ANNUAL GROSS MARINE PRODUCT



The annual gross marine product, the equivalent of a country's GDP, would make the ocean the world's 7th largest economy.



The ocean is valued at more than US$24 trillion; however, its actual value is likely to be much higher because many key ecosystem services are difficult to quantify.

The ocean's asset value would dwarf the world's largest sovereign wealth funds:

- **US$893bn** NORWAY — Government Pension Fund
- **US$773bn** ABU DHABI — ADIA
- **US$757bn** SAUDI ARABIA — SAMA
- **US$653bn** CHINA — China Investment Corp.

FIGURE 3 - OCEAN ECONOMY DEPENDENT ON HEALTHY ASSETS



Gross marine product is the ocean's annual economic value.

More than two-thirds of the gross marine product is dependent on healthy ocean assets.

Analysis for this section is provided by: BCG The Boston Consulting Group

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For more information on the BCG methodology, please visit: ocean.panda.org

Ocean ecosystems are critically important for feeding and supporting humanity

Drawing on assets worth at least US$24 trillion, the ocean provides a minimum contribution each year of US$2.5 trillion (Box 1/Figure 3).

Fisheries and aquaculture production was 158 million tonnes in 2012 , with two-thirds being produced by the ocean (wild caught and from aquaculture) (2). Nearly 3 billion people rely on fish as a major source of animal protein, getting almost 20 per cent of their dietary intake from this source (2). Fishing-related industries are also a major source of economic value for many countries, with an estimated asset value of US$2.9 trillion (methodology at ocean.panda.org). We believe that while this value may still be an underestimate given the challenges of data reporting (Box 3), it is clear that they contribute to national economies through the provision of employment in fishing, seafood processing and related industries (2).

BOX 3 CHALLENGES IN ESTIMATING GLOBAL FISHERIES

Fisheries are a vital source of food security and livelihoods, particularly for many of the world's poor coastal communities (a). Yet their economic importance is often underestimated, because many of these fisheries are small-scale in nature, spatially dispersed and therefore poorly documented and/or under-reported (b). There is growing recognition of the importance of having accurate data, and many initiatives are under way to improve data collection and reconstruction (c, d, e). One such initiative is led by the University of British Columbia which, along with its partners, has been compiling official national data and comparing this to data supplied to FAO from 1950-2010. The method, called "catch reconstruction", is designed to create a more accurate picture of what is being produced from territorial waters. This should enable better fisheries management decisions.

In the case of Panama (f), researchers have discovered substantial evidence that almost 40 per cent of the total catch, including tuna, lobster, shellfish and shark, was unaccounted for. The discrepancy is due to minimal reporting of bycatch by commercial vessels and lack of data from recreational, subsistence and artisanal fishers. Illegal fishing by foreign vessels and catches by Panamanian-flagged ships operating from foreign ports also play an important role. In the case of Senegal (g), research uncovered a variety of reasons why officially reported data does not reflect reality, including large and frequent migrations by Senegalese artisanal fishers, underestimation of fishing effort and increasing conflicts over fisheries.

"Today, the weather is changing, and we don't know what kind of catch to expect. When I was young, there were a lot more fish. I don't know why there are less fish now. In years past, even the fishermen netting off the beach were getting hundreds of different species of fish, but not anymore."

Dino Francisco, fisherman
Primeiras and Segundas
Mozambique

While the production of capture fisheries has plateaued over the past two decades, aquaculture has continued to grow (2), with most of the growth being associated with freshwater areas of countries such as China. Nonetheless, many countries are looking to marine capture fisheries and marine aquaculture as potential sources of protein for their expanding populations (2). Achieving this end, however, will require protecting and building sustainable practices when it comes to fisheries and aquaculture. It will require us to urgently pursue the eight key actions recommended in this report.

Productive fisheries rely on healthy ecosystems; places where fish and other marine life can feed, grow and reproduce. Conserving habitat is crucial for the long-term viability of fish stocks and for much of the ocean productivity that generates economic value.

Ocean assets provide a host of direct and indirect benefits, many operating at significant scale. Box 4 shows an example of how intact mangroves – a crucial and threatened ocean ecosystem – deliver important, diverse benefits to people. Mangroves can also literally be a lifesaver, particularly in the context of rising seas and devastating storms and waves.

BOX 4 MANGROVES: SAVING LIVES, SUPPORTING COMMUNITIES

A recent UN report reveals that the rate of deforestation of the planet's mangroves is three to five times greater than even the average global forest loss, resulting in economic losses of up to US$42 billion annually (a). This is having a devastating effect on biodiversity, food security, coastal stability, and the livelihoods of some of the most marginalized coastal communities in developing countries where more than 90 per cent of the world's mangroves are found.

Mangroves are found in 123 countries around the world and provide ecosystem services worth up to US$57,000 per hectare per year (a). They store carbon that would otherwise be released into the atmosphere and provide the over 100 million people who live in close proximity to mangroves with a variety of goods and services, such as fisheries and forest products, clean water and protection against erosion and extreme weather events (a).

In the Caribbean, mangrove-lined "hurricane holes" have functioned for centuries as safe-havens for sailors needing to ride out storms. The complex network of mangrove roots can help reduce wave energy, limit erosion and form critical barriers to the dangers posed by the strengthening tropical storms and cyclones that have been assailing coastal communities in recent years due to climate change (a).

Studies from India, Sri Lanka and the Philippines have shown that villages with intact seaward mangrove forests had significantly lower death rates during cyclones and calamitous events such as the 2004 tsunami (b, c, d). Some villages in the Philippines appear to have largely survived the destruction of Typhoon Haiyan in 2013 thanks to mangroves (e). Subsequently, the Philippine government earmarked roughly US$8 million for mangrove reforestation projects as part of a push to make its coastlines less vulnerable to extreme weather events (f).

US$57K/HA

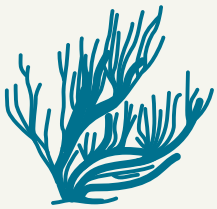
MANGROVES - FOUND IN 123 COUNTRIES - PROVIDE ECOSYSTEM SERVICES WORTH UP TO US$57,000 PER HECTARE PER YEAR



© Pablo Sanchez / WWF

Raffy, 10, carries salvaged materials to rebuild his house after Typhoon Haiyan hit Malapascua Island, off the north coast of Cebu, Philippines.

Healthy ocean habitat is the foundation for billions of dollars of value for the tourism industry. Box 5 summarizes some of the economic and employment benefits, largely from tourism, that the Great Barrier Reef delivers to the Australian economy. There is growing concern globally about the serious decline in the health of the Great Barrier Reef.



GREAT BARRIER REEF =
US$5.7 BILLION PER YEAR
69,000 JOBS

50%

THE GREAT BARRIER REEF HAS LOST 50 PER CENT OF ITS REEF-BUILDING CORALS

BOX 5 THE ECONOMIC VALUE OF THE GREAT BARRIER REEF

The Great Barrier Reef is the world's largest continuous reef system, and has an iconic status as a well-managed and valuable coastal ecosystem. Due to its reputation as one of the most intact coral reef ecosystems globally, the Great Barrier Reef attracts around US$5.7 billion each year in terms of direct and indirect economic activity, and employs approximately 69,000 people as a result of the income attracted to Queensland (a, b). Considerably fewer people are employed within the fishing industries associated with the Great Barrier Reef (worth approximately US$120 million each year). As pointed out elsewhere (Box 1), these numbers are probably underestimates of the total economic value of the Great Barrier Reef, given the problem of valuing intangible benefits such as the maintenance of coastal water quality, sand production and the benefits of associated gas exchange and primary productivity, among other contributions made by an intact Great Barrier Reef.

The Great Barrier Reef has benefited from world-class resource management through the Great Barrier Reef Marine Park (established in 1975), as well as protection under its World Heritage listing (1981). Yet the natural and economic values of the Great Barrier Reef have been found to be under serious threat from warming coastal waters and mass coral bleaching and mortality (b). Adding to these concerns is the impact of local stresses (principally declining coastal water quality), which appear to have slowed the recovery of corals from bleaching and other disturbances. The reef also suffers from the impacts of crown-of-thorns starfish outbreaks and cyclones. In combination, local and global pressures have resulted in the loss of 50 per cent of reef-building corals from across most of the Great Barrier Reef (c). These changes, and the immediate threats of coastal industrialization, including port development and the impacts of dredging, have attracted considerable international attention and emphasise the need for concerted and well-resourced responses to the current problems faced by invaluable ecosystems such as the Great Barrier Reef.



© Troy Mayne

The Great Barrier Reef's significant economic value is at risk due to declining water quality and plans for coastal industrialization, as well as global climate change.





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PART TWO

HOW HUMANITY IS DESTROYING THE OCEAN'S PRODUCTIVE ASSETS

We live in a time of global change. A growing global population, an expanding middle class, plus accelerating technology and a changing climate are just a few of the ways that the world around us is altering rapidly and fundamentally.
These changes are having a profound effects on our natural world, threatening to undermine natural and human systems. Understanding and responding is a critical part of any solution to the challenges that currently face the ocean.

Accumulating risks are challenging ecosystems and people

As we have progressively fished our way down the food web, we have increased the risk of large-scale changes to marine ecosystems (6, 7). As human activities have intensified along coastlines, there has been a major cumulative increase of coastal development, transforming whole coastlines, and clearing or transforming large areas of ecosystems such as mangroves, seagrass and reefs.

Coastal and marine life is highly threatened by a lack of adequate protection, with coastal development leaving few places for marine life to find refuge or reproduce (8, 9). As a result, the future of much of the ocean's rich biodiversity remains uncertain, ultimately threatening human communities that depend on coastal and oceanic resources. Inadequate planning has led to coastal resources being damaged by activities such as tourism and other development, ironically harming the very resources on which these activities depend. More recently, many regions are starting to adopt eco-tourism practices that seek to minimize negative impacts on the quality and sustainability of the key coastal resources (10, 11).



© Global Warming Images / WWF

Infrastructure for ports and associated shipping activity has increased dramatically in some regions, leaving its mark through dredging, oil spills, ship groundings, and the dumping of dredge spoil and polluted ballast water. In many cases, these changes have involved exploration and extraction of oil and gas from below the seafloor. Pollution such as that generated by the Deepwater Horizon disaster in April 2010 (12, 13) has left an indelible mark on ocean ecosystems. As society seeks fossil fuels from more challenging reserves and often deepwater areas, the risks of these types of accidents will only increase.

Seabed mining in shallow coastal areas, on seamounts, or in the deep ocean represents additional and potentially serious risks to important habitats and ecosystems.

Other industrial activities, such as aquaculture, if not planned and carefully managed, can have devastating impacts on habitat integrity and nutrient status of coastlines, with the appearance of anoxic (severely oxygen-depleted) regions beneath aquaculture cages or adjacent outflows (14). Coupled with untreated sewage, plastics, fertilizers, pesticides and industrial chemicals, land-based pollution is having major impacts on the viability of coastal ecosystems, and consequently, the resources upon which people depend (15).

THE PRESENCE OF DEAD ZONES HAS BEEN IDENTIFIED IN AT LEAST 400 LOCATIONS, ULTIMATELY OCCUPYING AN AREA THE SIZE OF ITALY (245,000 KM^2)

As multiple factors at local, regional and global levels have changed, so has the tendency for these factors to interact, with synergistic impacts being greater than the sum of the factors in isolation. “Dead zones”, which are areas of very low oxygen content, are being exacerbated by steadily warming temperatures and a combination of coastal eutrophication, acidification and pollution (16). Each of these changes, whether in combination or by themselves, is increasing the risk of additional changes that will further undermine the ability of ocean assets to provide support for humanity.

The ocean is warming and acidifying rapidly

Human activities such as burning fossil fuels and deforestation have increased the Earth’s average surface temperature by 0.85°C during the period 1880 to 2012 (17). Around 93 per cent of the extra heat has been absorbed by the upper layers of the ocean. As a result, the average sea surface temperature has increased in the world’s three ocean basins by 0.31°C to 0.65°C over the past 50 years (18).

As the upper layers of the ocean have warmed, many oceanographic properties have begun to change. In some areas, changes to the temperature profile of the ocean have led to greater stability (less mixing) of the water column (1). This is affecting surface nutrient concentrations as well as changing the concentration of key gases – for example, reducing oxygen concentrations in deeper areas of the ocean (18).

The warming of the ocean is also driving impacts across a wide array of ocean habitats and ecosystems through changes in weather patterns, and the frequency of extreme events, as well as sea level rise (1). More intense storm systems are increasing the energy of waves and winds in some regions, and consequently the stress on coastal ecosystems. Changes to the hydrological cycle, either through longer droughts or greater inundation, are impacting coastal run-off and coastal water quality (1). Together with rapid sea level rise, these transformations of the structure and function of the ocean have the potential to modify the conditions under which healthy coastal ecosystems can exist (Box 6).

TOTAL ACIDITY OF THE OCEAN HAS INCREASED BY 26 PER CENT SINCE THE PRE-INDUSTRIAL PERIOD

CO2 has flooded into the upper layers of the ocean (Box 6) where it has reacted with water to form carbonic acid. As this dilute acid has formed, the average pH of the ocean has decreased by 0.1 units since the beginning of the pre-industrial period, which is equivalent to an increase in total acidity of 26 per cent (1). In addition

BOX 6 OCEAN WARMING AND ACIDIFICATION: UNPRECEDENTED HUMAN-DRIVEN CHANGE

According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), which represents the consensus of thousands of experts, it is now beyond any credible scientific doubt that the Earth is warming rapidly as a result of increasing atmospheric concentrations of greenhouse gases such as CO_2 (a-d). As with the rest of the planet, the ocean has also undergone rapid warming, and has absorbed 30 per cent of the CO_2 from the burning of fossil fuels. The latter has decreased the pH and carbonate ion concentration of the ocean through the process of ocean acidification (1).

Warming the upper layers of the ocean influences currents and wind patterns, as well as the amount of mixing between the ocean and the atmosphere. Significant changes have occurred in the salinity of the upper ocean as a consequence of recent changes in the ratio of evaporation to inundation, as well as increasing contributions from melting glaciers. These changes in the ocean may seem small at first. But there is little to no doubt that climate change has already had a widespread impact on the distribution, abundance, seasonal behaviour and community composition of a broad range of species, from plankton to top predators (d, e).

These changes are already affecting human systems and industries, with impacts going well beyond high-profile ecosystems like coral reefs. Shelled molluscs (like clams and oysters), for example, are being harmed by an increase in water acidity. The oyster industry in the Pacific Northwest of the United States has already lost nearly US$110 million in revenue and some 3,200 jobs due to ocean acidification (f).

Both ocean warming and acidification represent major threats and uncertainties for organisms and ecosystems in the ocean. Under current projections, the ocean will warm by 3-5°C above the pre-industrial period, with the pH (an inverse measure of acidity) decreasing by a further 0.2-0.3 units by the end of the century. This represents a major increase in the ocean's acidity, which, when combined with increased temperatures, produces conditions that are likely to push many marine ecosystems beyond the point of no return.

Continuing with business as usual, which will drive enormous amounts of fossil fuel CO_2 into the atmosphere, will eliminate coral reefs and many other crucial ecosystems from the ocean by mid-century (d, e, g). Aggressive action to reduce the burning of fossil fuels is urgently needed to take the world toward a state in which magnificent and productive ecosystems such as coral reefs, oyster beds and kelp forests survive.



+3-5°C

UNDER CURRENT PROJECTIONS, THE OCEAN WILL WARM BY 3-5°C ABOVE THE PRE-INDUSTRIAL PERIOD BY THE END OF THE CENTURY

to increasing the acidity of the ocean, the influx of CO_2 has driven a decrease in the concentration of important dissolved compounds such as carbonate (Box 6). According to the scientific consensus of the Intergovernmental Panel on Climate Change (IPCC), the speed at which these changes are occurring has no parallel in at least the last 65 million years (19).

These novel conditions are putting enormous strain on marine organisms and ecosystems and there is no longer any doubt that marine species are already responding to the changes around them (20); (Box 6). Changes have been observed in almost every part of the ocean, with marine organisms relocating to higher latitudes, consistent with warming trends. Fish and zooplankton are migrating at the highest rates, particularly toward high latitudes in the northern hemisphere (18, 21, 22).

In some cases, organisms and ecosystems appear unable to relocate as surface waters increase in temperature. Ecosystems such as coral reefs, kelp forests, polar

ecosystems and intertidal communities have consequently experienced increasing mortality events triggered by underwater heatwaves. Along with local factors such as pollution and overfishing, mortality events have contributed to cause a major contraction of coral populations throughout the tropics (e.g. 23, 24).

Changes in ocean temperature are also altering the timing of key life history events such as plankton blooms, and the spawning and migratory behaviour of turtles, fish and invertebrates (21, 22, 25). All of these observations have been confirmed by a wide array of scientific studies (21); (Box 6).

Non-climate change factors are also interacting with ocean warming and acidification, producing major challenges to organisms. Sea turtles that are under pressure from pollution, illegal fishing and driftnets, for example, are also facing inundation of nesting sites by a rising ocean, as well as skewed sex ratios arising from warming nest temperatures (26, 27). The combination of these factors presents often overwhelming challenges to marine wildlife, especially long-lived species such as sea turtles. Important populations of whales and dolphins, and other organisms such as seabirds, are also suffering serious cumulative consequences of human activities.

CORAL REEFS, THE WORLD'S MOST DIVERSE MARINE ECOSYSTEM, ARE PROJECTED TO DISAPPEAR BY 2050

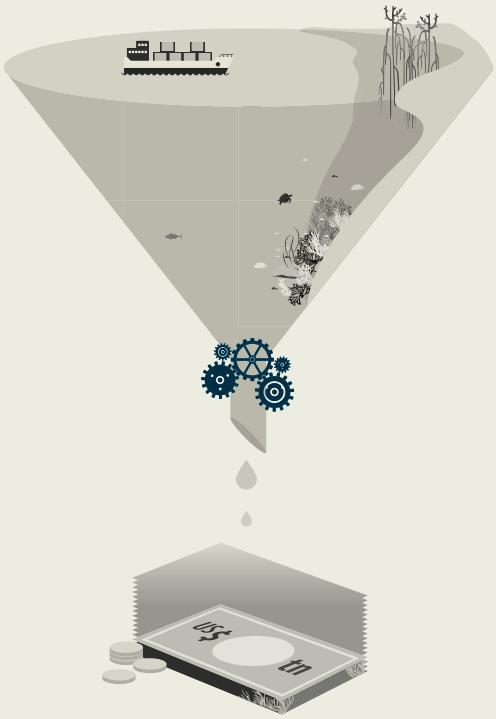
Projected changes in greenhouse gas concentrations and global temperature under the current emission pathway (Box 6) will overwhelm many ecosystems by mid-century. Coral reefs, the world's most diverse marine ecosystem, are projected to disappear by 2050 (18, 28-31, 32), illustrating the profound changes that are likely as we continue to warm and acidify the surface layers of the ocean. Coral reefs alone provide goods and services such as fisheries and nurseries for other organisms, coastal protection and income to several hundred million people across the world's tropical coastlines (15).

IN THE ARCTIC, AVERAGE TEMPERATURES ARE WARMING MORE THAN TWICE AS FAST AS THEY ARE FOR THE PLANET AS A WHOLE

In the Arctic, average temperatures are warming more than twice as fast as they are for the planet as a whole (33). Sea ice is melting. Arctic wildlife and people are beginning to live altered lives. As the summer sea ice disappears, the Arctic marine environment is fundamentally altered, with serious repercussions for animals such as polar bears, narwhals and walrus that rely on the ice to hunt, rest and breed. As these animals and ecosystem services are threatened, so too are the livelihoods and cultural values of Northern peoples. The loss of sea ice also opens up larger parts of the Arctic Ocean to shipping and drilling for oil and gas. These activities are likely to add further pressure to Arctic ecosystems already stressed by climate change (34, 35).

Habitat conservation in the Arctic has never been more urgent. International discussions regarding the future of the area where the summer sea ice will persist the longest – the "Last Ice Area" – have already begun. Special management of this area above Canada and Greenland, ideally defined and managed by indigenous people, would focus on securing habitat for ice-dependent species while protecting the cultural heritage and economic needs of local people (36). This is one part of a whole network of marine protection and management required to secure the future of this emerging ocean.

BOX 7 UNDERPERFORMING ASSETS: GLOBAL OCEAN ECONOMY IN DECLINE



DECLINE OF FISHERIES



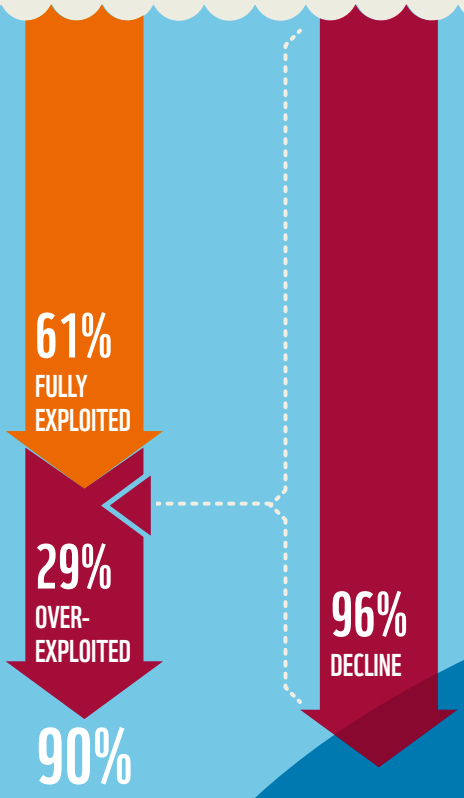
90% OF GLOBAL FISH STOCKS ARE OVER-EXPLOITED OR FULLY EXPLOITED



PACIFIC BLUEFIN TUNA NUMBERS HAVE DROPPED 96% FROM UNFISHED LEVELS

As natural assets are degraded, the ocean is losing its capacity to feed and provide livelihoods for hundreds of millions of people.

The downward trends are steep and reflect major changes in species abundance and diversity, as well as habitat extent, most over a single human lifespan.

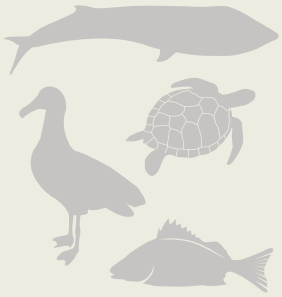


References:

FAO 2014, ISC 2012, WWF/ZSL 2014, Hoegh-Guldberg 1999, Hoegh-Guldberg et al. 2007, Waycott et al. 2009, UNEP 2014.

DECLINE OF HABITATS

DECLINE OF MARINE SPECIES



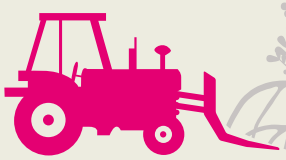
THE MARINE LIVING PLANET INDEX* SHOWS A DECLINE OF 39% BETWEEN 1970 AND 2010

39%

*The marine Living Planet Index is an indicator of the state of global biological diversity, based on trends in more than 900 marine species of mammals, birds, reptiles and fish.

3-5x

DEFORESTATION RATE OF MANGROVES EXCEEDS EVEN THE LOSS OF FORESTS BY 3-5 TIMES





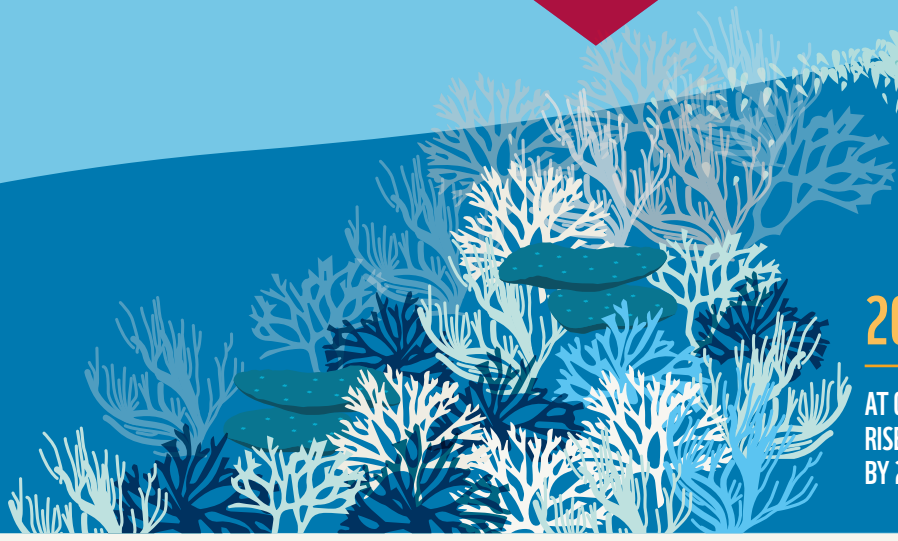
50% OF THE WORLD'S CORALS HAVE DISAPPEARED

50%



ALMOST ONE-THIRD OF ALL SEAGRASSES HAVE BEEN LOST

29%







2050

AT CURRENT RATES OF TEMPERATURE RISE, CORAL REEFS WILL DISAPPEAR BY 2050

BOX 8 DEGRADING ASSETS: THE LOSS OF 50 PER CENT OF CORALS IN JUST 30 YEARS

One of the most dramatic examples of the decline of marine ecosystems is that of coral reefs. Coral reefs have been persistent features of tropical coastlines, where they provide habitat for over a million species, and food and resources for hundreds of millions of people (a). The decline of water quality due to deforestation and coastal agriculture, along with increasing fishing pressure on key organisms such as grazing fish (a), has resulted in the loss of reef-building corals throughout the world. Recent studies indicate that at least 50 per cent of reef-building corals on tropical reefs in Southeast Asia, Australia, the Western Pacific, Indian Ocean and Caribbean have disappeared from reefs over the past 30 years (b, c, d). While declining water quality and over-exploitation represent serious short-term threats to coral reefs, ocean warming from climate change and ocean acidification are widely appreciated as two of the greatest threats to reefs. At current rates of temperature rise, oceans will become too warm for coral reefs by 2050, resulting in the loss of the world's most biologically diverse marine ecosystem (e, f). At the same time, ocean acidification is expected to slow the ability of corals to "bounce back" from disturbances such as bleaching events, cyclones and crown-of-thorns starfish outbreaks, further hastening their decline.



© Cat Holloway / WWF

2050

CORAL REEFS AND MANY OTHER ECOSYSTEMS WILL LIKELY DISAPPEAR OR BE CHANGED IRRETRIEVABLY BY MID-CENTURY

Ocean asset depletion: two divergent pathways, one decision

The analysis presented here shows that 70 per cent of the annual value of ocean activity is dependent on the health of the ocean (Box 1/Figure 3). For all of the reasons outlined above, we find humanity at a crossroads. If we continue on this pathway of polluting, over-exploiting, warming, acidifying, and destroying habitats, we will squander the ocean's considerable "shared wealth" fund over the next couple of decades. By this point, the science tells us that oceans will no longer be able to provide the healthy dividend that currently supports hundreds of millions of people.

In some isolated circumstances, changing conditions may lead to short-term benefits, such as the expansion of northern fisheries in a warming ocean. However, the vast majority of scientific literature shows that most positive changes are likely to be short-lived or negative in the longer term (18, 31). Under business as usual, coral reefs and many other ecosystems will disappear or be changed irretrievably by mid-century (Boxes 7, 8). As these important ecosystems are degraded, species and ecological processes that are important to the maintenance of coastal water quality, stable shorelines and many other critical features of our world today will also be lost. Primary productivity of the ocean will have changed in time and space. Many fisheries that today support the nutrition of hundreds of millions of people will be far less productive, and a large number will have moved geographically away from areas where they currently support people (18, 21-22).

At the same time, dead zones will continue to spread throughout the world's coastlines, damaging habitats and devastating coastal fisheries and aquaculture (16). Coastal ecosystems such as seagrass, mangroves and salt marshes will increasingly be pushed shoreward by rapidly rising seas, in many cases being squeezed up against coastal infrastructure (including coastal defenses built to resist sea level rise) and human communities (37-39). Such changes are decreasing the ability of these ecosystems to provide vitally important goods and services, as demonstrated when natural coastal defences such as reefs and mangroves are lost, exposing human settlements and infrastructure to the full force of waves and storms.

The good news is that it is not too late to reverse these trends and make real progress on solutions. But we must start today on the solutions before time runs out. The global community needs to commit to an aggressive international agenda focused on ocean repair and conservation. It must urgently address the vulnerability of habitats by protecting and effectively managing at least 10 per cent of a truly representative sample of all coastal and ocean habitats by 2020, and 30 per cent by 2030. It must urgently deal with the problem of coastal and oceanic pollution, while at the same time investing in repairing the fisheries that are now underperforming due to poor management (40).

If we choose a pathway that includes a healthy ocean as a central goal, then the investment and effort that needs to be applied to solve these problems will be repaid many times over through the benefits of a more productive and secure world (40, 41). As benefits will be shared, responsibility must be too, with wealthier nations assisting poorer nations.





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PART THREE

TIME TO HIT THE RESET BUTTON: EIGHT ACTIONS TO SECURE OUR OCEAN ASSETS

Expert opinion is telling us that we are entering a worrying period of change and uncertainty for the ocean. We are drawing too much on our primary assets, which directly threatens the value of our ocean annual returns. It is time to hit the reset button.

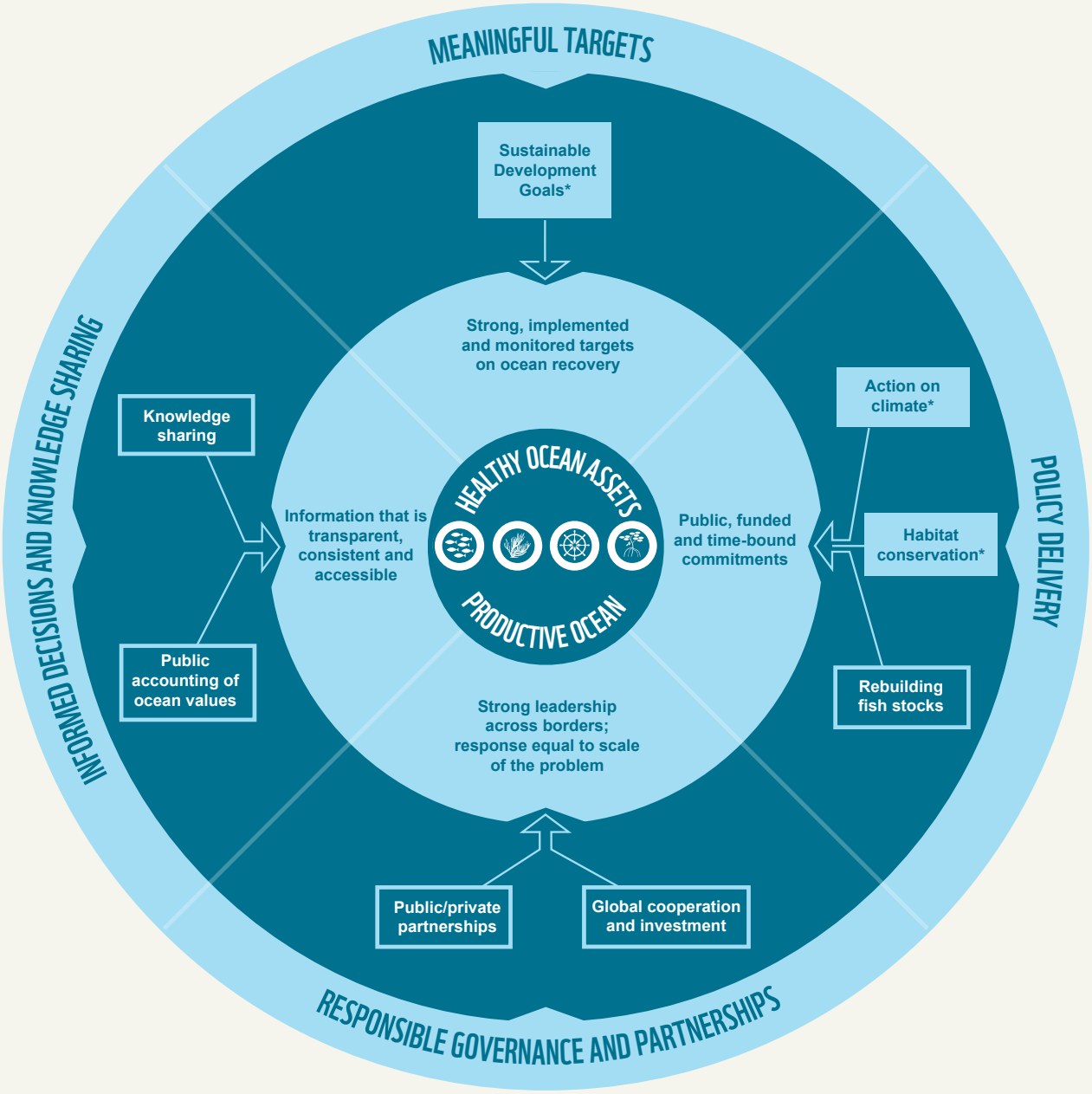
We have identified eight actions that, taken together, will restore ocean assets to their full potential, within the context of the permanent changes already in the system, and arrest the sharp decline in ocean asset value that is clearly under way.

These actions can be grouped under four headings as shown in Figure 4.

Eight actions to secure our ocean assets and restore the ocean economy:

1. Ensure ocean recovery features strongly in the UN Post-2015 Agenda, including the Sustainable Development Goals.
2. Take global action to avoid dangerous climate change and further damage to the ocean.
3. Conserve and effectively manage 10 per cent of representative coastal and marine areas by 2020, increasing coverage to 30 per cent by 2030.
4. Rebuild fish stocks to ecologically sustainable harvest levels.
5. Drive new global cooperation and investment for the ocean.
6. Reinvent public/private partnerships.
7. Build transparent accounting of the value of ocean assets to improve decision-making.
8. Share knowledge more effectively and drive institutional collaboration.

Figure 4 - Eight actions to secure our ocean assets



* Priority actions for 2015

ACTION 1 ENSURE OCEAN RECOVERY FEATURES STRONGLY IN THE UN POST-2015 AGENDA, INCLUDING THE SUSTAINABLE DEVELOPMENT GOALS

The international community, through the United Nations, is currently designing the Post-2015 Agenda, including a set of Sustainable Development Goals (SDGs) with associated targets and indicators and the means for their implementation. The Post-2015 Agenda will establish global ambition, outline practical policy steps and guide investment in sustainable development for the next 15 years or more.

These goals are set to build on and extend the Millennium Development Goals that successfully channelled billions of dollars of investments in, among other things, education, sanitation, access to water and vaccinations in developing countries. The SDGs are set to much more comprehensively incorporate the environment – including the ocean – as one of the three pillars of sustainable development. It is a vitally important opportunity to advance the pursuit of a healthy ocean. Many of the desired outcomes of the SDGs, such as reducing poverty and increasing food security, have direct links to ocean health.

The Post-2015 Agenda will be agreed in September 2015 by heads of state and government and will apply to all states. The SDG package covers major issues including poverty and hunger, health, food security, gender equality, climate change, ocean resources and biodiversity. As the ocean plays such an important role for the economy in many countries, its contribution to food, jobs and sustainable economic development needs to be recognized through relevant indicators at global and national level, for example related to food security, jobs, poverty, and climate, where there is a strong nexus with the ocean, as described in this report.

Goal 14 of the SDGs focuses specifically on the ocean, namely to "conserve and sustainably use the oceans, seas and marine resources for sustainable development." Indicators under this goal must address issues such as habitat destruction, overfishing, illegal fishing and marine pollution, and solutions must be crafted in an active, equitable and participatory way. In addition, the ocean goal needs strong indicators recognizing the links with food security and sustainable economic development (Box 9).

It is critical that states agree strong means of implementing the SDGs and a solid accountability framework as part of the UN Post-2015 Agenda process. This should include a clear commitment to coherent policy, financing, trade and technology frameworks to restore and protect ocean ecosystems.

If all this is achieved, the scene will be set for unprecedented and concerted international action, which is crucial for steering Earth's precious ocean toward a more sustainable future.

BOX 9 INTEGRATING CONSERVATION AND DEVELOPMENT OBJECTIVES ON LAND AND ON THE WATER

'Population-Health-Environment' (PHE) is an innovative and fast-growing approach to sustainable development. Its success lies in delivering an integrated portfolio of initiatives that are designed to address the inextricable links between poor health, unmet family planning needs, food insecurity, lack of livelihood alternatives, environmental degradation and vulnerability to climate change (a).

The marine conservation organization Blue Ventures has developed a PHE programme in southwest Madagascar to respond to unmet family planning needs. In this remote region, some villages are 50 km away from the nearest clinic, and the fertility rate is nearly seven births per woman (b).

With the population doubling every 10-15 years (c), communities are finding it increasingly difficult to meet their nutritional needs. Lack of agricultural options in this arid zone contributes to overfishing, which poses a significant threat to the marine ecosystems on which traditional livelihoods depend. Blue Ventures is integrating the provision of community-based reproductive health services and alternative coastal livelihood initiatives, such as sea cucumber farming, with support for locally led fisheries management in this region.

Applying a similar approach in Mozambique, CARE and WWF have partnered to address root causes of poverty and environmental degradation, and facilitate community-based natural resource management. Working with more than 10,000 coastal households since 2008, the alliance has helped develop marine sanctuaries to allow fish stocks to rebound (d).

In the Primeiras and Segundas region, fish sanctuaries based on these principles have already demonstrated benefits for fishermen, who are now catching a larger number of larger fish than a few years ago. Communities are now willing to expand no-take areas to secure food and income now and for the future (e, f).



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WWF supported the creation of Primeiras and Segundas, Mozambique's first Environmental Protection Area, which covers more than 10,400 km² and is home to some 340,000 people.

ACTION 2 TAKE GLOBAL ACTION TO AVOID DANGEROUS CLIMATE CHANGE AND FURTHER DAMAGE TO THE OCEAN

Successive assessment reports from the Intergovernmental Panel on Climate Change (IPCC), involving thousands of experts, have established the urgent importance of limiting the rise of atmospheric concentrations of CO_2 to no more than 450 ppm and an average global temperature to less than 2°C above the pre-industrial period.

The latest report from the IPCC was published in March 2014 and included a major focus on the rapid changes occurring within the ocean (18, 20). According to the IPCC's fifth assessment report, current rates of change in the ocean are unprecedented in millions of years (1, 19) and represent a very serious challenge to ecosystems and people everywhere (6, 42, 43). Reducing the rate of climate change to zero, while at the same time reducing the impact of local stresses, has become an international imperative and focus of the UNFCCC COP21 meetings in Paris at the end of 2015.

Increasing atmospheric concentrations of CO_2 beyond 450 ppm will produce a situation in which global conditions will fail to stabilize for thousands of years. This critical aspect – stabilizing environmental change driven by greenhouse gas concentrations – will determine whether effective management of other, non-climate change-related factors will produce benefits or not. The rapid movement, for example, of fish species as a result of warming sea temperatures is happening already and will escalate as we continue the current unfettered burning of fossil fuels and deforestation (1, 18, 42-44). Failure to solve the climate change problem will defeat attempts to bring sustainable practices to fisheries across the world. Dealing with climate change and ocean acidification must go hand in hand with efforts to solve problems such as unsustainable fisheries and pollution.

There is also serious concern surrounding the absolute amount of change. Current emission trajectories and policies will push the concentrations of greenhouse gases such as carbon dioxide close to 1,000 ppm by the end of the century, with average global temperature rising 4-6°C above the pre-industrial period. The surface layers of the world's ocean are projected to warm by 3-5°C over the same period, almost certainly leading to the widespread failure of ocean systems.

The majority of experts on climate change and its impacts feel that we must rapidly decarbonize energy systems and reduce deforestation and other land-use sources of greenhouse gases to zero over the next 20 years, while at the same time increasing our efforts to manage non-climate-change threats.



© Rebecca Greenfield / WWF-US

Some 400,000 people took to the streets of New York in September 2014 for the People's Climate March.

ACTION 3 CONSERVE AND EFFECTIVELY MANAGE 10 PER CENT OF REPRESENTATIVE COASTAL AND MARINE AREAS BY 2020, INCREASING COVERAGE TO 30 PER CENT BY 2030

There is now ample evidence that well designed and managed marine protected areas (MPAs) have positive impacts on ecosystems and fisheries, translating into tangible benefits for people and livelihoods (Box 10). Establishing active and lasting marine spatial plans in which protected areas are strongly represented is absolutely vital for success on the road to a sustainable ocean. Ideally, MPAs should be designed and managed to deliver social and ecological benefits, and include a range of levels of protection, from strictly protected areas to areas in which particular activities are permitted and regulated. Networks of MPAs need to be comprehensive, adequate and representative of marine ecosystems. Well located, they can also be cost-effective solutions for climate change adaptation, mitigation and disaster risk reduction. Ecologically coherent networks of MPAs which are effectively managed can make a considerable contribution to ocean resilience and sustainable use.

Despite having more than 17,000 MPAs worldwide, the total ocean area under some form of protection as of 2014 is only 3.4 per cent, with much of this being attributed to a few very large MPAs recently established, including in waters around Australia, New Caledonia and South Georgia and the South Sandwich Islands. Consequently, new agreements at local, national and regional scales must underpin an international push to protect at least 10 per cent of representative areas and habitats by 2020 (9).

Collaborative partnerships between communities, governments and/or non-state actors around the conservation and sustainable management of inshore marine resources can significantly contribute to reaching the Aichi Target associated with the Convention on Biological Diversity. These can include locally managed MPAs, collaborative fisheries management areas, and managed marine areas (45-46).

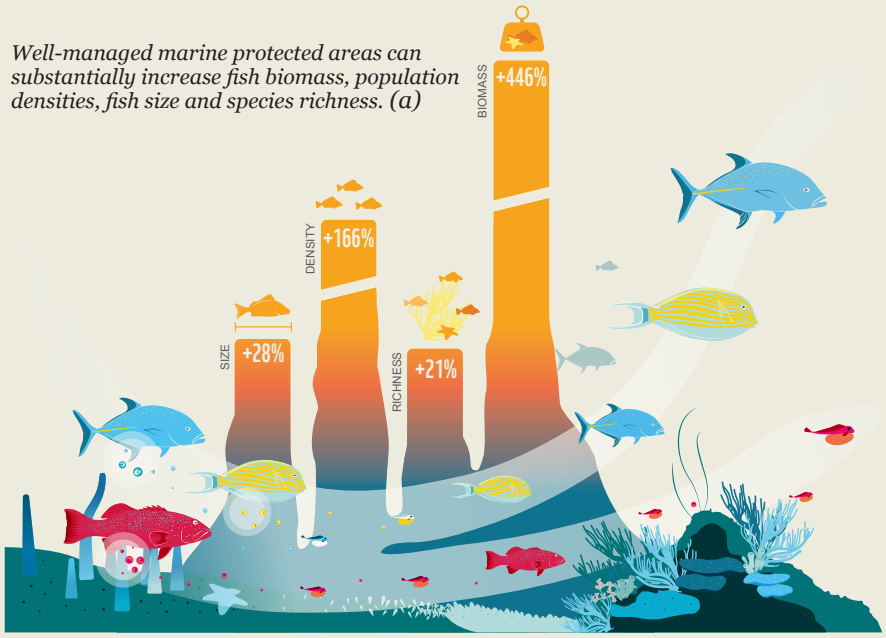
As reflected in the recommendations from the 2014 IUCN World Parks Congress, the aspiration beyond the Aichi Target is to protect at least 30 per cent of our ocean by 2030. This is the minimum area required to enable the persistence of the key environments and habitats that allow the ocean to be functional and for it to continue to deliver various ecosystem goods and services. While the percentage of an ecosystem under protection and management is important, it is also crucial to ensure that protected areas are of high quality, as well as being effective and well managed for the conservation of the natural systems they target.

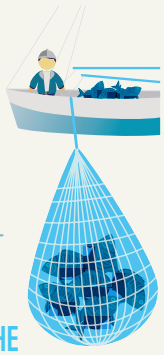
As MPAs alone cannot deal with threats beyond their limits (e.g., pollution, unsustainable coastal development, destructive fishing practices) they should be part of broader management frameworks and be used in combination with other management tools.

BOX 10 MARINE PROTECTED AREAS CAN SUPPORT FISHERIES AND LIVELIHOODS

For centuries, coastal communities around the world have established some form of protection of coastal areas in order to safeguard and replenish fisheries. Now research is proving the merit of this long-standing traditional knowledge.

Well-managed marine protected areas can substantially increase fish biomass, population densities, fish size and species richness. (a)





2X

CATCHES DOUBLE WHERE THE MPA IS CO-MANAGED WITH FISHERMEN

In Torre Guaceto, Italy, fishers participate in the management of a marine protected area. They record that large fish spawners produce 15 times more eggs and larvae within the protected area than outside. As a result, catches outside the area have doubled since protection was established (b).

At Apo Island, Philippines, where communities heavily depend on seafood as a main source of protein, fish populations have tripled since a marine protected area was established, resulting in an increase in catch per unit effort of 50 per cent. This allows fishermen to save on fuel and spend less time far out at sea (c).

In Mozambique, where about 40 per cent of the entire population lives on the coast, Quirimbas National Park has established fish sanctuaries to protect spawning grounds and restore fish populations (d). While these no-take areas represent only 0.05 per cent of the total marine area of the park, they are contributing to a rapid renewal of fish populations. As a result, communities are now voluntarily expanding the sanctuaries within and beyond the park (e).

In the Great Barrier Reef, larger fish inside no-take areas produce disproportionately more eggs and larvae than in areas that are fished (f, g). Besides their contribution to sustaining fisheries, no-take areas can also improve habitat quality, protect ecosystem structure and function, and maintain ecosystem goods and services (h, i, j).

ACTION 4 REBUILD FISH STOCKS TO ECOLOGICALLY SUSTAINABLE HARVEST LEVELS

Fisheries must be harvested at a sustainable rate – meaning that fish stocks do not decline over time and the wider ecosystem impacts are deemed to be acceptable, following rigorous assessment. Pushing a fishery beyond the sustainable rate of harvest may yield short-term benefits, but will eventually run the fishery down to a point where it will no longer recover and will eventually collapse.

Conservative estimates indicate that many fisheries are in trouble. With 61.3 per cent of the world's fisheries now fully exploited, and with 28.8 per cent over-exploited, depleted or recovering from depletion (2), there is an urgent need to revise policies to ensure that the over-exploitation and destruction of fisheries, and the broader ecosystem, does not continue.

At the same time, the international community must commit to the end of destructive fishing as well as illegal, unreported and unregulated (IUU) fishing by 2030. These activities are contributing to a serious loss of productivity, with many fishing technologies and approaches causing considerable harm to habitats. These same habitats are also critically important to the other goods and services provided by healthy ocean systems (6, 7). It is also clear that managing only for the sustainability of individual target stocks is an outdated approach because many forms of fishing typically have wider – sometimes major – impacts on habitat and other species, including those already in a seriously depleted state. For this reason we recommend that, where possible, fisheries management measures are combined with spatial conservation measures, such as marine protected areas.

If fisheries reform is achieved, nations are likely to recover some of the US$50 billion per year lost due to inefficiencies and IUU fishing (40). Clearly, addressing this urgent issue as a priority makes sense in terms of improving human livelihoods and well-being.

Not all fisheries are monitored to the same extent. There are many small-scale fisheries that do not attract sufficient attention because they do not involve well-documented markets, and therefore are largely unmeasured and unreported (Box 3). Hundreds of millions of people, however, rely on small-scale fisheries for food, and livelihoods. Due to rising coastal populations, many of these fisheries have become unproductive, leaving coastal people with reduced options for food and livelihoods. Establishing tenure rights (in some cases) and financial mechanisms by which coastal communities, often impoverished to begin with, can get help to rebuild their fisheries is a critical need (Box 11).

BOX 11 IMPROVING TUNA FISHERIES AND ENHANCING LIVELIHOODS

In the Philippines, a unique public-private partnership facilitated by WWF and funded by Bell/Coop and Seafresh is helping some 6,000 tuna fishermen to earn a decent, sustainable living, even in the face of large-scale commercial fishing and dwindling fish stocks (a).

By training fishermen of Lagonoy Gulf and Mindoro Strait in the Philippines in the correct way to handle and process tuna, this market-driven approach to fisheries management has improved income while increasing the sustainability of the fishery. The fishermen are encouraged to focus on the quality of fish catch, allowing them to stay in step with global market demands while participating in the conservation and management of resources for long-term sustainability (a).

This is part of WWF's work to reduce overfishing and promote sustainable fisheries through market incentives – spurring fishers, processors, buyers and retailers to commit to certified fisheries and to purchase and sell seafood products that can be traced back to their origin. Since many important fisheries are not yet managed well enough to meet sustainability standards like the Marine Stewardship Council (MSC), WWF also helps fishing companies to take part in fishery improvement projects to meet the challenge of improving their operations and, ultimately, achieve MSC certification (b).



© Greg Yann / WWF

"The most important thing we learned is quality. Before, we would catch one, two, three, and we still wouldn't be happy. Now, we have learned that with one good Grade A fish, you can set out early and be home by 10 in the morning, and you can earn more. Making 170 pesos a kilo is certainly better than making 100 pesos."

Andres Dacullo, fisherman from Barangay Putsan, the Philippines

ACTION 5 DRIVE NEW GLOBAL COOPERATION AND INVESTMENT FOR THE OCEAN

One of the greatest challenges to managing ocean assets is the fact that many spread across national boundaries and jurisdictions. Tuna in many parts of Southeast Asia and the Western Pacific, for example, spend parts of their lives in different countries across the region as well as on the high seas. Not surprisingly, attempts by one nation to manage a stock may not be matched by those of another, and in the high seas, this requires international cooperation. This type of problem is likely to worsen as stocks relocate in response to ocean warming, with the real prospect of fisheries stocks passing from one nation to another (18, 47). It will be very important to continue to develop international agreements and political mechanisms that enable cross-boundary management of marine assets, including coordinating efforts to link and manage protected areas. Examples such as the Coral Triangle Initiative (Box 12) point to how regional approaches can drive progress.

The legal regime on the high seas and the international seabed is fragmented and has large loopholes, making it difficult to establish cross-sectoral management and effective marine protected areas. For example, fisheries in these areas are managed through regional fisheries management organisations that have many shortcomings, shipping is governed by a separate set of conventions under the International Maritime Organization, and seabed mining, a relatively new but potentially fast-growing activity, by the International Seabed Authority. There is no global oversight that collectively manages cumulative impacts or addresses conflicting use of the high seas or the international seabed (48).

Early in 2015, a breakthrough was achieved at the UN when governments agreed, after 10 years of discussion, to start negotiating a new agreement for the high seas that would fill the gaps. Such an agreement would enable the international community to establish marine protected areas, environmental impact assessments, and access and benefit-sharing mechanisms for marine genetic resources found in international waters and associated seabed areas. States now need to ensure that this agreement is strong and comprehensive.

Agreements such those under the Antarctic Treaty system have fostered international cooperation in the management of fishing off Antarctica, although habitat conservation by way of marine protected areas needs to be accelerated to meet already established goals. There has been recent agreement on a framework to advance conservation of marine habitat in the Arctic, although many obstacles remain.

"BLUE ALLIANCE"

THE TIME HAS COME FOR RESPONSIBLE LEADERS TO BRING TOGETHER A BLUE ALLIANCE OF NATIONS TO DRIVE OCEAN HABITAT RESTORATION

To reflect the scale of the challenge we face and its international nature, we believe the time has come for responsible leaders to bring together a "Blue Alliance" of nations as well as concerned organizations and businesses to drive an ocean action agenda.

One of the actions the Blue Alliance could take would be to create a pool of funds to be invested in habitat restoration, fishery reconstruction and pollution reduction to enable countries to take action. This would draw on proven and innovative approaches from micro-financing of small-scale fisheries reform to regional funds to help countries collaborate on solving problems that cross national borders. This will help countries tackle ocean restoration problems that otherwise can be overwhelming.

Additionally, access to the United Nations Green Climate Fund should be given for projects to build marine ecological and social resilience, repair fisheries, enhance "blue" carbon stocks, and establish sustainable practices along the world's vast coastal areas. Given that roughly half of the world's population lives within 100km of the coast and 10 per cent within only a few metres of sea level (1, 3, 49), addressing coastal and marine issues within the broader climate change context is essential.

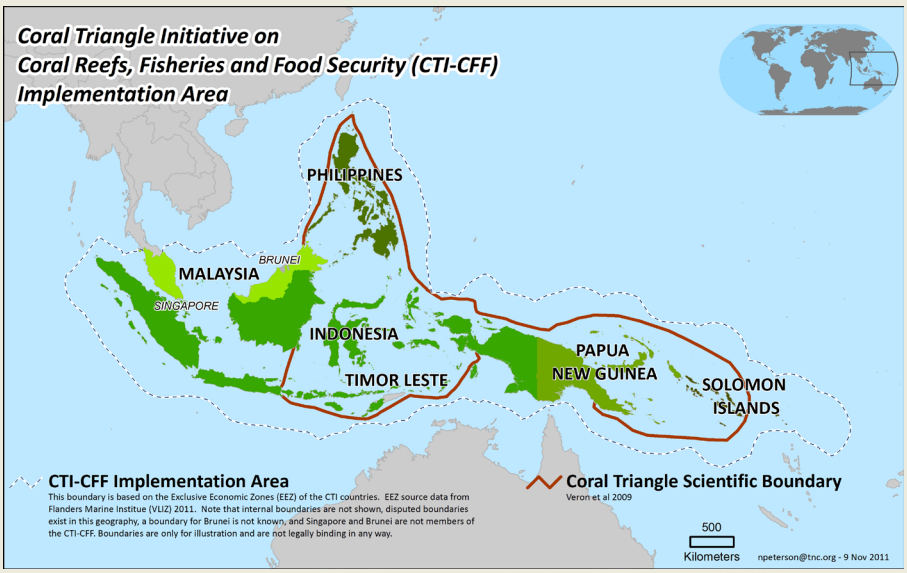
BOX 12 THE CORAL TRIANGLE INITIATIVE

The growing need to manage marine resources across jurisdictions and boundaries has inspired models of international cooperation and regional initiatives around the world. At their best, these can help ensure food security, health, economic growth and political stability.

The Coral Triangle Initiative on Coral Reefs, Fisheries & Food Security (CTI-CFF), is a multilateral partnership between Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor Leste. The six governments work with development partners and other stakeholders to address crucial issues such as food security, climate change and marine biodiversity conservation (a). At the Leader's Summit in 2009, these governments adopted a 10-year CTI Regional Plan of Action to safeguard the region's marine and coastal biological resources (b).

In 2014, the CTI-CFF Ministerial Council endorsed two significant regional policy frameworks that address the multiple needs and desires of societies, without jeopardizing options for future generations to benefit from the full range of goods and services provided by marine ecosystems. The Coral Triangle MPA System Framework and Action Plan aims to scale up and maximize the food, income and ecological benefits of marine protection and management through the adoption of regional criteria for management effectiveness (c). The Coral Triangle Regional Ecosystem Approach to Fisheries Management Framework focuses on managing fisheries in a sustainable way for both fish populations and ecosystems, including the management of the high-value tuna fishery (d).

These frameworks reveal the possibilities when nations come together over problems of common significance.



ACTION 6 REINVENT PUBLIC/PRIVATE PARTNERSHIPS

It is neither logical nor practical to consider people, ecosystems and industry as separate components when making decisions about ocean systems. Similarly, it is no longer feasible to consider ocean protection and restoration as simply being a matter for government; local communities and responsible business must be engaged as well (Box 13). Solutions must involve holistic thinking that includes natural, social and economic needs and limits. This has received considerable attention in recent international leadership fora (41), which have also been careful to outline the social and ethical principles that accompany such integrated thinking and solutions.

Solutions that are limited to one or two sectors and that do not take into account the full spectrum of social, political and ecological relationships are likely to deliver fragmented improvements that do not match the scale and urgency of the challenges confronting the world's ocean.

The Blue Ribbon Panel from the Global Partnership for Oceans identified five key principles (41) for ensuring that goal-driven partnerships pursue the common good of people, ecosystems and industry, while at the same time having real impact on the problems at hand.

These principles emphasize the need to ensure that sustainable livelihoods, social equity and food security are central tenets of these types of partnerships, while at the same time ensuring a healthy ocean within a setting of effective governance, long-term viability, and an atmosphere of innovation and capacity building. Adopting partnerships based on these principles is important if we are to avoid many of the pitfalls and perverse outcomes of past partnerships, and ensure that people and ecosystems are not disadvantaged (Box 14).

BOX 13 FINANCING THE RECOVERY OF MARINE ECOSYSTEMS

One of the most significant factors impeding marine conservation at scale is the cost of upfront conservation measures required to drive species and habitat recovery in a meaningful way. All too often, industry and local ocean users bear the burden of lost revenue and livelihoods, often becoming resistant to the desired reforms. To address this, WWF is testing an innovative investment-based funding model designed to finance the transition to sustainable fisheries and the recovery of marine ecosystems, with the potential to generate profits exceeding the original investment (a).

Channelling impact capital to sustainable measures, Financial Instruments for the Recovery of Marine Ecosystems, or FIRME, would facilitate marine ecosystem recovery by providing strategic short- to medium-term financing to connect producers to supply chains, provide working capital, enhance market access and implement sustainable practices.

BOX 14 IMPROVING LIVELIHOODS OF COASTAL COMMUNITIES IN THE SOLOMON ISLANDS

In the Solomon Islands, WWF is working with partners to develop sustainable financing mechanisms in the form of micro-savings and loans as well as small business opportunities around the introduction of inshore fish aggregating devices, locally known as "rafters." The devices help reduce fishing pressure on overfished and over-exploited coral reef ecosystems. The rafters are constructed and deployed by community members (a). This project, co-funded by the Australian government and corporate partner John West Australia, aims to improve the livelihoods and food security of the coastal artisanal fishing communities in the Ghizo Islands region (b, c).

Since its establishment in November 2013, the micro-savings scheme has been adopted by more than 600 women who have saved over SBD$130,000 (about US$16,700). This community-based fisheries work includes a strong focus on women's economic empowerment, recognizing that this can help to address some of the underlying socio-economic drivers of unsustainable practices (b, c).



© Andrew J. Smith / WWF-Australia

"Rafters", or fish aggregating devices, help fishing communities in the Solomon Islands maintain their food and income while taking pressure off over-exploited reefs.

ACTION 7 BUILD TRANSPARENT ACCOUNTING OF THE VALUE OF OCEAN ASSETS TO IMPROVE DECISION-MAKING

One key challenge to attaining sustainability is that biological systems are largely considered to be externalities within present day accounting systems, yet are essential to any economy. Consequently, when economic and political decisions are made, they tend to account poorly for the true cost of any activity or decision. Many ecosystems both on land and in the ocean are sacrificed in costly ways in the name of economic growth.

It is important that we move to a proper accounting of the value of ocean goods and services, and integrate those costs and values into economic systems and decision-making (Box 15). Only then can decisions be made that are based on the true economic ramifications.

Obtaining a complete value of ocean goods and services can be challenging given the intangible nature of some contributions. However, even gaining a minimum value for these important components of the natural and human systems will ensure that decision-making is improved when it comes to the ocean and its sustainable future. For example, if the true value of mangroves is correctly registered in terms of their value as a nursery for fish, protective barrier from storms and tides, and carbon store, then decisions to remove them are far more unlikely.

A complete, proper accounting of the value of ecosystem elements is an absolutely essential action along the road to ocean reform. The high-level analysis provided here indicates that ocean goods and services are worth trillions of dollars each year. The enormous value of ocean goods and services is not accounted for in the majority of countries and hence moving to a more accurate and inclusive assessment of the value of ocean ecosystems must be a priority.

Monitoring key indicators and regular, transparent reporting against them is considered a fundamental element of prudent business management and public administration, yet these systems are sorely lacking for the ocean. Managing the ocean's assets means tracking their health and performance, and judiciously investing in their maintenance, which will be self-evident to all experienced leaders in private and public sectors.

BOX 15 COASTAL ZONE PLANNING FOR BELIZE

US$14-16M

COMMERCIAL FISHERIES THAT DEPEND ON REEFS AND MANGROVES ARE WORTH AN ESTIMATED US$14-16 MILLION A YEAR

12-15% GDP

TOURISM ASSOCIATED WITH COASTAL ECOSYSTEMS CONTRIBUTED AN ESTIMATED US$150-196 MILLION TO THE BELIZE ECONOMY IN 2007 (12-15 PER CENT OF GDP).

Belize's coastal zone is one of its greatest assets. It is a complex of ecosystems that support countless ecological processes and a vast array of marine life and habitats that are often central to the Belizean way of life. An estimated 30 per cent of Belize's gross domestic product is directly linked to commercial activities within the coastal zone (a), and roughly 40 per cent of the population lives along the coast (b).

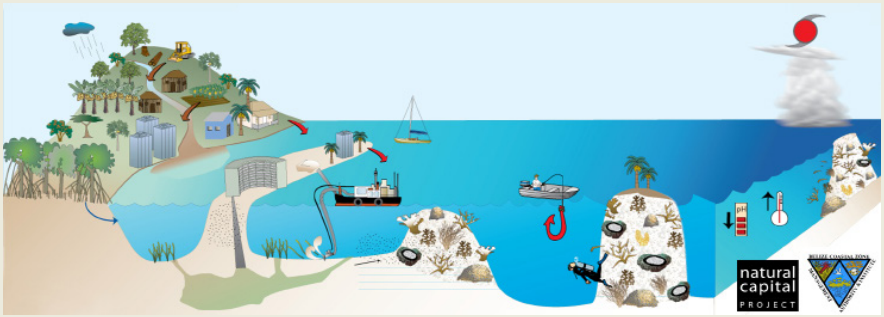
However, economic development and population growth have escalated over the past few decades. This has led to increased pressures on Belize's coastal and marine resources. Associated threats include expansion of tourism and recreational facilities, utility supply, dredging and minerals extraction, land clearance, pollution, waste disposal, fishing and aquaculture. These, in turn, compound the coastal zone's exposure and sensitivity to natural hazards.

Belize, like many nations, is seeking to build a strong economy based on marine and coastal resources, and is furthering this ambition using a plan to balance use and protection of this resource base.

Belize Coastal Zone Management Authority and Institute worked with the Natural Capital Project (c) and WWF to develop the country's first national Integrated Coastal Zone Management Plan to guide all coastal management decisions. The partners consulted with residents, business owners and other stakeholders to understand their use of and visions for the coastal zone. They mapped and valued marine ecosystem services provided now and under alternative zoning schemes. The results were used to produce a coastal zone management plan that designates areas for preservation, restoration, development and other uses.

The plan, which reflects local visions and values, is based on the best available science, and will ultimately enhance the coastal zone's ability to provide for people now and in the future.

Illustration of ecosystems goods and services available in coastal Belize *(Natural Capital Project, 2013).*



© Healthy Reefs (healthyreefs.org)

ACTION 8 SHARE KNOWLEDGE MORE EFFECTIVELY AND DRIVE INSTITUTIONAL COLLABORATION

New knowledge and solutions are vital to any effort as we tackle the many challenges outlined in this report. Much of the knowledge, and many of the solutions, will be relevant across a range of contexts. Establishing a mechanism by which ideas and solutions can be easily shared between countries and regions would ensure consistency and economy of effort. It would also help eliminate the disadvantages some countries experience when it comes to accessing advice and training capacity.

Establishing an ocean knowledge and solutions platform would help disseminate and transfer skill and capacity across all nations. The proposed platform will involve a network of universities, research institutes and other expertise providers, including non-governmental organizations and major management agencies. It will exploit teaching and training innovations such as massive open online learning (Box 16) as well as the development of common tools for use across different countries facing similar problems. This platform, along with the myriad tools and technologies that facilitate global communication, will help practitioners, policymakers and communities transcend the boundaries of language, culture and institutional structure to achieve greater conservation and development outcomes (Box 16).

There is an obligation for business to increase transparency and make data much more widely available.

There is a real opportunity to develop practices of much greater institutional collaboration among and between ocean-related institutions, both public and private. There should also be greater efforts made to forge collaboration between institutions that work across areas of relevance, including on topics like food security, poverty alleviation, health and terrestrial management. When all these efforts come together, there is exponential potential to create holistic solutions that work for people and nature.

BOX 16 BUILDING CAPACITY GLOBALLY...

Access to the Internet has revolutionized the spread of knowledge, information and training opportunities. Massive open online courses, or MOOCs, are free courses that are aimed at unlimited participation through open access. In addition to traditional course materials, many MOOCs facilitate user forums that develop and support an interactive community of students, experts, teachers and tutors (a). This approach to teaching and learning has triggered a revolution in the way that institutes of higher learning are able to engage globally. The combination of technologies has come of age, and the ability to offer effective teaching and training to large numbers of students simultaneously suggests an opportunity to build capacity in a range of essential knowledge areas required to tackle the problems of a changing ocean.

... AND ON THE GROUND

On the ground, initiatives to share traditional knowledge and increase local action on marine protection are expanding. In the Pacific, more than 500 communities in 15 countries manage 12,000km² of coastal resources (b). Social networks or support "umbrellas" have been crucial in establishing and underpinning communities and agency programmes involved in setting up locally managed marine areas. Operating at sub-national, national and international levels, these networks provide more flexible learning opportunities than do formal methods. They also allow communities to establish links that may promote both ecological and cultural resilience (c).



© Brent Stirton / Getty Images

Local fishermen celebrate the designation of a new marine protected area. Vanua Levu, Fiji.



© Jürgen Freund / WWF

This Indonesian fisherman uses a kite and line. Indonesia is part of the Coral Triangle, home to 120 million people and more than 2,000 species of reef fish.

THE TOP THREE ACTIONS FOR 2015

This year, 2015, is vital. The world is coming together to consider how the planet's strained ecosystems and the needs of people can be reconciled.

The key global priorities for the ocean this year are:

1. **Ensure ocean recovery features strongly in the UN Post-2015 Agenda, including the Sustainable Development Goals.**
2. **Take global action to avoid dangerous climate change and further damage to the ocean.**
3. **Conserve and effectively manage 10 per cent of representative coastal and marine areas by 2020, increasing coverage to 30 per cent by 2030.**



© WWF-Malaysia / Mazidi Abd Ghani

While roughly half of the world's population lives within 100km of the coast, some people – like these boys from the Bajau Laut (Sea Gypsy) community of Malaysia – depend almost entirely on the ocean for their well-being.

CONCLUSION

Ocean health is declining due to local stresses such as habitat destruction, overfishing and pollution as well as rapid and unprecedented changes in ocean temperature and acidity.

The message is clear. We are running down our ocean assets and will push the ocean economy into the red if we do not respond to this crisis with bold and decisive actions as an international community. We must do more, much more, to protect our ocean asset base. A prudent treasurer or CEO would not wait until the next financial report to correct course. They would act now.

This report draws on the research and conclusions of an expert community and marries the best scientific evidence with a common-sense economic case for action to safeguard our valuable ocean. Adopting the eight actions outlined here will result in a sustainable future for the hundreds of millions of people who depend directly on the ocean for their food and jobs, and for all humanity, which relies on the ocean for life as we know it on this blue planet.

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The ocean in numbers

100% RECYCLED

US$24TN

The overall value of key ocean assets is more than US$24 trillion

2/3

Two-thirds of the base economic value of the ocean is produced by assets that rely on healthy ocean conditions



2050

At current rates of temperature rise, coral reefs will disappear by 2050

7TH

Based on the gross marine product, the ocean is the 7th largest economy in the world

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