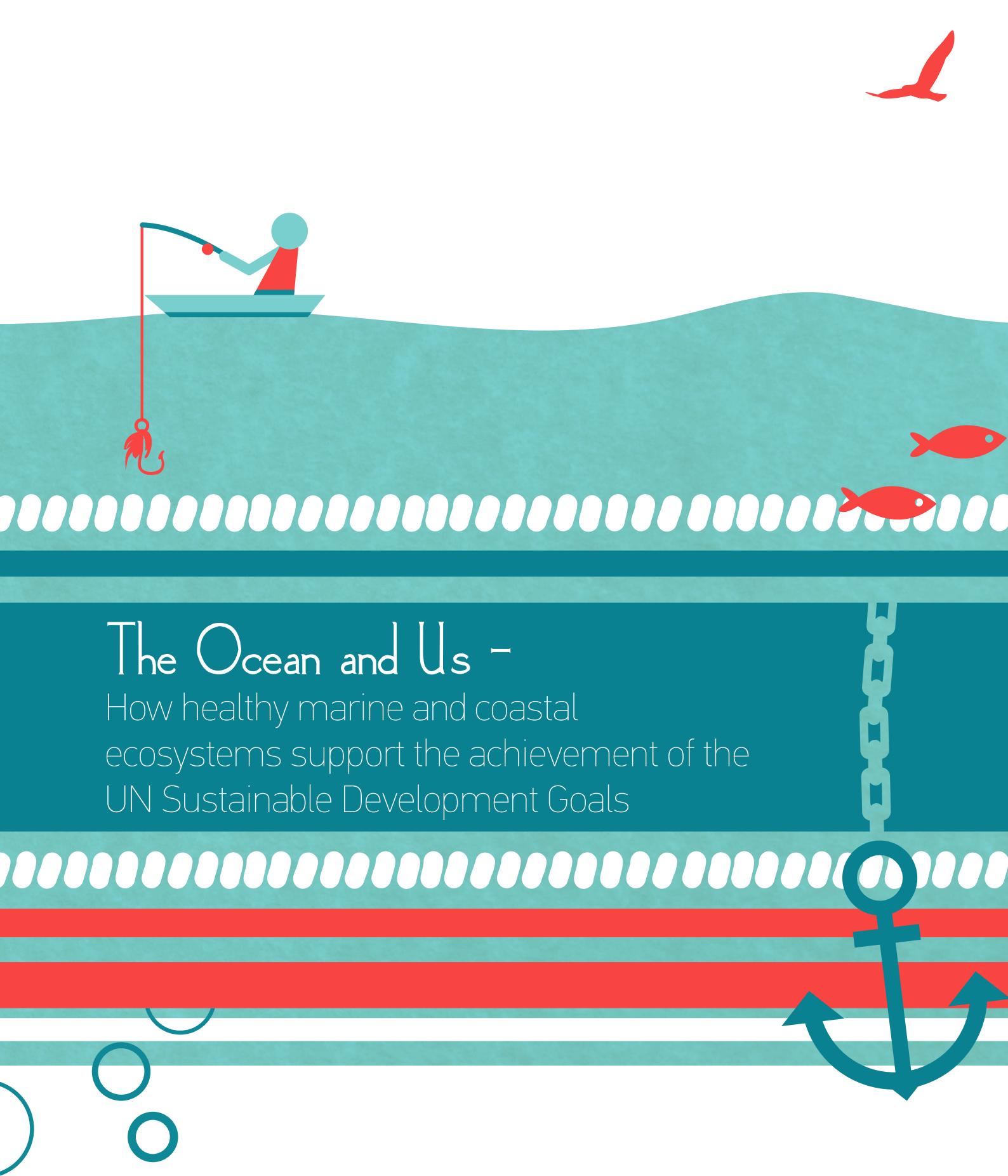

The Ocean and Us –

How healthy marine and coastal ecosystems support the achievement of the UN Sustainable Development Goals

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Partners

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GRID-Arendal has served as the chief editor of this publication. GRID-Arendal is a centre collaborating with the United Nations Environment Programme (UNEP), supporting informed decision-making and awareness-raising. GRID-Arendal supports the integration of marine and coastal ecosystem services into planning and decision making through a range of global projects developing and sharing good practice and building capacity of institutions and practitioners.

Linwood Pendleton holds the International Chair of Excellence for Marine Ecosystem Services within the Centre for the Law and Economics of the Sea at the European Institute for Marine Studies, University of Western Brittany. He is also Senior Scholar at the Nicholas Institute for Environmental Policy Solutions at Duke University. Anne Kaup is the Executive Manager of the Marine Ecosystem Services Partnership.

The United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) has contributed the chapters on Data Requirements and Linking to Policy-Making of this publication. UNEP-WCMC is the specialist biodiversity assessment centre of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organization. The Centre has been in operation for over 30 years, combining scientific research with practical policy advice.

The Nature Conservancy's Mapping Ocean Wealth project has made their infographics and case studies available to this publication. Mapping Ocean Wealth's mission is to describe – in quantitative terms – all that the ocean does for us today, so that we make smarter investments and decisions affecting what the ocean can do for us tomorrow. Supported by a consortium of global organizations, Mapping Ocean Wealth is informed by rapidly advancing marine science and field-based studies from around the globe that examine what drives the value of ecosystems and how they benefit people.

The Marine Ecosystem Services Partnership (MESP) strives to improve communication between valuation researchers and policy makers by providing contextual perspectives for understanding valuation data in relation to environmental management decisions. The Partnership aims to be a community of practice through which data users and managers can work collectively to better integrate ecosystem services data with marine policy needs. This collaboration is aided with the use of tools such as the MESP mapper and valuation library that provides access to a collection of economic valuation studies and data found on the MESP website.

Editors

Christian Neumann, GRID-Arendal, Arendal, Norway
Tanya Bryan, GRID-Arendal , Arendal, Norway
Linwood Pendleton, Nicholas Institute for Environmental Policy Solutions at Duke University, Durham, USA; Centre for the Law and Economics of the Sea at the European Institute for Marine Studies, University of Western Brittany, Brest, France
Anne Kaup, Marine Ecosystem Services Partnership
Jane Glavan, Abu Dhabi Global Environmental Data Initiative, Abu Dhabi, UAE

Chapter Contributors

Introduction: Christian Neumann, Tanya Bryan, Linwood Pendleton, Anne Kaup
How do Marine and Coastal Ecosystem Services Support the SDGs?: Luke Brander, VU University Amsterdam, The Netherlands; University of Hong Kong, China and Corinne Baulcomb, Scotland's Rural College, Edinburgh, UK
The Ocean's Ecosystem Services: A new language for an Ancient Wisdom: Glenn Edney, Ocean-Spirit
Marine and Coastal Data Requirements to Achieve Sustainable Development Goals: Lauren V. Weatherdon, Chris McOwen, Corinne S. Martin, Hannah Thomas, UNEP-World Conservation Monitoring Centre (UNEP-WCMC), Cambridge, UK
Linking Marine and Coastal Ecosystem Services to Policy-Making : Steve Fletcher, UNEP-WCMC, Cambridge, UK
Policy Actions That Ensure Marine and Coastal Ecosystem Services support the SDGs: Christian Neumann
The Future Management of Marine and Coastal Ecosystem Services for People: Linwood Pendleton, Anne Kaup

Maps and Graphics

Pages 8, 9, 10, 16, 18, 19, 21, 22, 35, 43, 46: Hisham Ashkar

Opinion-piece Contributors (in order of appearance)

Pawan Patil, The World Bank
Nicole Glineur, Global Environment Facility
Paul van Gardingen, Ecosystem Services for Poverty Alleviation Programme
Yvonne Sadovy and Claudio Campagna, IUCN SSC Marine Conservation Sub-Committee Catherine Lovelock, The University of Queensland
Vera Scholz, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
Andrew Hudson, United Nations Development Programme
Alasdair Harris, Blue Ventures Conservation

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Table of Abbreviations

BD	Biodiversity
BIP	Biodiversity Indicators Partnership
EBV	Essential Biodiversity Variables
ESPA	Ecosystem Services for Poverty Alleviation
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse Gases
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and ecosystem Services
LDCs	Least Developed Countries
LME	Large Marine Ecosystems
LMMA	Locally managed marine areas
MCES	Marine and coastal ecosystem services
MES	Marine Ecosystem Services
MPA	Marine protected areas
MSP	Marine Spatial Planning
NBSAP	National Biodiversity Strategies and Action Plans
OHI	Ocean Health Index
SDG	Sustainable Development Goals
SEEA	System of Environmental-Economic Accounting
SIDS	Small Island Development States
TEEB	The Economics of Ecosystems and Biodiversity
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
WAVES	Wealth Accounting and the Valuation of Ecosystem Services

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Preface

The ocean has been a cornerstone of human development throughout the history of civilization. People continue to come to the coasts to build some of the largest cities on the planet, with thriving economies, culture and communities. Ocean and coastal ecosystems provide us with resources and trade opportunities that greatly benefit human well-being.

These benefits are often taken for granted as we fail to recognize their underlying value. In our narrow pursuit of progress through purely economic and social development we often fail to protect the health of our marine system that we depend upon. Today, however, we increasingly realize the importance of healthy ecosystems for sustainable development that is reflected in the 17 Sustainable Development Goals (SDGs) recently adopted by the United Nations. We can no longer afford to apply an antagonistic paradigm between development and conservation. The SDG framework provides the world with the opportunity to transform how we think about the 'Oceans and Us'.

This publication highlights the critical contribution of healthy marine and coastal ecosystems to achieving the SDGs and describes the role of credible and accessible data, well communicated knowledge generated through dialogue with users, in supporting informed decision-making.

Prof. Jacqueline McGlade
Chief Scientist and ad interim
Director of UNEP's Division of Early
Warning and Assessment

Garth Cripps, Blue Ventures, 2015

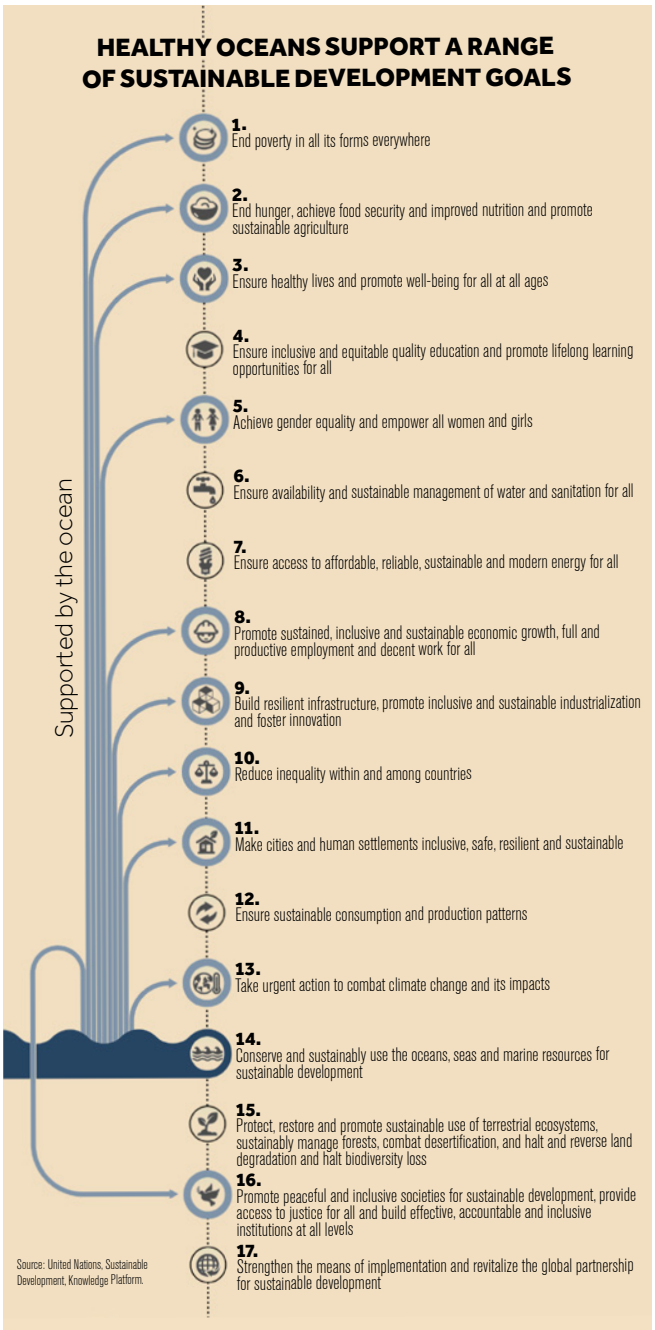
Executive Summary

The ocean, together with the ecosystems, habitats and species therein, provides benefits to humans in numerous and diverse ways, and this is reflected in many aspects of humanity's religions and traditions, stretching back to the dawn of civilization.

This understanding is also captured in the 17 United Nations Sustainable Development Goals (SDGs) adopted in 2015, which aim to reconcile the needs of people, the planet, prosperity, peace and partnerships. The SDGs focus more on the environment than the preceding set of Millennium Development Goals,. While the importance of a healthy ocean is recognized through a dedicated goal (Goal 14), the role it plays in sustainable development goes far beyond this goal alone.

The ocean produces half the oxygen we breathe, provided us with some 135 million tonnes of fish, seafood and aquatic plants for food and industrial application and contributed 16 per cent of the global population's animal protein intake. Marine fisheries alone supported an estimated 200 million full-time equivalent jobs - about one in every fifteen people employed on the planet. Over half of nearly 5,000 patented genes of marine organisms have found applications in pharmacology and human health. At the same time, the coasts are also a social, cultural and spiritual home for people. Overall, we find a healthy ocean to support 10 out of the 17 SDGs, in addition to the dedicated ocean goal.

Progress towards achieving SDGs is underpinned by an understanding of marine and coastal ecosystems and the corresponding relationships with those who depend on them for their livelihoods and well-being. Ocean-based research is expensive and logistically difficult, and our knowledge of the marine environment is subject biases in data availability. A number of initiatives aim to address these challenges by producing robust, extensive and interoperable biodiversity observation networks to support policy-relevant ecological, socioeconomic and climatic datasets and indicator monitoring.



A better understanding of marine ecosystem services enables of informed policy choices for sustainable development. It is therefore critically important that assessments are undertaken in ways that support their integration into SDG policy-making. Their co-construction through a partnership between stakeholders, policy-makers, the public and technical experts is likely to support SDG delivery.

Development policy making capturing the benefits provided by a healthy ocean can build on existing global initiatives and experiences, as well as conventional national policy frameworks and planning processes. This will require a shift in paradigm: to one that recognises conservation as a contribution towards sustainable development, rather than an obstacle to it. The understanding of natural ecosystems as an asset brings with it the opportunity of protecting and investing into it.

There is a growing recognition among world and local leaders that ecosystems are indeed our shared factory. Marine and coastal ecosystems are being counted on to produce many of the essential goods and services that help us achieve the SDGs. Only with reliable, objective and widely available data can we harness this powerful, sustainable and global natural factory to achieve the Sustainable Development Goals we have set for the people of this planet.

Demi-UNEP/Still Pictures

Introduction

This is a landmark year for sustainable development globally, with the adoption of a set of 17 United Nations Sustainable Development Goals (SDGs) that aim to reconcile the needs of people, the planet, prosperity, peace and partnerships. Reflecting the development of the Green Economy approache and the Outcome Statement of the 2012 United Nations Conference on Sustainable Development ('Rio +20'), the SDGs focus more on the environment than the preceding set of Millennium Development Goals, with a greater emphasis on sustainable management and consumption of natural resources, as well as the conservation and protection of natural ecosystems.

The critical role of the ocean in sustainable development has already been recognized through a dedicated goal - Goal 14: *conserve and sustainably use the oceans, seas and marine resources for sustainable development.* However, the role that a healthy ocean plays in sustainable development goes far beyond this goal alone. In fact, the ocean, together with the many ecosystems, habitats and species therein, underpins life on Earth in numerous and highly diverse ways.

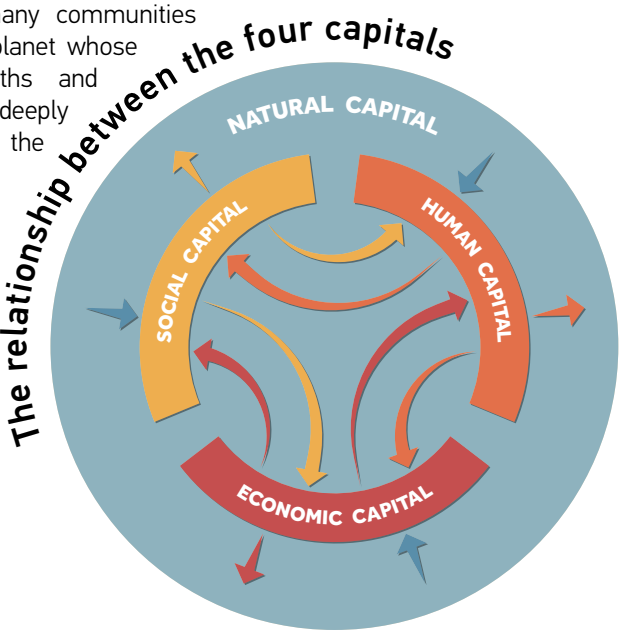
A great deal is now known about the importance of marine and coastal ecosystems for the well-being of people around the world (Barbier et al., 2011). Far less is known about:

- who depends most on marine and coastal ecosystem services and where these communities are located;
- how these ecosystems are changing over time; and
- how the competing aspects of environmental degradation, including climate change, restoration and human dependence affect the well-being of people (Suich et al., 2015).

Achieving sustainable development requires more than an awareness or a measurement of *natural capital*. We must take action to maintain and enhance the value of all four types of *capital* upon which people depend: natural capital (including of living and non-living components), social capital (including relationships, norms and institutional components), human capital (including knowledge, experience and wisdom), and economic capital (including cash and economic assets).

The ocean produces half the oxygen we breathe, and absorbs 30 per cent of the anthropogenic emissions of carbon dioxide and approximately 93 per cent of the added heat arising from human-driven changes to the atmosphere (IPCC, 2013). In 2013, the ocean provided us with 135 million tonnes of fish, seafood and aquatic plants for food and industrial application (FAO, 2015), and contributed 16 per cent of the global population's animal protein intake (FAO, 2014). Marine fisheries alone supported an estimated 200 million full-time equivalent jobs (Teh and Sumaila, 2011) - about one in every fifteen people employed on the planet. Over half of nearly 5,000 patented genes of marine organisms have found applications in pharmacology and human health. (Arrieta et al., 2010).

The coast is also a social home to millions of people who enjoy the ocean in their leisure time, a cultural home to those societies that have lived near the coast for centuries or millennia, and the spiritual home to many communities across the planet whose ancient myths and religions are deeply rooted in the oceans.



Garth Cripps, Blue Ventures, 2015


Garth Cripps, Blue Ventures, 2015

This myriad of ecosystems services, *the benefits people obtain from ecosystems* (MEA, 2005), provided by the ocean and their role in sustainable development is the focus of this publication. By examining which of the Sustainable Development Goals, specifically beyond Goal 14, are supported by healthy marine and coastal ecosystems, this report will help bridge the communities of conservation and development and raise the awareness among the public, political decision-makers, the private sector and donor community of the essential nature of conserving and restoring marine and coastal ecosystems.

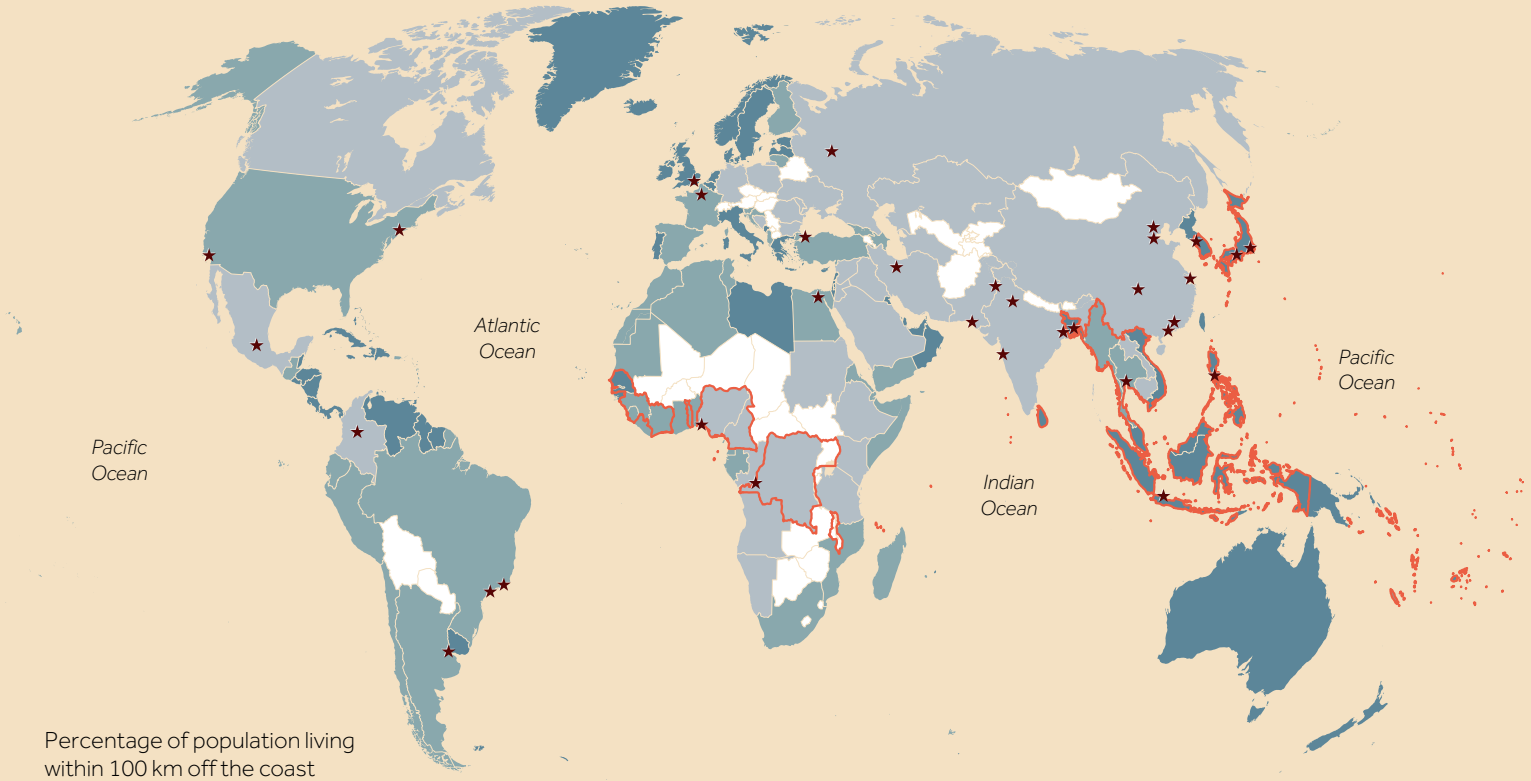
While 'ecosystems services' might be considered a new term, the concepts underpinning it, of the earth and ocean as a life-giver, is much older and deeply enshrined in our religions, ancient myths and traditional management approaches. This report, therefore, includes a chapter focusing on the many different ways the ocean, and its importance in all aspects of life, has been integrated into the cultural mindset for millennia. While not often found in scientific reports, we felt it was also important to document how society intuitively understands the importance of the ocean.

This report explores the data needs for achieving the SDGs, examines ways of linking information about marine and coastal ecosystem services to decision-making and recommends policy actions that support the integration of ecosystem services into development planning and ocean policies.

A number of individuals and organizations from both the conservation and development communities have been invited to provide their views on the role of healthy marine and coastal ecosystems for sustainable development. Their contributions can be found throughout the publication.

By highlighting the interconnectedness of the ocean throughout many the SGDs, this report seeks to create a greater recognition of the importance of the oceans for sustainable development, and the very existence and well-being of mankind.

Our closeness to the ocean



Source: Kawarazuka, *The potential role of small fish species in improving micronutrient deficiencies in developing countries*, 2011. UNEP, *GEO Year Book*, 2005. Wikipedia, 2015.

The Ocean Economy and Sustainable Development

Pawan G. Patil, Senior Economist, World Bank Group

Nowhere is the link between poverty and the environment more obvious than in the ocean. The ocean plays a vital role as the planet's life-support system. It holds about 97 per cent of our water, it absorbs heat and carbon dioxide. It generates oxygen and shapes our weather patterns.

However, the ocean is not a life-support system in the abstract sense. It feeds over a billion people and supports hundreds of millions with jobs and livelihoods, many of which are located in some of the poorest coastal areas and island nations. Over half of the world's economy is produced within 100 kilometres of the ocean.

This is exactly why the World Bank has engaged in the ocean agenda for many years now. If we care about ending extreme poverty by 2030, we cannot ignore the ocean. The ocean is fundamental to the economic well-being and future food security of a huge number of our client countries.

The work we do on natural capital accounting shows the value of a healthy ocean to a country's economic prosperity. Countries tell us they want our help to put in place the laws and institutions needed to better manage their ocean resources for sustainable economic growth. In a changing climate that is already displacing thousands, endangering millions and threatening the development gains that have been so hard won, this is increasingly important.

To give the ocean a fighting chance of withstanding climate change, we have to tackle the other issues threatening its health in the meantime: overfishing, destructive and illegal fishing, marine pollution and the destruction of marine habitats like coral reefs, seagrasses, mangroves and salt marshes. The good news is that solutions exist for all these challenges. We can act to rebuild fish stocks, protect critical natural habitats and reduce pollution levels.

In fact, an integrated approach to all these threats is the best thing we can do for the health of the ocean while we transition away from carbon-based economies.

As the World Bank Group, our portfolio of support to fisheries and ocean habitat conservation now runs to over USD 1 billion, and we are providing another USD 5 billion to support pollution reduction and water resource management in coastal areas. We have heard, however, while a good start, this is not enough.

Through this work, we learned that change can happen and when it does, people benefit. There are many examples. We know that our work alone isn't enough. No one organization or country can do what is needed to turn around ocean health on their own. That is why we see partnership as so important. When the global community comes together to focus on real solutions, the opportunities that emerge are tremendous. The newly minted Sustainable Development Goals and particularly the SDG on oceans is yet another opportunity to galvanize global support and work in partnership to turn the tide on declining ocean health.

Nicole Glineur, Global Environment Facility

Healthy oceans, which cover about 70 per cent of our planet, allow for the delivery of services and goods and their sustainable use. It is crucial to protect marine ecosystems, to maintain the services and goods they deliver. It is also essential for people's livelihood and health and the opportunities for future generations - to further ensure economic growth through sustainable use and trade. Fish provides the primary protein to about 1 billion people in developing countries. Jobs in artisanal and commercial fishing and tourism provide livelihoods for millions of people in those countries. Artisanal fisheries are also a model of gender balance and empowerment, providing work for both men and women who cooperatively and respectively catch and market fish. Healthy mangroves are one of the most unique ecosystems on earth in that they thrive where no other trees can survive – the transition between the ocean and the land. Mangroves stabilize shores and trap sediments. They are a buffer zone protecting the coasts from the effects of severe weather; they provide shelter and food sources for aquatic and terrestrial organisms; and serve as carbon sinks.

Developing countries contribute to the protection of the coastal and marine ecosystem and the services they generate via the Marine Portfolio of the Global Environment Facility (GEF) supporting 200 International Waters projects involving 180 collaborating countries, 20 Transboundary River Basins, 23 Large Marine Ecosystems (LMEs) representing 60% of developing countries LMEs, more than 250 Marine Protected Areas (MPAs) and Multifocal Programmes. All projects integrate socio- economic, gender and climate dimensions.

For example, the recent Coastal Fisheries Initiative in West Africa, Eastern Indonesia and Latin America is designed to demonstrate holistic ecosystem-based management, to improve governance of coastal fisheries and to support human well-being and livelihoods by increasing the economic and social value generated by coastal fisheries.

The Sustainable Fisheries Management and Biodiversity Conservation in Areas Beyond National Jurisdiction program focuses on tuna, and deep sea and straddling stocks to ensure sustainable fisheries and the conservation of globally significant biodiversity ecosystems and species in oceans.

The 14 Pacific Islands Ridge to Reef Program (PICS R2R) works across the Conventions of Biodiversity, Climate Change and Desertification, the Law of the Sea, and integrates the crucial Adaptation to Climate Change dimension to deliver multiple global environmental benefits. Each country is adopting specific aspects of R2R in line with national priorities and development needs while delivering global environment benefits. For example, the Cook Islands are focusing on MPA effectiveness; and Fiji is enhancing integrated management of a series of forested watersheds to protect land, water, forest and biodiversity resources, maintain carbon stocks and protect coastal mangrove and coral reef MPAs. The national demonstration projects are integrated through an International Waters Regional Ridge to Reef project. The GEF Coral Triangle Initiative supports sustainable management of natural resources; expansion of MPAs and Marine Managed Areas networks; development of adaptive management strategies in response to climate change impacts; and improves management of fisheries - all essential to ensure that an adequate supply of food exists to directly sustain more than 120 million people living along the coastlines.

Small Islands Developing States (SIDS) and Least Developed Countries are particularly vulnerable to the effects of climate change and receive additional Adaptation to Climate Change grants to curtail disruption and strengthen the resilience of coastal ecosystems to climate change thereby maximizing the economic benefits from tourism and fisheries.

Garth Cripps, Blue Ventures, 2015

How Do Marine and Coastal Ecosystem Services Support the Sustainable Development Goals?

The ocean, marine and coastal ecosystems are vital to life on Earth, and thus achieving the Sustainable Development Goals without the services they provide is going to be significantly more challenging, if not impossible. Marine ecosystem services include seafood, genetic material, coastal protection, carbon sequestration, biodiversity, recreation and other cultural services. These services support many of the Sustainable Development Goals (SDGs). Although SDG 14 – *conserve and sustainably use the oceans, seas and marine resources for sustainable development* – focuses specifically on the marine environment, marine ecosystem services contribute directly to the achievement of many of the other SDGs. In this chapter, we examine how key SDGs are supported by marine ecosystem services.

Poverty Alleviation, Economic Growth and Reduced Inequality

SDG1: End poverty in all its forms everywhere

SDG2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture

SDG8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG10: Reduce inequality within and among countries

Several of the SDGs are directed at improving human well-being by addressing major areas of deprivation and scarcity. Marine ecosystems play an important role in supporting a great variety of economic sectors that provide livelihoods and employment opportunities for the poor (SDG1 *end poverty in all forms everywhere*). This support may be direct when industries interact with marine ecosystems (e.g. subsistence and commercial fishing, mariculture, tourism and recreation, shipping, transportation and associated industries, and renewable energy production), or indirect as marine ecosystem services move through a series of interlinked industries employing large numbers of people around the world (SDG8 *promote full and productive employment and decent work for all*).[18][19] Livelihood and jobs that are supported by marine ecosystem services – many of which are subsistence or small-scale commercial activities – support billions of people in low-income countries around the world (WB 2012) (SDG10 *reduce inequality within and among countries).*

Fisheries

Fisheries depend exclusively on marine ecosystem services through food provision as well as habitat and water purification functions. As well, these fisheries support around 260 million jobs worldwide, both directly in fishing, and indirectly through all the sectors in the production chain (SDG8 *promote full and productive employment and decent work for all); (SDG10 reduce inequality within and among countries).* A significant proportion of these jobs are in small-scale fisheries in lower income countries, whereas higher income countries tend to have larger scale industrial fisheries (Teh and Sumaila 2011). Marine aquaculture is an increasingly important source of fish production and employment (SDG2 *promote sustainable agriculture).* This includes both employment provided directly at the farm level as well as non-farm opportunities in supply, processing and marketing activities[20].

18 According to the OHI, "Every US dollar of gross revenue from the [coastal/marine] fisheries sector supports nearly three US dollars within the world economy (OHI 2014).

2 As reported in the Ocean Health Index (OHI), in 2003, "the USD 84 billion of fish caught worldwide [globally] generated $235 billion in economic impact [globally]" (OHI 2014). Although this should not be interpreted as the value of the marine ecosystem service itself, it does indicate that marine ecosystems and their services have continuous impacts that are widely felt.

20 As reported in the Ocean Health Index (OHI), in 2003, "the USD 84 billion of fish caught worldwide [globally] generated $235 billion in economic impact [globally]" (OHI 2014). Although this should not be interpreted as the value of the marine ecosystem service itself, it does indicate that marine ecosystems and their services have continuous impacts that are widely felt.

MAPPING OCEAN WEALTH

FISH PRODUCTION

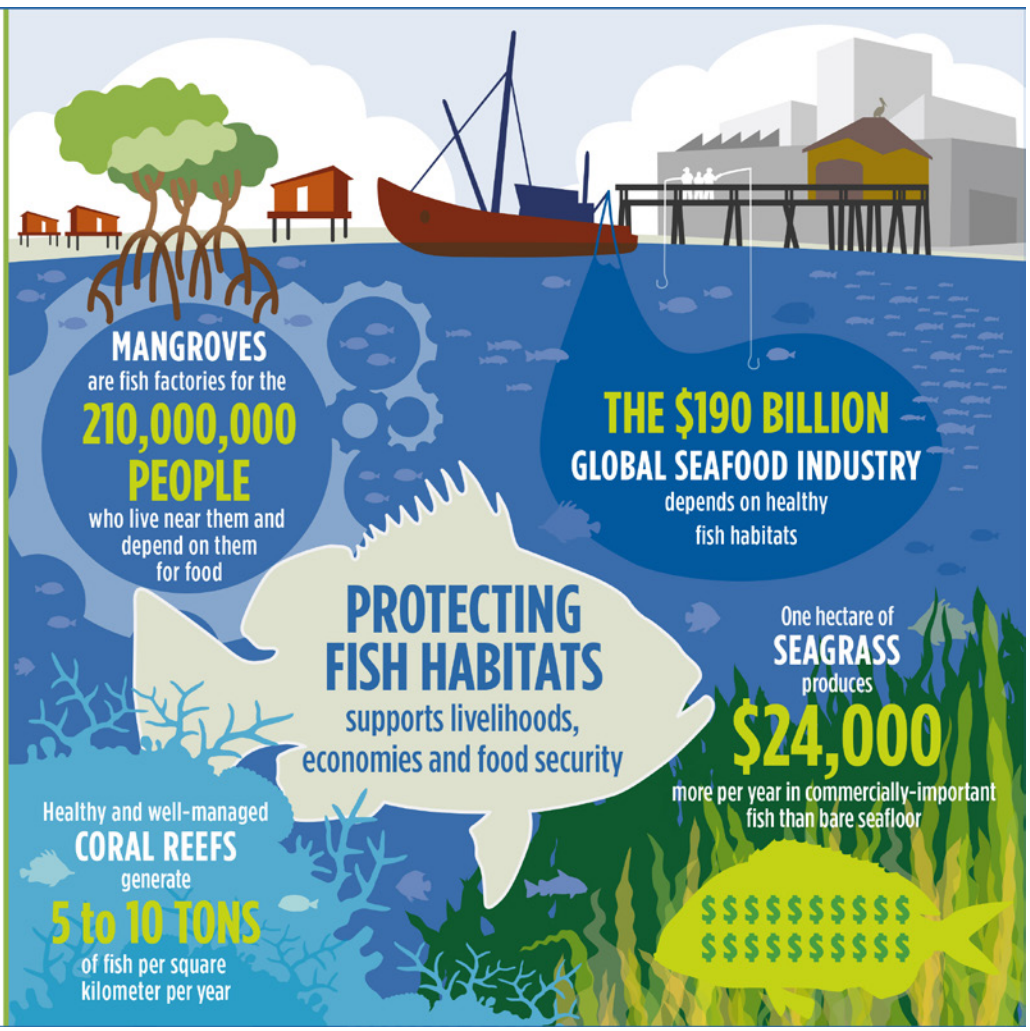
Ocean habitats are crucial nurseries and breeding grounds for fish – driving commercial, recreational and subsistence fisheries.

Coastal communities, fishers and managers should protect and restore the habitats that support livelihoods, economies and food security.

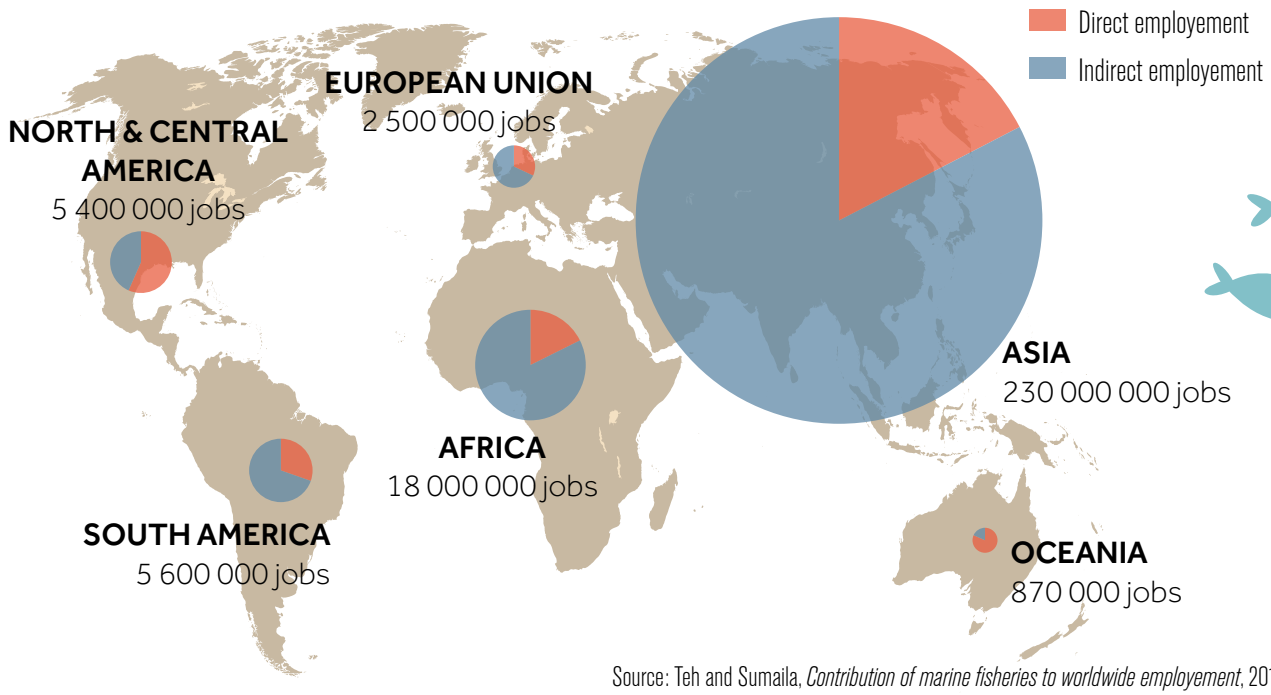
Mapping Ocean Wealth demonstrates what the ocean does for us today so that we maximize what the ocean can do for us tomorrow.

oceanwealth.org @ocean_wealth

The Nature Conservancy
Protecting nature. Preserving life.



Marine fisheries employment 2011, by region



Source: Teh and Sumaila, *Contribution of marine fisheries to worldwide employement*, 2011

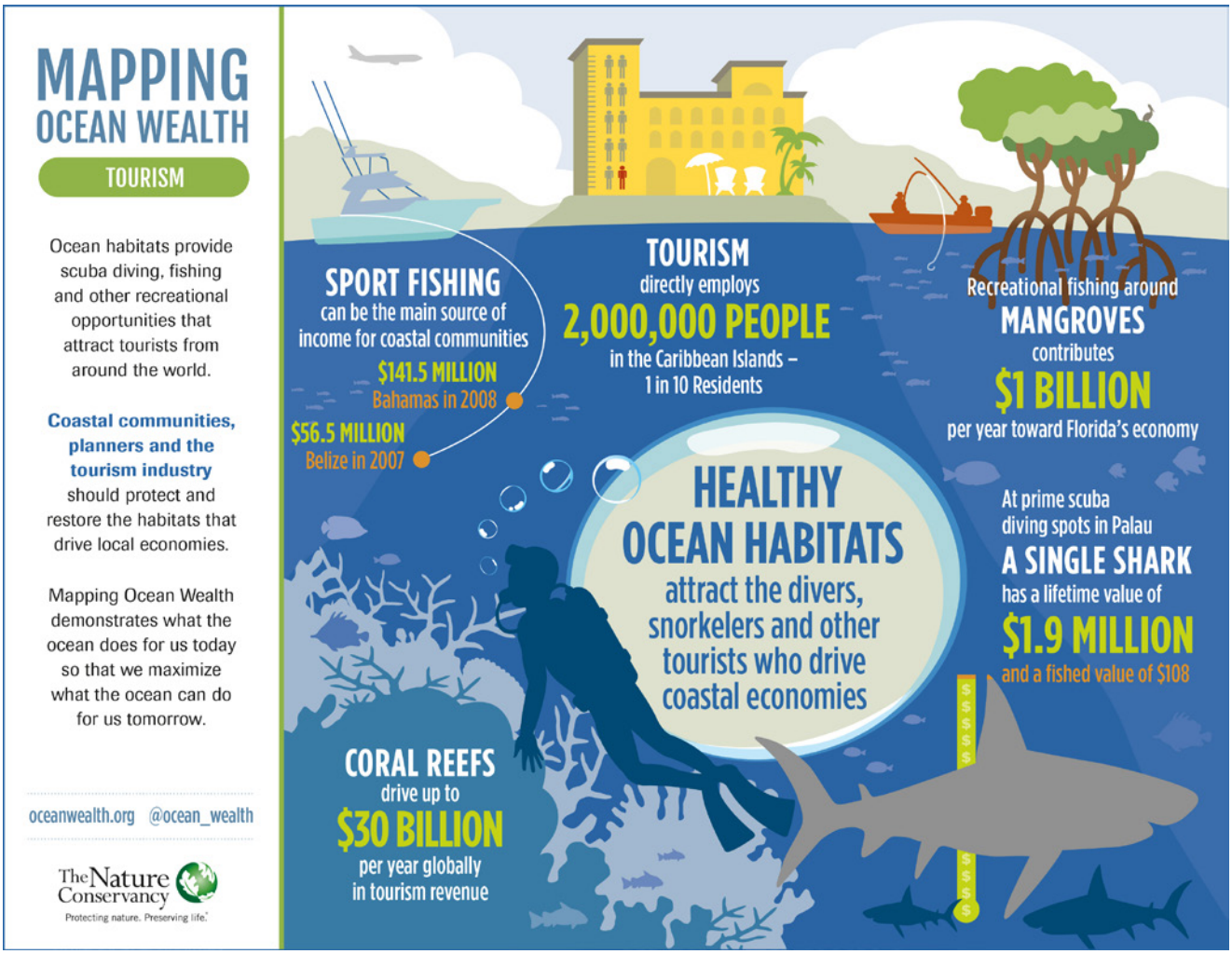
The combined employment in marine fisheries, aquaculture and related sectors supports a substantial percentage of the world's population (i.e. ~ 16%).[21] Marine ecosystems also indirectly support sustainable agriculture by providing fish that can be used as raw material for high protein feed for livestock (FAO, 2014).

In some countries, fish can be a high proportion of the total animal protein consumed, directly improving nutrition (SDG 2 *achieve improved nutrition*) particularly where total protein consumption is low or in countries where fish is the only readily available source of protein.

In 30 countries of the planet, fish constitutes more than one third of total animal protein consumption (Kawarazuka and Béné, 2011). Populations in developing countries tend to depend more than those in developed ones on fish as part of their daily diets. Fish often represents an affordable source of animal protein that may not only be cheaper than other animal proteins, but preferred and part of local and traditional recipes (FAO, 2014).

21 FAO (2012) estimated the percentage of the world's population supported by fisheries and aquaculture without discriminating between inland, brackish, and marine production. This estimate assumed that for each person directly employed in fishing or aquaculture that 3-4 jobs were created further down the supply chain, that each employed person employed supports 3 dependents. The result was 10-12% of the world's population in 2010 was supported by aquaculture and fisheries. The estimate shown here has used the same assumptions (i.e. each fisher/aquaculture producer supports 3 additional persons down the supply chain, and each person employed has 3 dependents). It also assumes that the number of primary jobs in marine (animal) aquaculture is directly proportional to the fraction of total production undertaken in marine and brackish waters in 2010 (i.e. ~40% (FAO 2012)). Using the Teh and Sumaila (2011) figures for primary and secondary employment in marine capture fisheries, and the FAO (2012) estimate for marine (animal) aquaculture production in 2010, assuming no difference in the supply chain or supported dependent numbers based on whether the primary sector job is full time or part time, and employing the other assumptions described here as needed, it is estimated (very approximately) that 1.1 billion people are supported by marine fisheries and brackish/marine aquaculture (animal) production. This is roughly 16% of the 2010 world population of 6.9 billion people (PRB 2010). This is considerably higher than the FAO (2012) estimate for total fishery and aquaculture production. It is also higher than the FAO (2009) estimate for the total number of people dependent on just marine fisheries (i.e. 520 million people). This is because the Teh and Sumaila (2011) employment estimates are significantly larger than the FAO estimates, and because of the assumption needed to isolate marine aquaculture employment from total aquaculture employment.

Garth Cripps, Blue Ventures, 2015



Fish also contributes to a diversified and nutritious diet. It provides high-value protein and also represents an important source of essential micronutrients, minerals and fatty acids. While average per capita fish consumption may be low, even in small quantities fish can have a significant positive nutritional impact by providing essential amino acids (FAO, 2014).

Plants

In addition to fish, marine ecosystems provide harvestable plants (SDG2 'promote sustainable agriculture'). The production of seaweed (both for human consumption and as input to other sectors, e.g. as fertilizer for agriculture) has increased rapidly between 2002 and 2012, totalling more than 23 million tonnes of cultured seaweed (FAO, 2014). Approximately 9 million tonnes of this production was for human consumption and 14 million tonnes for industrial

purposes. Additionally, as of 2011 nearly 800,000 tonnes of wild seaweed was harvested annually in 28 countries around the world (Rebours et al, 2014).

Tourism

A wide range of economic sectors utilise marine ecosystem services, and some sectors, such as tourism, depend partly on marine environments and their services such as water purification, and partly on other infrastructure (SDG8 *promote full and productive employment and decent work for all*) ; (SDG10 *reduce inequality within and among countries*). Tourism, a growing sector in many economies, that is often concentrated in coastal environments. More than 100 countries and territories benefit from tourism specifically associated with coral reefs. In 23 of these, reef related tourism accounts for more than 15 per cent of gross domestic product (GDP) (Burke et al., 2011). Annually, more than 120 million people pursue recreational marine fishing, whale watching and/or diving. Pursuit of just these three activities in 2003 was estimated to support nearly 1 million jobs and resulted in nearly USD 50 billion (2003 USD) in spending (Cisneros-Montemayor and Sumaila, 2010).

Waste

Some economic sectors, such as mining and sanitation, utilise marine ecosystem services indirectly (e.g. waste treatment) in order to reduce their operational costs (SDG8, SDG10). The ocean absorbs a significant amount of anthropogenic waste. In a year, it absorbs as much as 400 million tonnes of dredge waste, 7 million tonnes of mine tailings, and 100,000 tonnes of fish waste (MKC, 2012). A proportion of these wastes is bio-remediated (broken down into less hazardous substances) by the oceans.

Garth Cripps, Blue Ventures, 2015

Healthy Lives, Human Well-being and Sustainable Industrialization

SDG3: Ensure healthy lives and promote well-being for all at all ages

SDG9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

As discussed above, marine and coastal ecosystems help ensuring healthy lives by providing high-value protein and essential micronutrients, minerals and fatty acids to people's diets, often at very significant levels.

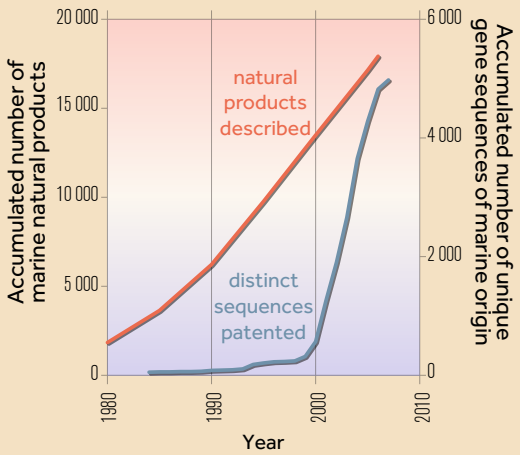
Recreation and Relaxation

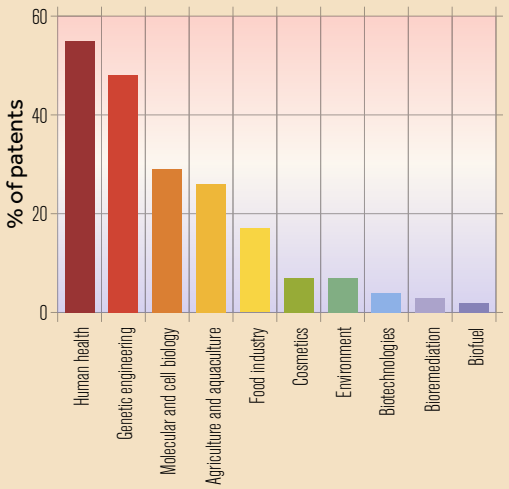
Marine and coastal habitats also promote well-being (SDG3 *Ensure healthy lives and promote well-being for all at all ages)* through opportunities for recreation and relaxation distinct to coastal and marine ecosystems. Recreation improves physical and mental health, and there is evidence that people who immerse themselves in natural areas enjoy a variety of psychological, emotional and mental health benefits, reduced stress and increased quality of life (UKNEA, 2011).

Raw Materials and Future Innovation

A range of natural marine compounds have been found to have important properties (e.g. anti-oxidant, anti-fungal, anti-viral, anti-biotic, anti-cancer, anti-degenerative) that may be useful in a wide number of medical and cosmetic applications (SDG9 *promote inclusive and sustainable industrialization and foster innovation*). Marine compounds are already used in the treatment of HIV, herpes, and cancer (Arico and Salpin 2005; Leary 2008; Lloyd-Evans 2005 a,b). Marine genes are used, among other applications, in the production of ethanol from corn (Vierros and Arico, 2011), in detergent, and in the tenderisation of meat (Arrieta et al 2010). The number of marine compounds and genes discovered is increasing extremely rapidly, as are their associated industries.

Marine genetic diversity and human health





Source: Arrieta, Arnaud-Haond & Duarte, *What lies underneath: Conserving the oceans' genetic resources*, 2010

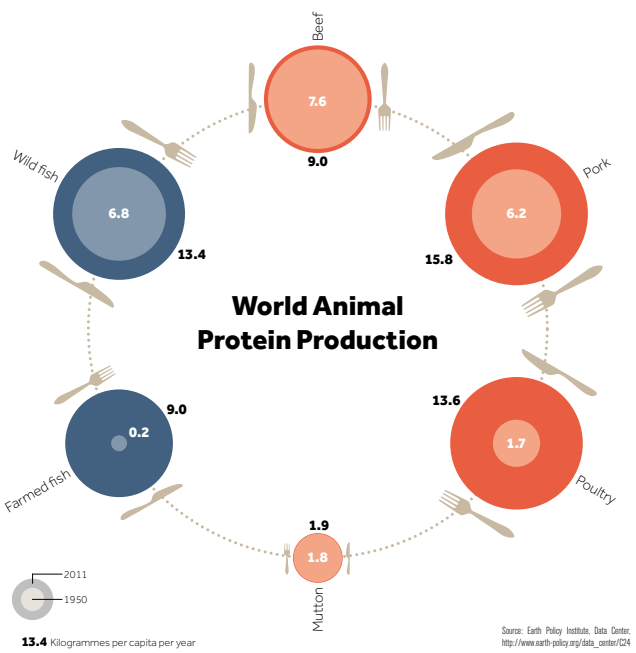
Gender Equality & Peaceful and Inclusive Societies

SDG5: Achieve gender equality and empower all women and girls

SDG16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Women and Girls

Around the world, the role of women and men differ with respect to the marine environment, especially in lower income countries. And yet, there are many places worldwide where a healthy marine ecosystem can provide opportunities for women and girls (SDG5 *achieve gender equality and empower all women and girls*).



About half of all those employed in fisheries are women. They work primarily in post-harvest activities such as fish marketing and processing and a range of auxiliary activities but can also have a critical role as financiers and providers of working capital for the fishing trips. Poor families can benefit substantially as women's engagement in subsistence fishing can bring vital protein and other nutrients. Small-scale aquaculture can also be an important activity for rural women in developing countries as it often takes place close to the home and can be integrated with other food production and household activities (UNEP et al., 2012).

Social Cohesion

Marine ecosystem services of all types can also contribute to the development of peaceful and inclusive societies by fostering the creation of social institutions, trust and reciprocity between beneficiaries (SDG16 *promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels*). Coastal communities that jointly manage their marine resources tend to benefit further from these social relationships. This is a two-way relationship, in which the availability of marine ecosystem services helps to develop social cohesion and the strength of social cohesion ensures the conservation and management of marine ecosystems. A recent study in Madagascar shows that traditional communities place a high value on the social institutions used for managing marine resources (Barnes-Mauthe et al., 2014).

Safe Human Settlements, Coastal Protection and Combating Climate Change

SDG9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

SDG11: Make cities and human settlements inclusive, safe, resilient and sustainable

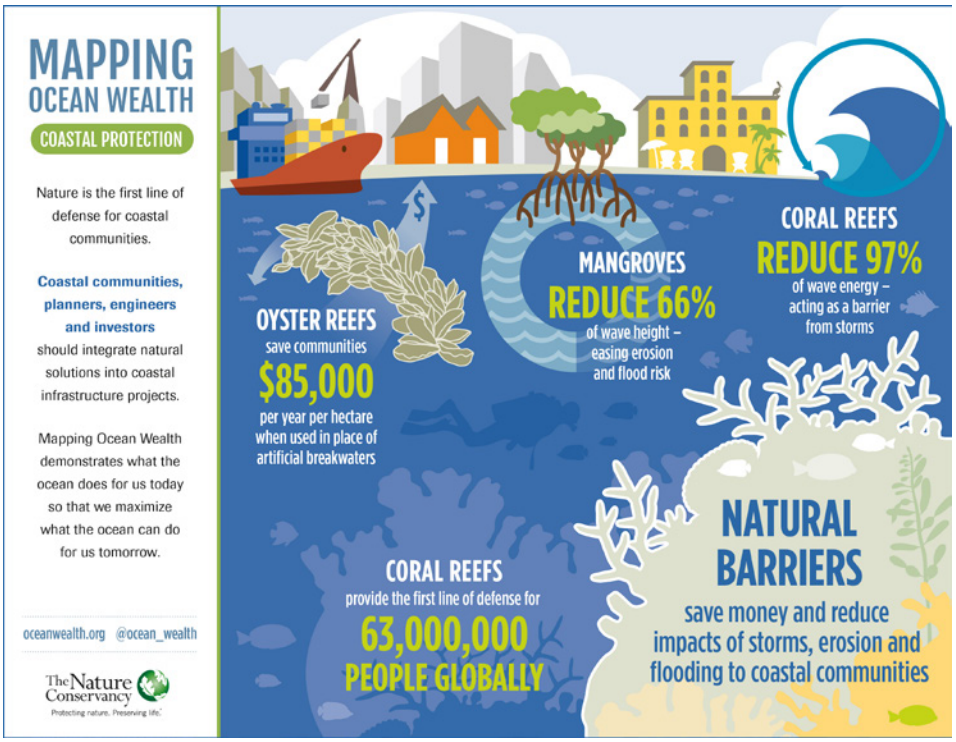
SDG13: Take urgent action to combat climate change and its impacts

Coastal Protection

Coastal ecosystems can provide protection against storm surges that threaten many low lying coastal cities (SDG9 *build resilient infrastructure*); (SDG11 *make cities and human settlements inclusive, safe, resilient and sustainable*) . Currently around 1 billion people live within 20 metres of mean sea level (WOR, 2010) and the populations of coastal megacities are projected to continue to grow, particularly in Asia.

Globally, population density in flood-prone coastal zones and megacities is expected to grow by 25 per cent by 2050 (Aerts et al., 2014). Combined with projected sea level rise and increasing frequency and severity of large-scale floods, this means that a growing proportion of the world's population will be exposed to the impacts of flooding.

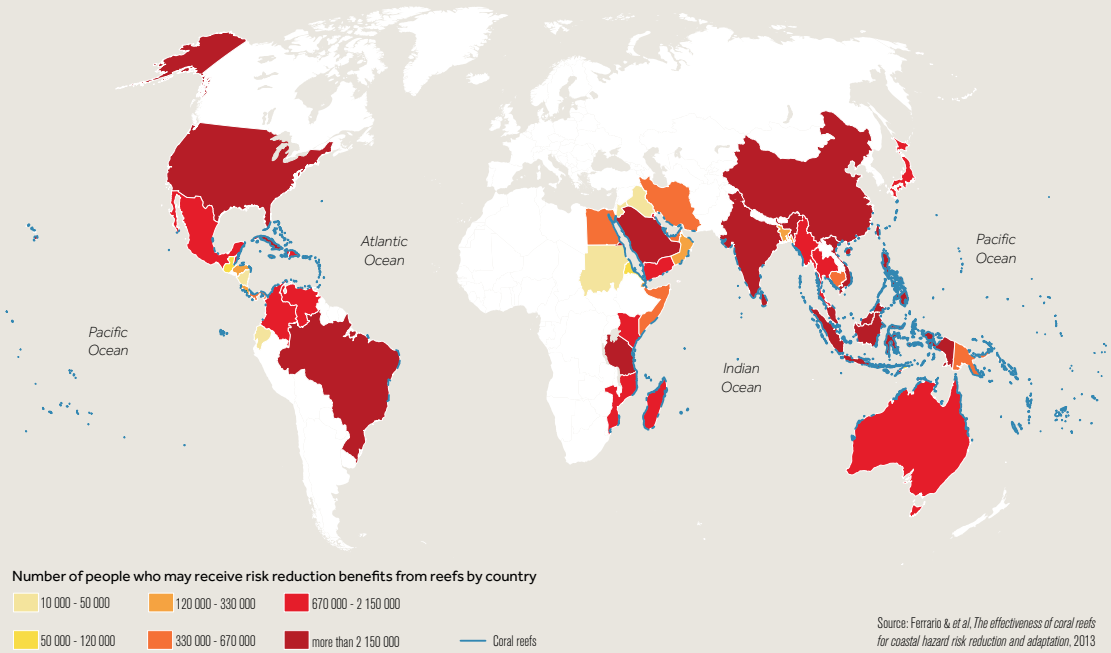
Coastal ecosystems protect shorelines from erosion (Gedan et al., 2010), and can play an important and cost-effective role in



reducing vulnerability, possibly in hybrid solutions combining 'grey', engineered infrastructure with 'green' natural coastal protection (Spalding et al. 2013), and including key local stakeholders (Barbier, 2015). Coastal ecosystems can play a role in making cities and human settlements safe even in the case of coastal megacities. A recent study for New York City (Aerts et al., 2014) shows that wetland restoration and beach nourishment can be used in a hybrid approach to reducing vulnerability to flooding.

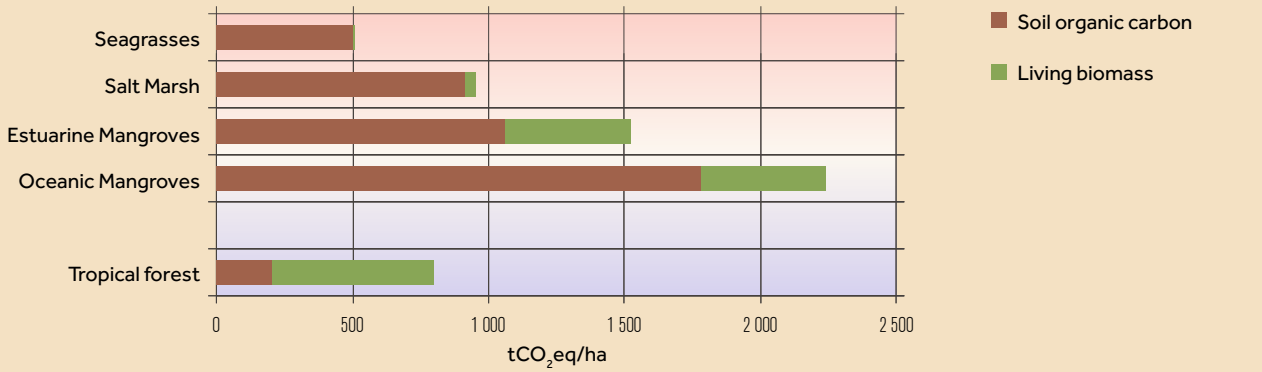
In terms of providing protection from extreme events, coral reefs, seagrasses, mangroves and dunes, can also, in certain circumstances, provide protection against storm surges by forming barriers along coastlines.

Such ecosystems can act in a similar manner to breakwaters or shallow coasts. In this way, coastal ecosystems play a role in reducing the impacts of climate change (SDG13 *take urgent action to combat climate change and its impacts*), particularly the increased frequency of storms and sea level rise. Importantly, recent studies have also found that salt marshes can adjust to sea-level rise and can reduce coastal erosion and increase accretion, depending on a range of site-specific variables, as a part of adaptation to climate change (Fagherazzi et al., 2013; Shepard et al., 2011).



Coastal communities across the globe are increasingly at risk from storms and flooding as a side effect of climate change paired with rapid human-led coastal development. Nature- based solutions like coral reefs offer a low-cost opportunity to reduce risk and also can be paired with other ecosystems services such as tourism and fish production. The map above shows the number of people by country that may derive a risk reduction benefit from reefs. The countries are grouped by the number of people living below 10m elevation and within 50 km of a coral reef to demonstrate the capacity for coral reefs to protect coastal communities.

Blue Carbon



Source: Murray and *et al, Green Payments for Blue Carbon Economic Incentives for Protecting Threatened Coastal Habitats*, 2011

Climate Change

The oceans play a pivotal role in the regulation of climate change through the absorption and storage of heat, the uptake and sequestration of carbon dioxide from the atmosphere, the attenuation of storm surges, and the prevention of coastal erosion. Thus the oceans mitigate both the drivers and effects of climate change (SDG13 *Take urgent action to combat climate change and its impacts*).

The oceans absorb the vast majority of the heat trapped by atmospheric greenhouse gases (GHGs), that otherwise would have already warmed the atmosphere and fuelled the progression of climate change (GOC, 2014).

Coastal ecosystems such as salt marshes, seagrass beds, and mangrove forests all contribute to the sequestration of carbon in marine sediments (i.e. 'blue carbon'). Not only do these systems draw CO_2 out of the atmosphere, but they also trap carbon in detritus and sediment. Annual average carbon sequestration rates range from 4.4 ± 0.95 tonnes CO_2-eq per hectare per year (for seagrass beds) to 8.0 ± 8.5 tonnes CO_2-eq per hectare per year (for salt marshes) (Murray et al 2011).[22]


EUO © OCEANA Juan Cuetos

22 Estimated by converting grams of carbon sequestered to tonnes of CO_2-equivalent and using the social cost of carbon (SCC) for the year 2015 as shown in table A1 from IAWG (2013).

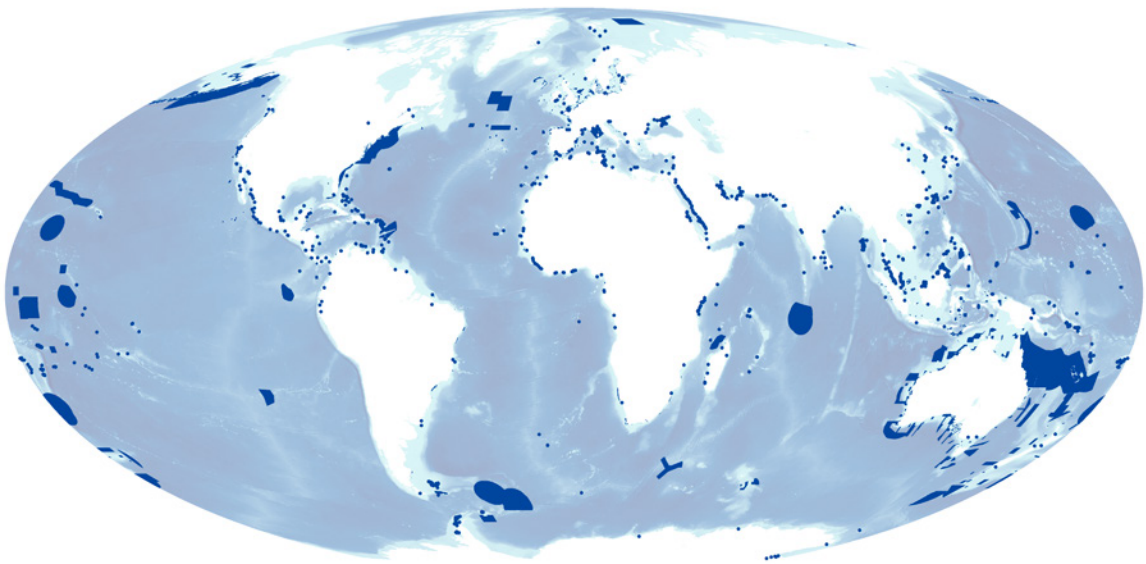
Sustainable Use of the Oceans

SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Marine and coastal ecosystem services provide a bounty of provisions for achieving SDGs, but there are sustainable limits. We must conserve and sustainably use our oceans (SDG14 *conserve and sustainably use the oceans, seas and marine resources for sustainable development*). Marine ecosystems face a wide range of threats including land and marine based pollution, eutrophication, infrastructure development (leading to habitat loss and degradation), sedimentation, overfishing, hypoxia (de-oxygenation), invasive species, acidification and changes in temperature, currents and sea level (Brander, 2007; Turley et al., 2013; Noone et al. 2014). The population of phytoplankton has varied through time and space, and may now be declining noticeably in parts of the ocean (Boyce, 2010). Marine pollutants include agricultural fertilizers, untreated wastewater, toxins, litter and oil. These threats have a variety of negative impacts on marine ecosystems and their services.

Marine Protected Areas

Marine protected areas (MPAs) have been advanced as potential means of conserving coastal and marine areas. An MPA is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature and the associated ecosystem services and cultural values (IUCN-WCPA, 2008). When well designed and managed, MPAs allow for the protection and restoration of key habitats, the replenishment of fish stocks and an enhancement of the resilience of marine ecosystems. The expansion of MPA coverage is expected to enhance the provision of marine ecosystem services. A recent study estimates that the economic benefits of reaching 10 per cent coverage globally by 2020 are in the range of USD 622–923 billion for the period 2020–2050 (Brander et al., 2015). Currently, only 3.4 per cent of the global marine area is designated as an MPA, with 0.59 per cent established as no-take MPAs.



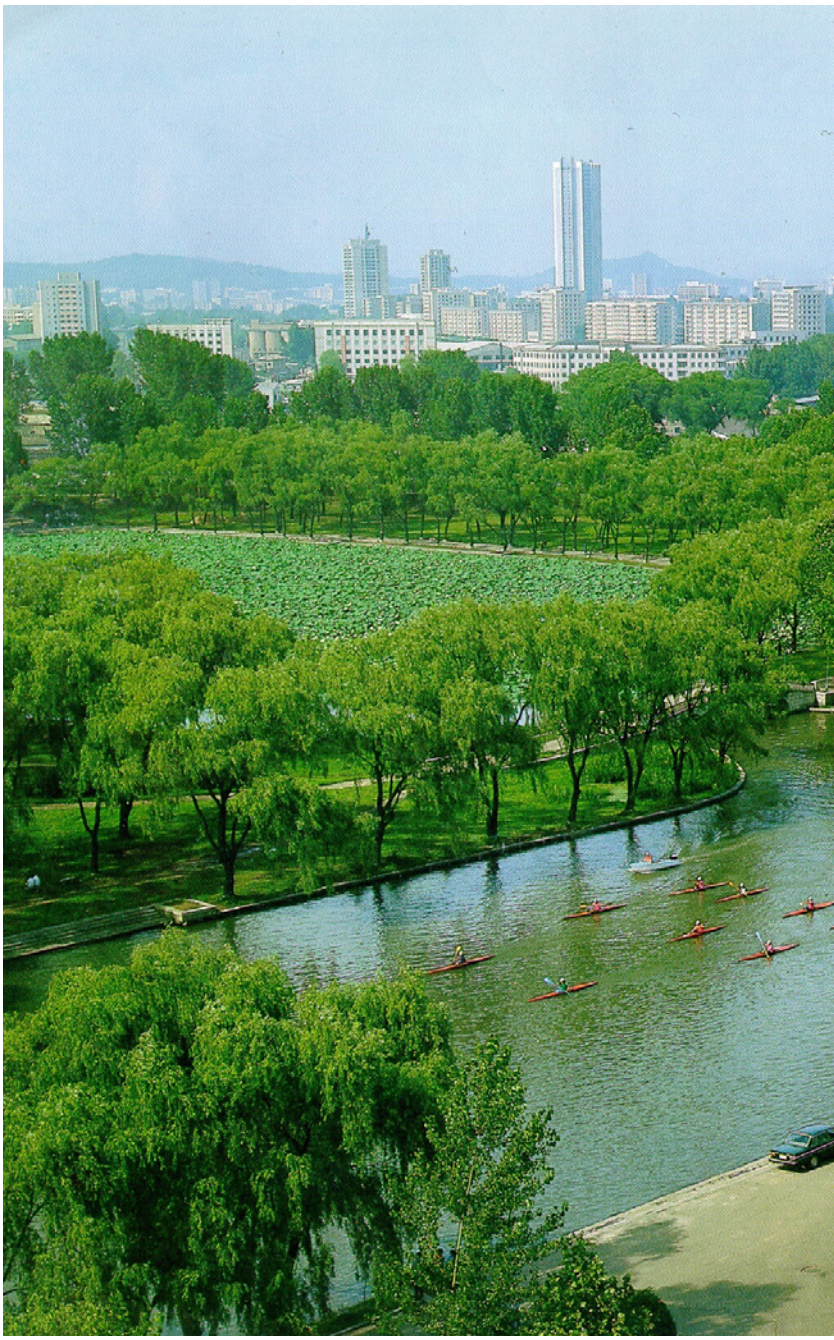
IUCN and UNEP-WCMC (2015). The World Database on Protected Areas (WDPA)[On-line], September 2015, Cambridge, UK: UNEP-WCMC. Available at: www.protectedplanet.net

Sustainability

The sustainability of economic activities that use marine ecosystems services is in question. For some uses, sustainability thresholds may have been reached or exceeded already. The Ocean Health Index (OHI) score for sustainable seafood production is 51/100 and the score for sustainable tourism and recreation is 44/100 (OHI 2014). The United Nations Environment Programme estimates that the number of individuals fishing may need to be reduced by up to 22 million people in order to achieve a transition to globally sustainable fishing (UNEP, 2011). There is a need to both invest in the natural capital that underpins these sector points and to identify the particular thresholds of sustainability with respect to human use. Economic exploitation of marine ecosystems without reference to natural capital sustainability will undermine the achievement of (SDG 8 *promote [...] economic growth, full and productive employment and decent work for all*)by running down the resources that would otherwise support its achievement.

It is important to recognise that the pursuit of some SDGs could potentially jeopardise the continued provision of marine ecosystem services, and, as a result, also reduce progress towards achieving other SDGs. Unsustainable uses of marine and coastal ecosystem services, such as overfishing or high-impact tourism, will undermine the delivery of the ecosystem services that otherwise would contribute to the achievement of the SDGs. While harvesting seaweed, for example, may support sustainable agriculture (SDG2 *End hunger, achieve food security and improved nutrition and promote sustainable agriculture*), if harvested unsustainably, it can undermine the role of these plants in supporting fish stocks and thus diminish the social benefits associated with those stocks fish and also undermine the ecological resilience of affected coastal ecosystems (Rebours et al., 2014).

There are additional, non-marine factors such as agricultural runoff, pollution and waste (especially plastic), continued emissions of GHGs, and the development of

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energy sources, that are related by-products in pursuing the achievement of SDGs but may impede on the health and sustainability of marine ecosystems, and therefore might in fact counteract those efforts.

In addition to oil and natural gas exploration, oceanic waves, currents and off-shore wind are potentially a huge source of energy containing 300 times more energy than humans currently consume (SDG7 *ensure access to affordable, reliable sustainable and modern energy for all*) (World Ocean Review, 2010). While these energy sources do not rely on the ecological health of the oceans, the development of these energy sources in pursuit of SDG7 may, however, put the ecological health of the ocean in jeopardy and thus could threaten the achievement of other SDGs if such impacts are not carefully addressed.

Healthy marine and coastal ecosystems significantly support the achievement of a range of SDGs, in many different ways and often at a very fundamental level. However, the role they play is both insufficiently understood as well as under-recognized in the current policies and efforts we make towards sustainable development. Informed and effective decision making requires the right data to be generated, communicated, and linked to policy needs and applications. Without significant advancements of the science of the nexus of marine and coastal ecosystem services and sustainable development, and an increased uptake and application of the science, we will not be able to capture the full support we're receiving from the ocean.

Paul van Gardingen, Director, Ecosystem Services for Poverty Alleviation

Services from Marine and Coastal Ecosystems are Essential in Transforming our World by 2030.

Since 2010, when the United Kingdom's Ecosystem Services for Poverty Alleviation programme, ESPA, (www.espa.ac.uk), was launched, its research generated evidence of how ecosystems contribute to human well-being and the reduction of poverty around the world. Ten of ESPA's projects have documented the importance of coastal and marine ecosystems in some of the world's poorest countries.

ESPA was designed to link the Millennium Development Goals and the Millennium Ecosystem Assessment to demonstrate how ecosystem services can provide a sustainable pathway out of poverty for the world's poor. The results of research are now highly relevant as plans are developed to implement the UN's SDGS.

What does ESPA's research on coastal and marine ecosystems mean for the SDGs?

The benefits that people derive from coastal and marine ecosystems are linked to virtually all of the 17 proposed SDGs. Efforts to 'conserve and sustainable use the oceans, seas and marine resources' (Goal 14), will help to end poverty, end hunger, promote health, provide clean drinking water, promote jobs and economic growth, provide resilient infrastructure and combat climate change and its impacts (Goals 1, 2, 3, 6, 8, 9, 13).

In many locations, human consumption of services from marine and coastal ecosystems is no longer sustainable (Goal 12), leading to resource degradation and in some cases conflict.

Climate change including sea-level rise and extreme events, is also reducing the resilience and productivity of ecosystems, but so are other social and environmental changes.

In some regions the combined impact of environmental change and loss of ecosystem productivity means people's livelihoods are being affected leading people to migrate to other locations, often cities.

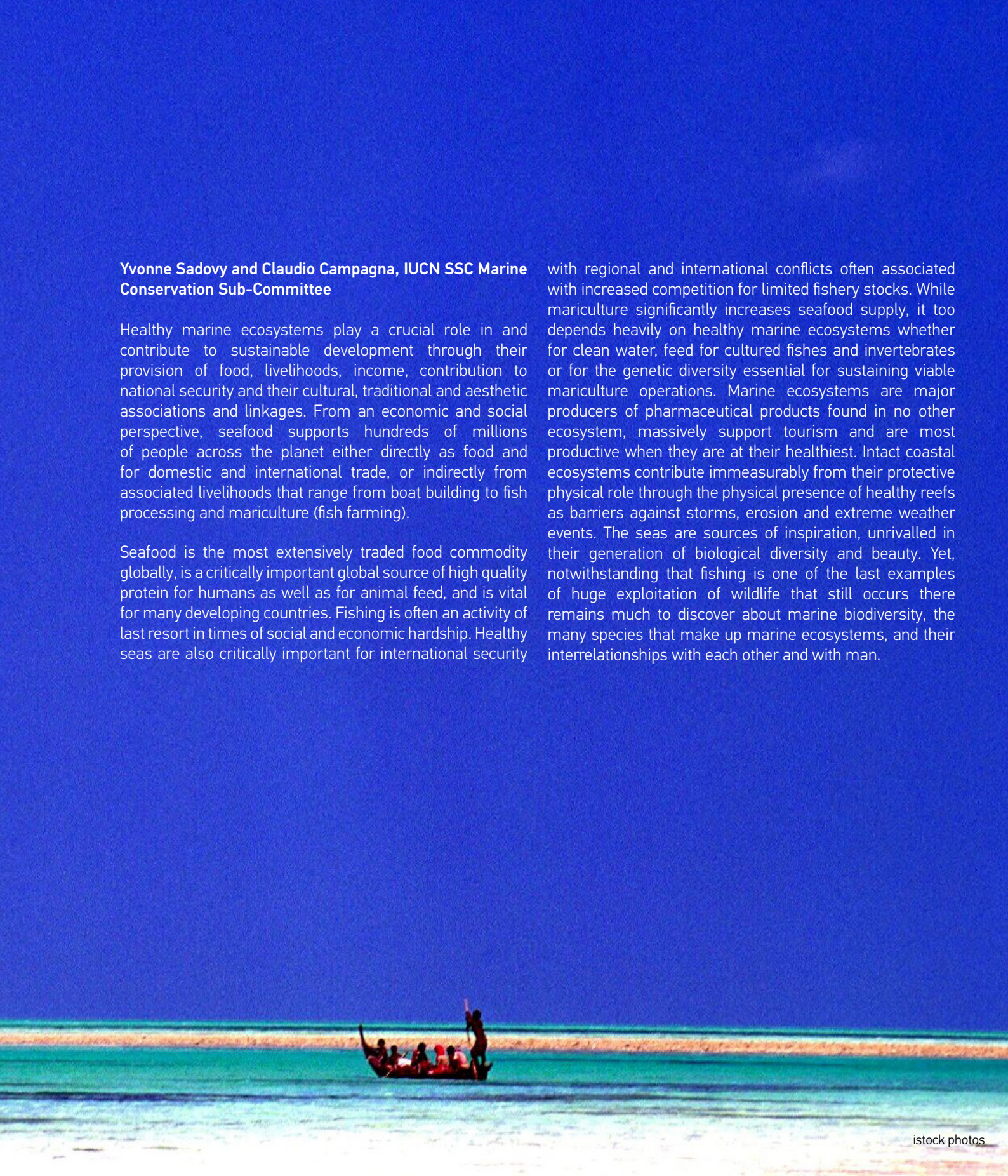
ESPA's research is however also showing that it is possible to reverse the trends of over-exploitation, degradation and conflict over resources. There are examples of how communities are being empowered to make better decisions leading to more sustainable and resilient outcomes.

As we look forward to implementing the SDGs, evidence from research programmes including ESPA shows that coastal and marine ecosystems must been seen as a crucial component of how the world builds a sustainable future. The challenge will be how to learn from this research evidence to build a future where the links between ecosystems and people become more productive, resilient and sustainable in a rapidly changing world.

Yvonne Sadovy and Claudio Campagna, IUCN SSC Marine Conservation Sub-Committee

Healthy marine ecosystems play a crucial role in and contribute to sustainable development through their provision of food, livelihoods, income, contribution to national security and their cultural, traditional and aesthetic associations and linkages. From an economic and social perspective, seafood supports hundreds of millions of people across the planet either directly as food and for domestic and international trade, or indirectly from associated livelihoods that range from boat building to fish processing and mariculture (fish farming).

Seafood is the most extensively traded food commodity globally, is a critically important global source of high quality protein for humans as well as for animal feed, and is vital for many developing countries. Fishing is often an activity of last resort in times of social and economic hardship. Healthy seas are also critically important for international security with regional and international conflicts often associated with increased competition for limited fishery stocks. While mariculture significantly increases seafood supply, it too depends heavily on healthy marine ecosystems whether for clean water, feed for cultured fishes and invertebrates or for the genetic diversity essential for sustaining viable mariculture operations. Marine ecosystems are major producers of pharmaceutical products found in no other ecosystem, massively support tourism and are most productive when they are at their healthiest. Intact coastal ecosystems contribute immeasurably from their protective physical role through the physical presence of healthy reefs as barriers against storms, erosion and extreme weather events. The seas are sources of inspiration, unrivalled in their generation of biological diversity and beauty. Yet, notwithstanding that fishing is one of the last examples of huge exploitation of wildlife that still occurs there remains much to discover about marine biodiversity, the many species that make up marine ecosystems, and their interrelationships with each other and with man.



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The Ocean's Ecosystem Services: A New

We have always been completely dependent for our well-being on the ecosystems we inhabit. The new language of 'ecosystem services' recognises our modern, scientific understanding that the entire biosphere is an interconnected and interdependent system, which interacts with the geophysical forces of the planet to create a dynamic functional unit: a whole greater than the sum of its parts. This understanding acknowledges the emergent, self-regulating influence life has on the composition of the atmosphere, climatic stability and global nutrient cycles, including the carbon cycle.

The ocean is by far the largest part of this living system. Not only does it cover more than 70 per cent of the planet's surface but it also accounts for somewhere between 97 to 99 per cent of the liveable biosphere (Mark, 1995). So it is not surprising that virtually all of the self-regulating mechanisms that keep the planet liveable involve the ocean in some way (Earle, 2010). We now therefore understand that our well-being, indeed our very survival, depends on the continued healthy functioning of the ocean.

However, the complexity of the many and varied geo-physiological processes, intertwining on a global scale, renders predictive modelling of the whole ocean system particularly challenging. Embracing this inherent 'unpredictability' forces us to widen our view and acknowledge that our management decisions, even at a local scale, may have unforeseen ramifications for the whole system, which in turn, may feedback to threaten the very ecosystems that sustain us.

Couched as it is in modern rhetoric and scientific terminology, we may be forgiven for thinking that this is a new understanding. But in fact, our ancestors understood this very well and their sense of 'embeddedness' within their immediate surroundings, as well as knowledge of the interconnected nature of life, was reflected in their worldviews and expressed through mythology, religion and cultural tradition. While the growing list of anthropogenic threats to the healthy functioning of the ocean, and the ecosystem services provided, is lending a sense of urgency in addressing our current exploitation of the ocean, we may find it beneficial to take time to reflect upon some of this traditional wisdom.

The importance of a worldview

Our worldviews provide the framework by which we engage with the world. They represent our conception of 'how the world is' and lay the foundation for the development of our cultural values, which in turn inform our cultural practices. They also incorporate our cosmologies: 'how the world came to be'. Traditionally our worldview was represented through myth and legend, which were told and re-told as a way of maintaining culturally important belief/practice complexes. When our ancestors first encountered the ocean some 70,000 years ago they were faced with the challenge of expanding their worldview to encompass the distant blue horizons and the unknown that lay beyond. They needed to evolve their existing mythologies and beliefs to accommodate this vast new realm.

The details of that cosmological evolution are now lost in time, but virtually all indigenous and pre-monotheistic creation myths include the ocean as a foundational element. In early Greek mythology for example the Earth Goddess, Gaia, mother

"To stand at the edge of the sea, to sense the ebb and flow of the tides, to feel the breath of a mist moving over a great salt marsh, to watch the flight of shore birds that have swept up and down the surf lines of the continents for untold thousands of years, to see the running of the old eels and the young shad to the sea, is to have knowledge of things that are as nearly eternal as any earthly life can be."

Rachel Carson, The Edge of the Sea

Language for an Ancient Wisdom

of all, brought forth Pontos, the great sea from her own body. From her union with Ouranos (the sky), she gave birth to the twelve Titans, including Tethys (a sea Goddess), and Okeanos (the ocean) (Maguire, 2015). In many Polynesian cultures Tangaroa – God of the sea – was born out of the union of Rangi – Sky father – and Papa – Earth Mother (Knappert, 1992). In the traditional Yoruba religion of west African cultures Yemoja is the Goddess of the living ocean, considered the mother of all. Her name is a contraction of Yey Omo Eja, which means, 'Mother Whose Children are the Fish'. As all life is thought to have begun in the sea, all life is held to have begun with Yemoja (Wikipedia, 2015). Yemoja is also associated with Mami Wata (Mother water), the sacred female water deity that spread across the Atlantic with the west African Diaspora during the Atlantic slave trade (Wicker, 2005) .

Traditional Ecological Knowledge

It is in the 'living' cosmologies, myths and legends of indigenous cultures that we find the strongest links to an ecological understanding of the interconnectedness of life. A common thread in the worldviews of many indigenous peoples is that of a 'community of beings', in which humans are not separate from the other animals and plants nor indeed from any of the physical characteristics of their surroundings (Berry, 1999).

For many indigenous peoples this understanding of being in the world underpins their traditional ecological knowledge. Traditional ecological knowledge is defined as a '...cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment' (Berkes, 1999).

There are different levels to this knowledge-practice-belief complex, beginning with practical, empirical knowledge gained through long-term observation. This represents the in-depth knowledge of local animals, plants and environment. The next level represents the application of this knowledge through resource management practices that require an understanding of the ecological processes at work, including inter and intraspecies relationships. These practices need to be framed within social structures that encompass rules of use, codes of conduct and social mechanisms for cooperation and the coordination of ongoing monitoring and reviewing of the rules. This enables adaptive modifications to resource use and management practices. Finally, there is the overarching worldview, which gives shape and context to the development of environmental perceptions and provides a framework for meaning in relation to environmental observations (Berkes, 2012).

An example of how this knowledge-practice-belief complex is applied in an ocean context can be seen in the Maori concept of kaitiakitanga or guardianship. Embedded within kaitiakitanga is the geneology, or whakapapa, which links all life back to Papatuanuku, the Earth Mother (Barlow, 1994). Papatuanuku is experienced as a living being, nourishing all her children through her network of support systems, and in turn being nourished by their biological functions. The different species and genera contribute to the welfare of other species and also help to sustain the biological functions of the whole. Humans are a part of this network and all other forms of life are our siblings.

The spiritual sons and daughters of Paptuanuku are the guardians (kaitiaki) of her various realms. Tangaroa is the kaitiaki of the ocean and as such, all life in the ocean is under his care. And whilst humans are free to harvest those resources they are duty bound to honour and give thanks for his generosity. They also have a responsibility to manage their behaviour, through kaitiakitanga, so that resources are not depleted and the natural cycles of regeneration are protected.

The responsibility of monitoring the health of tribal marine areas lies with the Tohunga, who holds the accumulated ecological knowledge of their marine environment. If any resource depletion is identified, various guardianship customs (Titanga tiaki) can be employed to redress the imbalance. This is often in the form of Rahui or tapu, which can include a range of restorative measures, from total bans to restricted access or limitations on fishing or harvesting shellfish. Rahui can also be instigated to protect ecosystems from pollution.10 Similar systems of close, participatory guardianship customs are widely used throughout Oceania as the primary marine resource management tool (Marsden, 1992).

Towards an Ecological World View of the Ocean

A key understanding of kaitiakitanga is that guardianship does not confer ownership of natural resources. Rather, it reinforces the knowledge that the resources of the earth do not belong to humans but instead, humans belong to the earth. We have the same privileges of use as all other beings but also carry the responsibility to manage our usage so that ecological balance is maintained (Marsden, 1992).

This concept of guardianship and respect for the balance of nature is also a common theme in most major religions including Islam, Christianity, Hinduism, Judaism, Jainism Buddhism, Baha´i, and Taoism (Palmer, 2003). The following are selected quotes from the 'Faith Statements on Ecology', first articulated as the 'Assisi Declarations' on Religion and the Environment in 1986, but since refined and added to by each faith.

Baha´i: 'Nature reflects the qualities and attributes of God and should, therefore, be greatly respected and cherished. All things are interconnected and flourish according to the law of reciprocity.'

Buddhism: 'The health of the whole is inseparably linked with the health of the parts, and the health of the parts is inseparably linked with the whole.'

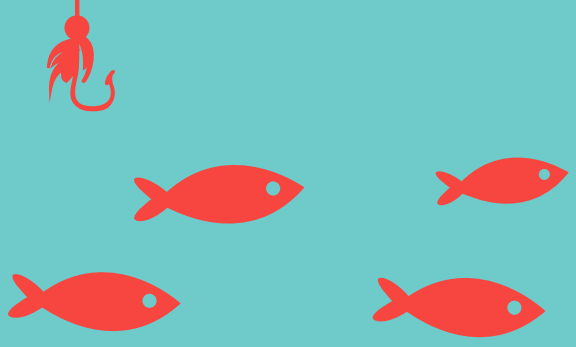
Christianity: 'The integrity of creation has a social aspect which we recognize as peace with justice, and an ecological aspect which we recognize in the self-renewing, sustainable character of natural ecosystems.'

Daoism: 'People should take into full consideration the limits of nature›s sustaining power, so that when they pursue their own development, they have a correct standard of success. If anything runs counter to the harmony and balance of nature, even if it is of great immediate interest and profit, people should restrain themselves from doing it, so as to prevent nature›s punishment.'

Hinduism: 'There is no life that is inferior. All lives enjoy the same importance in the Universe and all play their fixed roles. They are to function together and no link in the chain is to be lost. If some link is lost, the whole ecological balance would be disturbed.'

Islam: 'Allah has invited us to partake of the fruits of the earth for our rightful nourishment and enjoyment, He has also directed us not to waste that which Allah has provided for us – for He loveth not wasters. Furthermore, Allah has also ordered us to administer his responsibilities with justice. Above all, humanity should conserve the balance of Allah›s creation on Earth.' (UNEP, 1999)

The current state of resource depletion and ecosystem degradation evident in the ocean today suggests that we have lost this sense of guardianship. Recognising our dependence on the healthy functioning of the ocean is the necessary first step in redressing this loss. Developing an ecological world-view that acknowledges that dependence seems to be the critical next step in providing a framework for sustainable development in our relationship with the ocean. The UN Sustainable Development Goals are a way to guide our efforts towards global human well-being in harmony with nature, both on land and in the oceans. In this regard there is much we can learn from the wisdom of our ancestors preserved in our traditions, cultures, myths, and ready for us to rediscover.



Marine and Coastal Data Requirements to Achieve

Progress towards achieving Sustainable Development Goals (SDGs) is underpinned by an understanding of the current state of marine and coastal ecosystems and the corresponding relationships with those who depend on these environments for their livelihoods and well-being.

This knowledge requires data on the current state of and pressures on biodiversity, as well as the benefits derived from biodiversity and relevant policy frameworks in each region. Once these baselines have been established, quantitative and scientifically-informed targets and indicators[18] are necessary for each SDG, ensuring that these targets and SDGs are closely aligned (Lu, 2015). Baseline data collection and monitoring of change are therefore necessary to track progress towards SDGs, functioning as an 'early warning system' and ensuring that policies can be adapted, if necessary.

Data challenges in the marine environment

Although methods often exist, obtaining the data required to develop suitable indicators from the marine environment is challenging. Ocean-based research is expensive and logistically difficult due to the size and remoteness of the ecosystems and the need for advanced technologies and equipment (e.g., oceanographic research vessels, submersibles, remotely-operated vehicles, satellite telemetry, aerial photography). These requirements mean that the cost of marine data gathering projects typically exceed those experienced by terrestrial scientists (Martin et al., 2014).

Our knowledge of the marine environment is therefore subject to temporal, seasonal, spatial, and species-specific biases in data availability with most data obtained from areas with better access (e.g. shallow inshore waters) and higher productivity, or for commercially-important or charismatic species (Geijzendorffer et al., 2015). For data that do exist, data formats or collection methodologies are often unsuitable for alternative uses or incompatible with one another, varying in scale, quality, and units (Martin et al. 2014). Standardising such incongruous data for use in developing indicators and in decision-making is a real challenge.

Quantifying the services derived from marine and coastal ecosystems is also challenging, particularly due to the limited availability of data and understanding of the relationships between ecosystem components, processes and services. Thus, indicator development has often focused on ecosystem structure and composition (i.e., biotic and abiotic components) rather than flows of services (de Groot, Alkemade, Braat, Hein, & Willemen, 2010). Moreover, existing examples of ecosystem service flows more frequently cover the terrestrial environment due to the spatial complexity and relative absence of data in the marine environment (Serna-Chavez et al., 2014). The following examples, however offer useful resources for indicators of changes in the availability of marine ecosystem services.

Current progress towards addressing these challenges

Increasing equitable and open access to policy-relevant marine and coastal data

Initiatives such as the Group on Earth Observations Biodiversity Observation Network (GEO BON; www.geobon.org) and the regional European Biodiversity Observation Network (EU BON; www.eubon.eu) aim to address these challenges by producing robust, extensive and interoperable biodiversity observation networks to support the acquisition and integration of policy-relevant ecological, socioeconomic and climatic datasets. To assist this endeavour, a framework of Essential Biodiversity Variables (EBVs)[19] has been proposed to provide priority measurements for monitoring the state of biodiversity and our trajectories towards national and global targets.

18 An indicator is "a measure or metric based on verifiable data that conveys information about more than itself". In some cases, information from several different measures or datasets can be combined to form an index (e.g., Consumer Price Index) (2010 Biodiversity Indicators Partnership, 2011).

19 Essential Biodiversity Variables are measurements required for studying, reporting, and managing biodiversity change. For more information, please visit https://www.earthobservations.org/geobon_ebv.shtml.

An Example

SDG 14.5: Conserve at least 10% of marine and coastal areas by 2020

Targets: Sustainable Development Goal 14.5 requires that 10% of marine and coastal environment is protected by 2020, with areas selected based on the 'best available scientific information'. This selection process should consider both the ecological and socioeconomic outcomes associated with proposed management approaches within the area chosen, as well as their effectiveness.

Examples of indicators

Examples of indicators include: the extent and proportion (%) of marine and coastal protected areas (Thomas et al., 2014); the proportion (%) of overlap with areas of particular importance to marine biodiversity and habitats; and management effectiveness scores for assessed protected areas (2010 Biodiversity Indicators Partnership, 2010b, 2010c, 2010d, 2010e). Likewise, the distribution and relative importance of ecosystem services derived from designated or proposed protected areas could be used as indicators of the importance of these regions to different aspects of human well-being.

Examples of available data

From an ecological perspective, a broad selection of data are available from different sources, including: the World Database on Protected Areas (WDPA; www.protectedplanet.net); modelled and empirical data outlining the global distributions of marine and coastal habitats, including mangroves, warm- and cold-water corals, seamounts, and seagrasses (available from the Ocean Data Viewer; http://data.unep-wcmc.org); Key Biodiversity Areas (KBAs), Important Bird Areas (IBAs), Ecologically or Biologically Significant Areas (EBSAs), Alliance for Zero Extinction sites (AZEs); and the IUCN Red List of Threatened Species.

Examples of areas for data improvements

An improved understanding of the features targeted by each protected area as well as the ecosystem services derived from these areas would be required to develop indicators of progress towards both ecological and socioeconomic targets under SDG 14.5. For instance, UNEP-WCMC, The Nature Conservancy (TNC), Cambridge University and partners are currently mapping the distribution and relative value of mangrove and coral reef ecosystem services globally, with an aim to quantify the degree to which these ecosystem services are captured within existing marine and coastal protected areas. Likewise, projects related to 'Areas Beyond National Jurisdiction' (ABNJ) and 'Biodiversity Beyond National Jurisdiction' seek to expand our capacity to manage and protect Ecologically or Biologically Significant Areas (EBSAs).

Web-based platforms, such as UNEP Live[20], can operate alongside such initiatives to support progress towards SDGs by providing open access to substantiated, contextualised knowledge about the environment. For instance, global datasets outlining known distributions of important marine and coastal habitats, such as warm- and cold-water corals, mangroves, seagrasses, seamounts and knolls, have been collated and disseminated freely on the UNEP World Conservation Monitoring Centre (UNEP-WCMC) Ocean Data Viewer[21], and could be used towards establishing the baseline knowledge required for SDGs 14.2[22] and 14.5[23].

Developing metrics and indicators suitable to national and global targets

Drawing from available data, the Biodiversity Indicators Partnership (BIP; www.bipindicators.net) used the pressure-state-benefit-response framework to identify a series of indicators that measure progress against the Aichi Biodiversity Targets of the UN Strategic Plan for Biodiversity 2011-2020 (BIP, 2010; Secretariat of the Convention on Biological Diversity, 2010). As these biodiversity indicators measure the biodiversity components that also underpin sustainable development, they offer opportunities to establish complementary indicators for SDGs using a similar framework. For example, existing National Biodiversity Strategies and Action Plans (NBSAPs) can offer further guidance for developing SDG indicators and implementation plans (Bowles-Newark et al., 2014) as there is considerable alignment across indicators identified by the BIP (BIP, 2011) and the UN Sustainable Development Solutions Network (UN SDSN, 2014) .

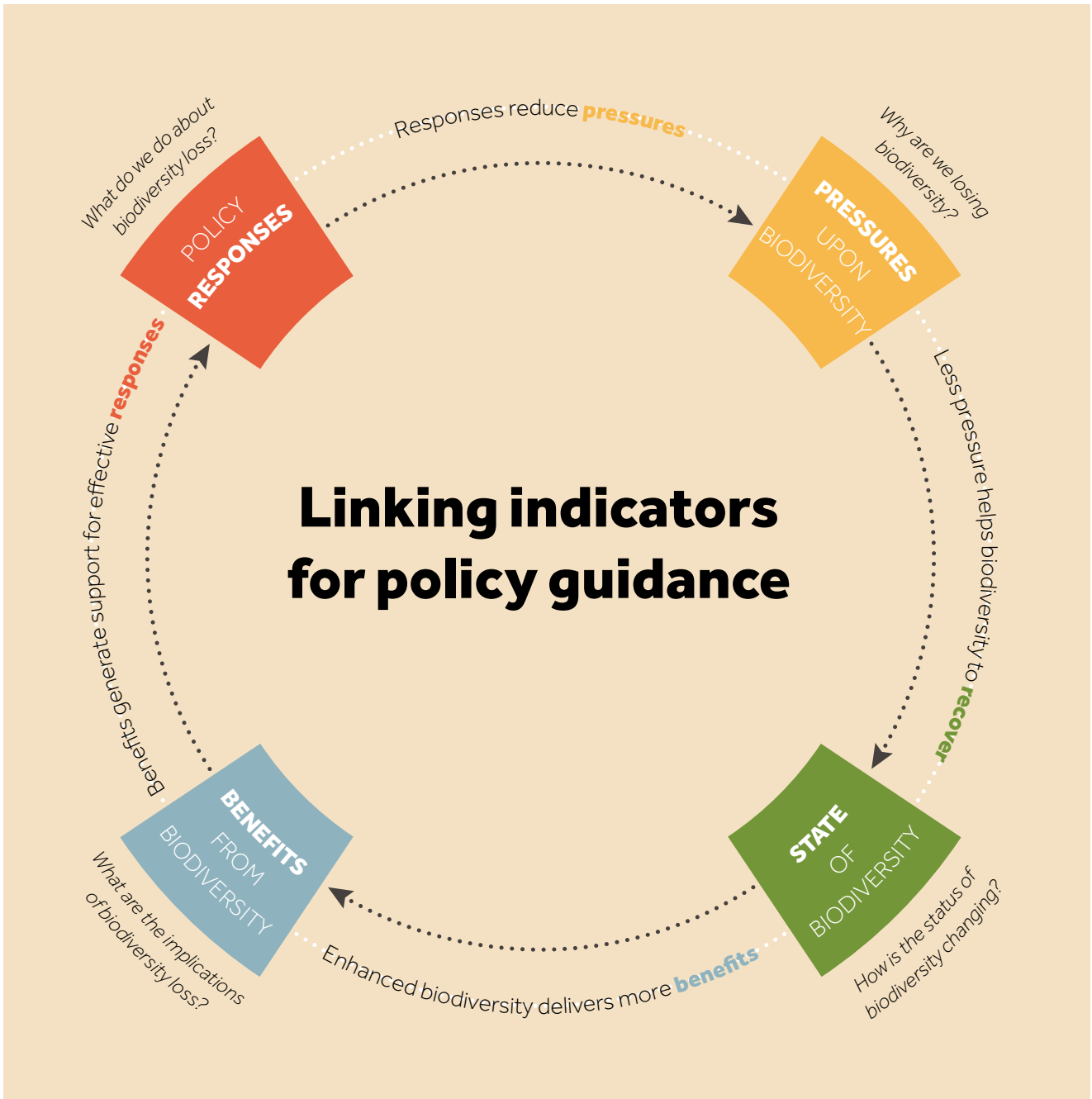
Incorporation of marine and coastal ecosystem services is essential to reaching SDGs that demonstrate alignment of ecological and socioeconomic objectives. UNEP-WCMC, the UN SDSN and the BIP have produced guidance documentation to support the development of ecosystem service indicators of relevance to national and global targets, particularly SDGs (2010 BIP, 2010a; UN SDSN, 2014; UNEP-WCMC, 2011). Examples of ecosystem service indicators for marine and coastal environments include: the percentage of fish tonnage landed within the Maximum Sustainable Yield (SDGs 12 and 14); the percentage of reduced wave energy or coastal erosion through conserved or restored coastal habitats, thereby protecting coastal communities (SDGs 11, 13, and 14); and revenue obtained from marine and coastal recreational activities, such as diving (SDGs 8 and 14) (UN SDSN, 2014; UNEP, 2014; UNEP-WCMC, 2011). The development of integrated indicators measuring progress towards a number of targets would reduce the effort of monitoring and reporting.

20 http://uneplive.unep.org

21 http://data.unep-wcmc.org

22 14.2: By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration, to achieve healthy and productive oceans.

23 14.5: By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on best available scientific information.


Linking indicators for policy guidance
POLICY RESPONSES
PRESSURES UPON BIODIVERSITY
STATE OF BIODIVERSITY
BENEFITS FROM BIODIVERSITY
Responses reduce pressures
Less pressure helps biodiversity to recover
Enhanced biodiversity delivers more benefits
Benefits generate support for effective responses
What do we do about biodiversity loss?
Why are we losing biodiversity?
How is the status of biodiversity changing?
What are the implications of biodiversity loss?

Catherine Lovelock, The University of Queensland

Conserving and restoring mangrove forests is vital for achieving the SDGs throughout the coastal regions of the tropics because of the wide range of ecosystem services they provide. There are a range of challenges in achieving conservation and restoration of mangrove forests – some technical, many are social and economic – but all of the challenges will be exacerbated by sea level rise, which needs to be incorporated into conservation and restoration planning for the SDGs. Sea level rise poses a serious threat to mangrove forests because although mangrove trees grow in the intertidal and are inundated at high tides, they have a limited capacity to survive prolonged inundation and recruitment of seedlings is limited when water gets too deep too often. The negative effects of sea level rise on mangrove forests are not only associated with rising water levels but also dependent on subsiding land. The land in many of the world's largest deltas, where mangroves support millions of people, is sinking relative to sea level because of the extraction of oil, gas and groundwater and because sediment delivery to the coasts, which enriches mangrove forests adding to their elevation, has been limited by hydrological modification upstream as rivers are dammed, water used for irrigation and sediments mined. Degradation of mangrove forests also increases rates of land subsidence and their vulnerability to sea level rise. To meet the SDGs, the attention of a wide range of natural resource managers, from those that directly manage mangrove forests to those that manage extraction of underground and sediment resources and river flows must be engaged to facilitate favourable conditions for mangrove growth. This in turn will limit coastal erosion, which supports SDGs.

Vera Scholz, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Oceans and seas are the largest connected ecosystem on our planet. Marine waters cover about 71 per cent of the planet's surface and provide essential ecosystem services. They play an important role in food production, climate stability, oxygen generation, coastal protection, transportation of goods and energy generation, among many others. Fish and other marine life, for instance, are the main sources of protein for one sixth of the world's population. In addition, coastal areas are densely populated, with half of the world's people living within 200 kilometers of the coast. Thus, oceans are a key system supporting life on earth and therefore highly integrated in the sustainable development trajectories.

Despite their global significance, marine and coastal ecosystems face a wide array of threats, mainly due to human activities. Habitat loss and degradation, overfishing and destructive fishing methods, eutrophication and pollution deteriorate the state of oceans and coasts. Furthermore, the impacts of climate change are heavily affecting the sensitive ecosystems.

Against this background, the key question is how to create an economically viable, environmentally sound and socially responsible vision for the use of ocean biodiversity and marine natural resources?

The SDGs are the strategic, global and integrated pathway to address this question. Hence, the challenge is to guarantee a sustainable development that is based on the conservation and sustainable use of biodiversity for the benefit of all of us, today and tomorrow.

In response to this, the German government and its implementing agencies strive to ensure that sustainable use and conservation of biodiversity are key elements of the global post-2015 development agenda. Annually, half a billion Euros are made available to conserve biodiversity, reduce the drivers of biodiversity loss and promote sustainable use worldwide.

Oceans and the ecosystem services they provide are continuously becoming more important in this regard, and are a crucial and integrated element of the SDGs.

We need a healthy blue planet for a sustainable world.

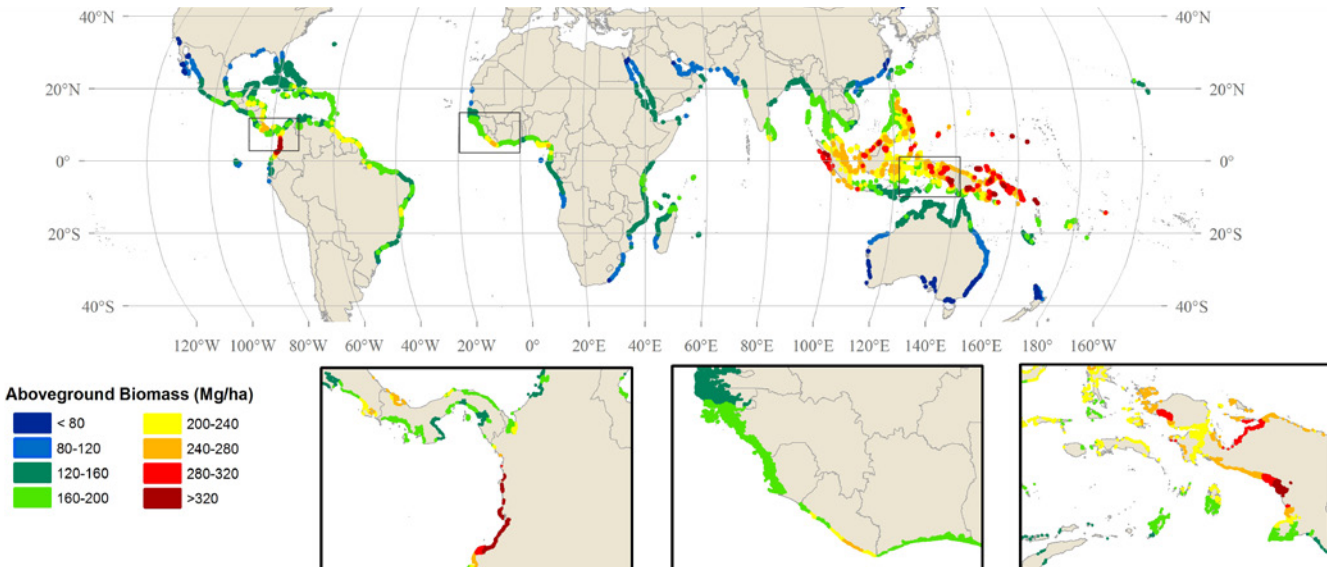
Garth Cripps, Blue Ventures, 2015

A better understanding of marine ecosystem services contributes to the achievement of the SDGs through enabling the development of informed policy choices (Laurans et al., 2013). This may be in terms of helping policy-makers to appreciate the key questions they need to address to achieve the SDGs, through providing decisive evidence to support the formulation of specific SDG policies, or through providing technical support related to SDG policy delivery, such as the design of implementation tools.

Marine ecosystem service assessments in themselves do not guarantee effective SDG policy. The use of such assessments can present significant challenges for policy-making, not least because the assessments often use unfamiliar, complex multi-disciplinary approaches, compounded by limited or incomplete data. As such, marine and coastal ecosystem service assessment results may be difficult to interpret and trust. It is therefore critically important to the achievement of the SDGs that ecosystem service assessments are undertaken in ways that support their convenient and assured integration into SDG policy-making. Lessons learned from previous examples of the use of marine ecosystem services assessment to support marine policy-making point to some simple steps that are likely to aid SDG achievement (Pittock et al., 2012; Slootweg and van Beukering, 2008; Cesar and Chong, 2004; EA, 2009, Laurans et al., 2013, Liu et al., 2010; Hoelzinger and Dench, 2011; Rea et al., 2012; UNEP, 2006; Barde and Pierce, 1991; Schuijt, 2003):

- The marine and coastal ecosystem services assessment should be focused on the specific policy need. This will determine the objective of the assessment and will guide key decisions concerning the method and scale of assessment undertaken.
- In order to be useful for SDG policy-making, the ecosystem service quantification or valuation must be done in such a way that the results are directly relevant to the policy. For example, if the SDG policy need relates to human health benefits from biodiversity conservation, monetary valuation will not be a useful metric to value ecosystem services.
- Terminology should be kept simple and understandable, using familiar vocabulary, and concepts should be explained in a familiar and practical context.
- The format of outputs should be explored with policy-makers to ensure that information is delivered in an appropriate format relevant to the stated SDG policy need. Limitations and uncertainties associated with outputs should be clearly communicated in a non-technical manner that makes clear any implications for SDG policy-making.

In order to connect the results of a marine ecosystem services assessment to SDG policy and ultimately SDG delivery, the pathway between the generation of evidence and the SDG policy need must be clearly defined. Evidence from a range of projects suggests that assessments that are co-constructed through a partnership between stakeholders, policy-makers, the public and technical experts are likely to support SDG delivery. This requires a structured process that full engages all interested parties. As a result of their continued engagement, participants are more likely to understand the strengths and constraints of marine and coastal ecosystem service assessment methods, and in which ways the resulting evidence can support SDG delivery. Most importantly, co-construction of marine ecosystem services assessments will allow policy-makers to gauge how much trust to place in the results of an assessment and how it can be used to support SDG policy-making and other decisions that contribute to the achievement of Sustainable Development Goals.



Source: Hutchison, J., Manaci, A., Swetnam, R., Balmford, A., Spalding, M. 2013. Predicting global patterns in mangrove forest biomass. Conservation Letters 00 (2013) 1–8

Andrew Hudson, United Nations Development Programme

Globally, the socioeconomic costs of overfishing, nutrient and plastics pollution, invasive species and habitat degradation are well over half a trillion dollars per year. SDG 14 calls for the conservation and sustainable use of the oceans, seas and marine resources for sustainable development and provides a comprehensive framework for moving towards sustainable ocean use.

SDG targets include reducing marine pollution (especially nutrients and marine debris); restoring and protecting coastal ecosystems; restoring fish stocks by reducing overfishing; illegal, unreported and unregulated (IUU) fishing and destructive fishing; conserving 10 per cent or more of coastal and marine areas; reducing or eliminating destructive fisheries subsidies; increasing economic benefits from marine resources realized by SIDS and Least Developed Countries (LDCs); increasing ocean research, knowledge and technology transfer; and full implementation of the United Nations Convention on the Law of the Sea (UNCLOS) and relevant regional and international regimes pertaining to ocean sustainability.

While not exhaustive, UNDP suggests the following actions as critical to achieving the Oceans SDG:

- Complete processes to ratify and bring into force the Global Convention on Ship's Ballast Water and Sediments; all countries and industries accelerate efforts to achieve compliance with the Convention
- Promote recovery and reuse of nutrient pollution from agriculture, wastewater and industry via adoption and implementation of economic and policy incentives for fertilizer use efficiency, nitrogen recovery from wastewater, and enhancement of key nutrient sinks
- Promote sustainable fisheries by internalizing the socioeconomic (USD 50 billion/year) and environmental costs of unsustainable fishing practices into sustainable fisheries management (scale up Individual Transferable Quotas (ITQs), expand MPAs and sustainable aquaculture, reduce or eliminate destructive fisheries subsidies, strengthen national and regional fisheries management organizations)
- Scale up proven policy and economic tools and mechanisms that deliver high levels of plastic waste recovery, recycling and reuse (bottle bills, selected bans, producer incentives for recovery, etc.)
- Slow down and reverse ocean acidification by putting a proper price on carbon emissions and removal of fossil fuel subsidies

Alasdair Harris, Blue Ventures Conservation

At a time when 90 per cent of global fish stocks are either overfished or fully fished, it is worth remembering that this crisis is not just affecting our planet's marine biodiversity: over 1 billion people worldwide rely on seafood as a primary source of protein, and more than half this number depend on fishing for their livelihoods. Most of the world's seafood catches (around 80-90 per cent) originate in developing countries which are home to over 97 per cent of fishers, the vast majority of whom operate in traditional, subsistence and artisanal sectors in the tropics and subtropics. For these people seafood is not an optional dietary choice; it is a key component in food security, household income and coastal economies for many of the planet's most vulnerable communities. Globally, coastal regions are already bearing the brunt of climate change, and many communities have no other alternatives beyond fishing for survival.

Yet the critical ecosystems underpinning the futures of these coastal populations are being decimated at unprecedented rates by overfishing, pollution and climate change. From the Caribbean to the Pacific, declining catches, rapid growth of coastal populations and a lack of livelihood alternatives have pushed small-scale fishers into more intensive fishing activities, speeding the collapse of stocks and trapping many in a cycle of poverty. Safeguarding the critical marine ecosystems supporting these coastal economies will require global recognition of the importance of rights-based fisheries management which empowers coastal communities to manage their own marine resources, thus safeguarding small-scale fisheries from the threats posed by competing outside and industrial fishing interests.

The island of Madagascar, one of the poorest coastal states in the Indian Ocean, has recently made great strides towards achieving this goal. Over the past decade, more than 12 per cent of the country's inshore seabed has been designated as locally managed marine areas (LMMAs). These are areas of coast and ocean managed at a local level to safeguard the fisheries on which communities depend. Studies have already shown compelling economic benefits, with villages seeing sustained increases in catches that far outweigh the opportunity costs of forgoing fishing during seasonal fishery closures. Building on this groundswell of local interest in marine management, the Government of Madagascar recently committed to tripling the total area of ocean under community-based management.

Experiences from Madagascar and across the Indo-Pacific are providing important lessons by showing that sustainable marine management is about much more than just biodiversity conservation: healthy marine ecosystems and sustainable fisheries play a critical role in the global sustainable development agenda, creating lasting economic benefits to coastal economies, safeguarding food security and building resilience to climate change.

Garth Cripps, Blue Ventures, 2015

Ensuring that the benefits provided by healthy marine and coastal ecosystems are captured in policy-making to achieve the Sustainable Development Goals is not a trivial undertaking. However, it can build on existing global initiatives and experiences, as well as conventional national policy frameworks and planning processes. This will first require a shift in paradigm: to one that recognises conservation as a contribution towards sustainable development, rather than an obstacle to it. The understanding of natural ecosystems as an asset, a capital similar to social and economic capital, yet with special value to those users in particular who have little access to other forms of capital, brings with it the opportunity of protecting and investing into it.

The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), established in 2012, is dedicated to assessing the state of the planet's biodiversity, its ecosystems and the essential services they provide to society.[18] It provides a mechanism recognized by both scientific and policy communities to synthesize, review, assess and critically evaluate relevant information and knowledge.

Undertaking dedicated activities to inform policy-making

Natural capital accounting is a process of assessing the total stocks and flows of natural resources and the services they provide to people, often conducted at the national level. These include not only more tangible resources such as minerals or timber, but also ecosystem services such as water filtration or coastline protection. Natural capital accounting can complement the assessment of other forms of capital, such as produced capital, and provides important information for a holistic understanding of a country's wealth. Particularly in developing countries, natural capital can form a large share of total wealth – understanding this wealth can support effective management towards achieving the SDGs. The United Nations Statistical Commission's System of Environmental-Economic Accounting (SEEA), adopted in 2012, now provides an internationally agreed standard method. The WAVES partnership (Wealth Accounting and the Valuation of Ecosystem Services)[19] supports countries in national capital accounting.

The Economics of Ecosystems and Biodiversity (TEEB)[20] is a global initiative focused on 'making nature's values visible'. The initiative aims to mainstream the values of biodiversity and ecosystem services into decision-making at all levels. It has developed a structured approach to valuation, helping to: recognize ecosystem services, demonstrate their values in economic terms and, where appropriate, capture those values in decision-making. A number of countries have completed TEEB studies.

Integrating Ecosystem Services into existing policy frameworks

Through Aichi Target 2 *"[b]y 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems"*, Contracting Parties to the Convention on Biological Diversity provide an important anchor in global policy frameworks for ecosystem services, including marine and coastal ones.

At a national and local level, ecosystem service assessments, mapping, valuation and the identification of beneficiaries and other relevant stakeholders are activities that can be integrated into and strengthen 'conventional' policy and planning frameworks and processes, even where integrated, ecosystem-based management approaches are still under development.

National development plans often form the basis of governments' strategic investments in infrastructure, the design of sectorial regulation and the setting of incentives for the private sector. [21] Development goals relating to activities located far from the coast might have impacts on the ability of marine and coastal ecosystems to provide services.

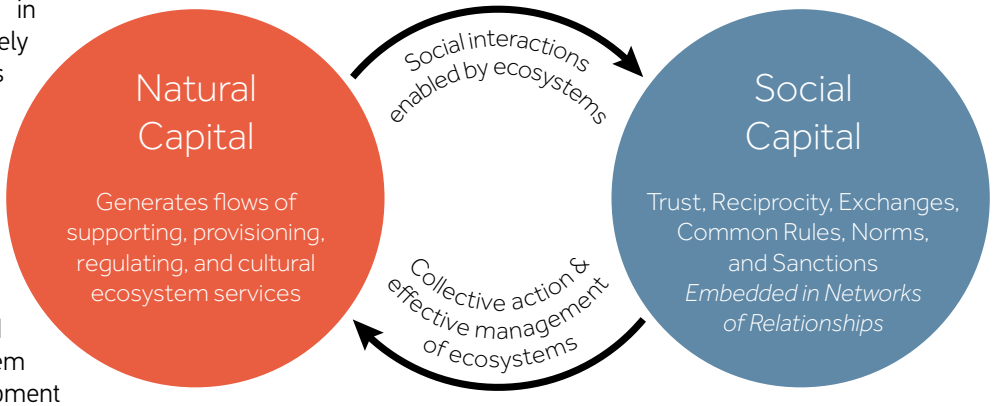
18 http://www.ipbes.net

19 https://www.wavespartnership.org

20 http://teebweb.org

21 For example, see UNCTAD An Action Plan for promoting private sector contributions http://unctad.org/en/PublicationChapters/wir2014ch4_en.pdf

Ecosystem Services support the SDGs



Intensification of agriculture in upstream areas may negatively affect the health of coral reefs through nutrient loads, for example, with potential effects to livelihoods derived from fisheries or coastal tourism. Therefore, it is helpful to identify how national development plans and objectives depend on, and impact, ecosystem services, and how far development objectives might be conflicting as they relate to natural assets. A TEEB Country Study[22] can inform policy-makers about ecosystem services hotpots relevant to national development plans and objectives, and guide investment in their protection or restoration. The identification of ecosystems services' beneficiaries, particularly those local coastal communities with limited economic options, can increase the long-term robustness of development plans.

Furthermore, ecosystem services assessments can be integrated into Strategic Environmental Assessments and Environmental Impact Assessments, to better understand the potential consequences of sectorial programmes and projects, as they might jeopardise other activities towards development objectives; and the negative impacts on ecosystems and their ability to provide fundamental services, as well as social and economic opportunities.

Marine Spatial Planning (MSP) is a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that usually have been specified through a political process.[23] As ecosystem services and their use are spatial by their very nature, MSP processes can incorporate, and be strengthened by, marine and coastal ecosystem service information.

In addition to bringing together conservation and development objectives, the ecosystem services perspective has the potential to create a link between human activities as they benefit from, or impact on, marine and coastal ecosystems. As such, marine and coastal ecosystem services can support the integration of sectorial policy processes and governance frameworks, the segregation of which can impede effective, goal-oriented management. An arrangement that accounts for these relationships and is able to effectively guide the coordination and alignment of development goals, objectives and related governance and management mechanisms in the marine and coastal environment will help policy-makers ensure the benefits from healthy marine and coastal ecosystems can support sustainable development.

22 http://www.teebweb.org/areas-of-work/teeb-country-studies/

23 http://www.unesco-ioc-marinesp.be/marine_spatial_planning_msp

Recent efforts have increased our ability to quantify economic and social capital aspects in developing countries (e.g. World Bank indicators, social capital indicators, etc.), which can be integrated into policy actions. Far less, however, has been done to understand the state and distribution of the natural capital provided by marine and coastal ecosystems. The Ocean Health Index (OHI)[18] has produced 'sustainability scores' for coastal countries, territories and the entire global ocean, and the World Bank WAVES project strives to incorporate a small, but growing set of natural capital measures into systems of national accounting. Both OHI and WAVES are national level endeavours. More fine-scale measures of the value and capital stock of marine and coastal ecosystems are needed in order to effectively target local actions that can help achieve SDGs.

Economic, social, human and natural capital are all inter-linked and are constantly changing. All four types of capital contribute directly to human well-being. Economic and social capital are seen most commonly through the production of food, which creates jobs and generates income, allowing for direct reinvestment in economic capital. Natural capital, on the other hand, is often an afterthought in the decision-making and planning process, if at all. The natural capital of marine ecosystems has not always been used sustainably, as society. This is because society has often failed to reinvest the proceeds generated by increased social and economic capital in the protection, management and restoration of marine ecosystems.

Marine and Coastal Ecosystem Services for People and Sustainability: The Importance of Data and Monitoring

Baseline data on marine and coastal ecosystem services needed to meet the SDGs includes measures of basic ecological function, and flows of goods and services. However, further empirical data, is required to understand the following key questions: What is the coverage of key marine and coastal ecosystems? What is the ecological output of these systems? What is the annual flow of ecological goods and services that come from these systems?

Long-term data also needs to be considered and made a priority to help determine how the status of marine ecosystem services is changing over time. For example, there is growing recognition and measurement of the value of shoreline protection, but long-term data on the effects of shoreline protection (both positive and negative) is still rare.

In addition, for many types of marine ecosystems, the only data collected is based on the market values (Vegh et al., 2014; Hejnowicz et al., 2015; Raheem et al., 2012; Cullen-Unsworth and Unsworth, 2013). As a result, the status of cultural ecosystem services, as well as services associated with raw materials, erosion control, water purification and carbon sequestration services remain unclear and under-measured (Barbier et al., 2011).

All baseline measurements of marine and coastal ecosystem services need to address both ecological and human dimensions of the system at scales that are meaningful for policy action. Ecosystems have the most direct impact on achieving the SDGs when they direct provide benefits to people. So, it is important to ensure that we also continue to collect data, not only on ecosystems and ecological outputs, but also on the people who depend on these ecosystems: Where are they? Who are they? What goods and services do they derive from marine and coastal ecosystems? What proportion of their well-being depends on these ecosystems? Yet, to date far more effort has been spent on measuring ecosystem services, in particular their economic values, at a national level (Suich et al., 2015). As a result, much of the current collection of marine and coastal ecosystem services data, especially valuation data, is of limited use in designing policy to helping achieve social change (Honey-Rosés and Pendleton, 2013; Pendleton, 2015). Baseline data at a finer scale is needed to determine which village, port or estuary, or whose lives and livelihoods are at risk from environmental change. It can also help to determine where policy action can simultaneously improve the ecological as well as the human goals that underpin the SDGs.

18 http://www.oceanhealthindex.org

The dynamic relationship between humans and marine and coastal ecosystem services demands constant monitoring and assessment in order to measure progress towards the SDGs and the ecological conditions required for their achievement. It is therefore important that baseline measures of marine and coastal ecosystem services include ecological and human measures that can be reassessed on a regular basis.

From Data and Discovery to Leadership and Implementation

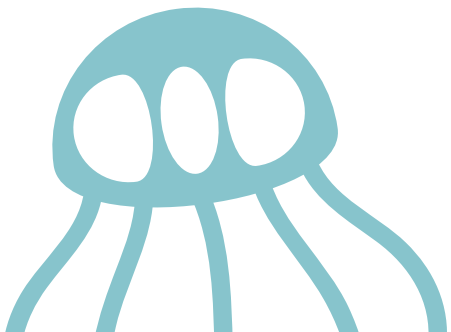
To achieve the SDGs, we must continue to work to integrate marine and coastal ecosystem services into decision-making and marine management on a local, but regionally integrated, platform. A deeper understanding of human-ecosystem interactions is a first step to developing connections between marine and coastal ecosystem services and to policy-making. As highlighted earlier, stakeholders must be identified, and policy and technical experts must work together to adopt a shared terminology and develop assessments that fit specific policy needs. To fully harness the power of marine and coastal ecosystem services to meet the SDGs, it is crucial to continue to develop international strategies that can be implemented at a local (sub-national) level in order to collect baseline data and to implement monitoring of a key set of ecological and human indicators.

This will require:

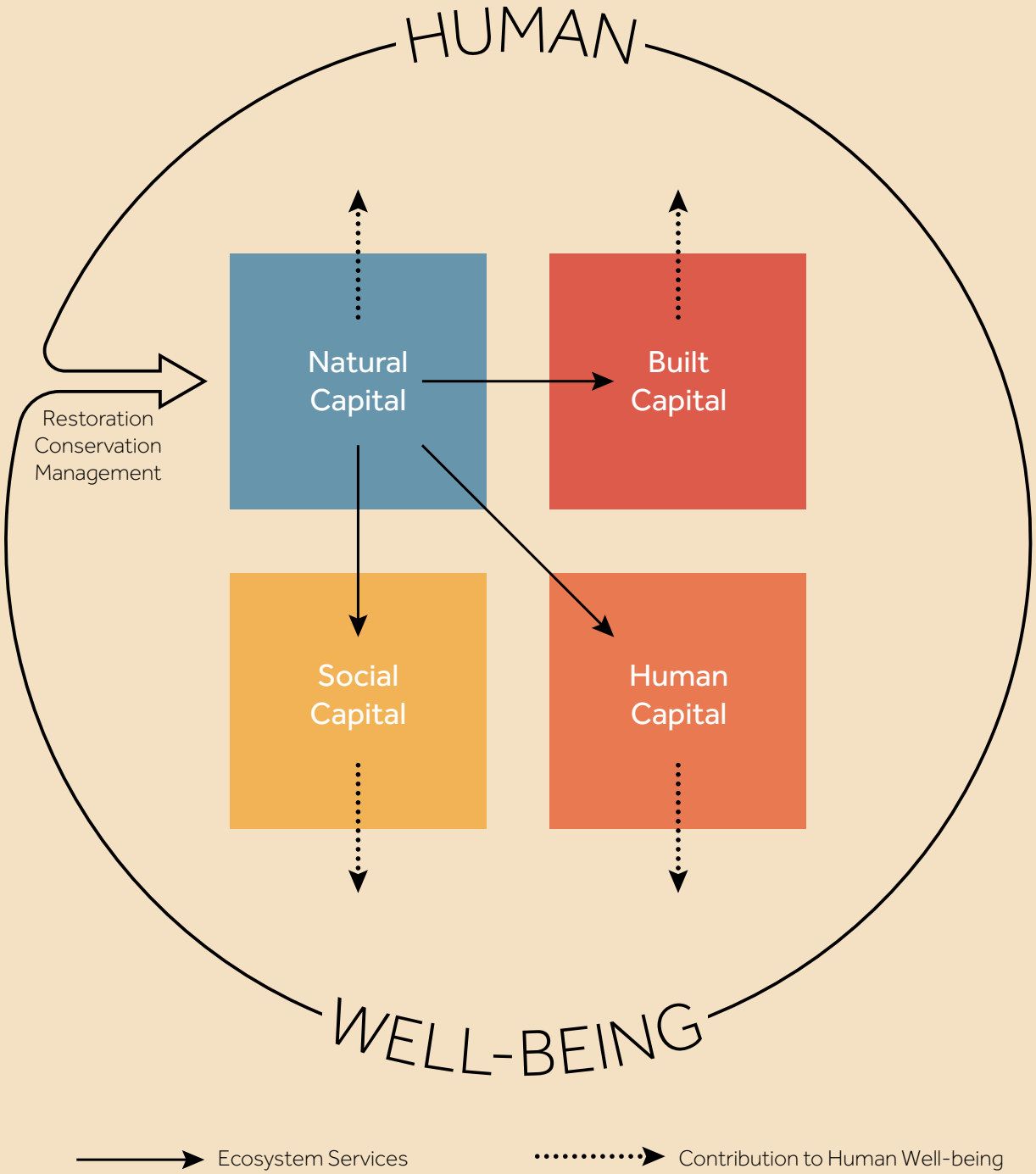
- A leadership role by an international organization
- An international strategy that gives countries a supportive framework for conducting the necessary scientific research and taking policy action
- National policies that translate an international framework into local action, and respond to the specific context of local development goals and marine and coastal ecosystems
- Coordinated data collection and local level training to ensure capacity for future data collection and monitoring, supported by a steady stream of funding to enable monitoring of progress and effective, targeted and informed decision-making.

There is a growing recognition among world and local leaders that ecosystems are indeed our shared factory. Marine and coastal ecosystems in particular are being counted on to produce many of the essential goods and services that will fuel the new blue economy and help us achieve the SDGs.

Moving forward, there is a need for reliable, objective and widely available data. Only then can we harness this powerful, sustainable and global natural factory to achieve the Sustainable Development Goals we have set for the people of this planet.



Human well-being and the four capitals



Garth Cripps, Blue Ventures, 2015

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