Securing Blue Wealth: The Need for a Special Sustainable Development Goal for the Ocean and Coasts

Martin Visbeck[a], Ulrike Kronfeld-Goharani[b], Barbara Neumann[c], Wilfried Rickels[d], Jörn Schmidt[e], Erik van Doorn[f], Nele Matz-Lück[f], Konrad Ott[g], Martin F. Quaas[e]

[a] GEOMAR Helmholtz Centre for Ocean Research, Düsternbrooker Weg 20, 24105 Kiel, Germany.
[b] Institute of Social Sciences, Kiel University, Wilhelm-Seelig-Platz 2, 24118 Kiel, Germany.
[c] Institute of Geography, Kiel University, Ludewig-Meyn-Straße 14, 24098 Kiel, Germany.
[d] Kiel Institute for the World Economy, Hindenburgufer 66, 24 105 Kiel, Germany.
[e] Department of Economics, Kiel University, Wilhelm-Seelig-Platz 1, 24118 Kiel, Germany.
[f] Walther-Schücking-Institute for International Law, Kiel University, Westring 400, 24118 Kiel, Germany.
[g] Department of Philosophy, Kiel University, Leibniz-Straße 4, 24118 Kiel, Germany.

The ocean regulates the global climate, provides humans with natural resources such as food, materials, important substances, and energy, and is essential for international trade and recreational and cultural activities. Together with human development and economic growth, free access to, and availability of, ocean resources and services have exerted strong pressure on marine systems, ranging from overfishing, increasing resource extraction, and alteration of coastal zones to various types of thoughtless pollution. Both economic theory and many case studies suggest that there is no “tragedy of the commons” but a “tragedy of open access”. With high likeliness, structures of open access are non-sustainable. International cooperation and effective governance are required to protect the marine environment and promote the sustainable use of marine resources in such a way that due account can be taken of the environmental values of current generations and the needs of future generations. For this purpose, developing and agreeing on one *Sustainable Development Goal* (SDG) specifically for the *Ocean and Coasts* could prove to be an essential element. The new SDGs will build upon the Millennium Development Goals (MDGs) and replace them by 2015. Ensuring environmental sustainability in a general sense is one of the eight MDGs but the ocean is not explicitly addressed. Furthermore, the creation of a comprehensive underlying set of ocean sustainability targets and effective indicators developed within a global *Future Ocean Spatial Planning* (FOSP) process would help in assessing the current status of marine systems, diagnosing ongoing trends, and providing information for inclusive, forward-looking, and sustainable ocean governance.

Keywords: blue wealth, sustainable development, sustainable development goal, ocean governance

JEL classification: Q56, Q57, Q58

1 Introduction

It has been said that the major challenge for the future of life on this planet is achieving a species of development that increases wealth and reduces poverty while sustaining the natural resources that such a development is necessarily based on. This challenge has been taken up and institutionalized notably in the framework of the United Nations (UN) *Agenda 21,* an action plan for achieving sustainable development in the 21st century, which was a major outcome of the UN Conference on Environment and Development in Rio de Janeiro in 1992 and has been affirmed and further elaborated at the subsequent conferences devoted to this topic. To accelerate the still rather slow progress being made in achieving sustainable development at the global level, the recent UN Conference on Sustainable Development in 2012 (*Rio+20*) produced a document called *The Future We Want* which not only emphasizes the need for action but also proposes agreeing on a set of measurable Sustainable Development Goals (SDGs) to support focused and coherent action in priority areas at the global level [1]. The idea is that the SDGs will be based on *Agenda 21* and the *Johannesburg Plan of Implementation* (JPOI) and to build on the Millennium Development Goals (MDGs).

Ensuring environmental sustainability is the seventh of the eight MDGs. But the role played by the environment in development, wealth, and poverty reduction is inadequately foregrounded (e.g. [2]). Furthermore, the sustainability of the largest, most diverse, and arguably most important ecosystem, the ocean, is not explicitly addressed. The ocean's influence on wealth and development is clearly global in nature but its role in sustainable development and above all poverty reduction at the regional level is rarely fully acknowledged. It seems fair to say that the ocean has been neglected with respect to comprehensive sustainability strategies. The ocean provides humanity with both animate and inanimate natural resources such as food, materials, essential substances, and energy. Furthermore, the ocean is crucial for international trade and recreational activities, thus generating wealth and facilitating development. In addition to its resource abundance and its role in development, the ocean has fascinated humans since time immemorial, providing us with aesthetical and cultural values and delighting us with the beauty and variety of marine life. The immense range of seascapes gives us a well-defined sense of place. Coastal waters are used for religious rituals and recreational purposes. While such values elude monetization, they contribute significantly to meaningful human life.

Consequently, ocean services are essential for human life on earth, so all development needs must consider *planetary (and ocean) boundaries* (e.g. [3]). Such boundaries are not natural ones but must be set with prudence and caution. Together with human development and economic growth, the free access to, and availability of, ocean resources and services has exerted major pressures on the ocean, ranging from overfishing and increasing resource extraction to various sources of thoughtless pollution and alterations to coastal zones that often cause the degradation of marine ecosystems (coral reefs, mangroves, etc.). Irrespective of such threats and the overall importance of the ocean in providing various services, the mitigation of current and future marine environmental problems and approaches to sustainable use, and the development of marine resources have been accorded only very low priority in many states. Hence, this paper provides arguments that sustaining blue wealth requires a comprehensive approach and that a SDG devoted explicitly to the ocean and coasts would be a crucial factor in achieving sustainable ocean management.

Box 1 about here

Such a goal has to be set at the highest international level. A multitude of piecemeal domestic and regional approaches and policies can neither effectively address the difficulties the ocean faces in a coherent manner nor monitor global progress. Given that it is the only international organization with universal membership, the UN is well positioned to take the lead in supporting ocean sustainability. The largest part of the ocean—the high seas—is a global common with largely unrestricted access to ocean resources and functions for all users, regardless of nationality and geographical location. Ocean currents connect coastal environments and societies world-wide. Accordingly, environmental sustainability for the ocean is of universal concern, calling for a correspondingly global forum for the formulation of policies and the monitoring of their success. The annual UN General Assembly resolution on oceans and the law of the sea—the longest resolution the UN adopts every year—sets out the transnational and global issues associated with using the ocean sustainably and the need for coordinated action based on policy agreements, international law, and national implementation.

This paper first discusses the challenges for securing blue wealth (Section 2). Section 3 provides arguments that an *SDG Ocean and Coasts* with specific targets and instruments would be essential for realizing a sustainable development strategy for the ocean and its coasts. Furthermore, it discusses the general objectives of a potential *SDG Ocean and Coasts* (Section 3.1) and the need to appropriately conceptualize sustainable development so as to encompass all the various oceanic resources (Section 3.2). For that purpose, a comprehensive indicator set would be an important instrument for measuring the status and progress of developments over and against the various targets. To properly account for the complexity of the human-ocean system, the targets and the indicator set should be supplemented with *safe minimum standards* [4] to keep development in *safe operating space* (Section 3.3). The derivation of an effective and specific set of targets and the potential for monitoring progress against these targets could be guided by a *Future Ocean Spatial Planning* (FOSP) approach (Section 3.4). Section 4 provides some concluding remarks.

2 Challenges in Securing Blue Wealth

Services provided by the ocean are of direct economic relevance for sectors like fisheries, aquaculture, offshore oil and gas mining, shipping, tourism and – potentially in the future – deep seabed mining for mineral resources. Estimates for the value provided by the ocean-based economy range from 1 to 5 percent of GDP for developed countries [5]. In many developing countries, these shares are considerably larger, for example in Mauritania and Vietnam with about 12.5 percent and 10 percent of GDP respectively [6], [7]. Furthermore, these shares increase considerably if the contributions of the coastal economy are considered [5]. Even though the coastal economy does not necessarily rely on ocean services as inputs, a healthy ocean is a prerequisite for a stable coastal economy which provides tax revenues and indirect economic and social benefits by, for example, community identity [8].

However, such estimates can only be considered to be first steps towards acknowledgment and quantification of the ocean's contribution to wealth and development. The ocean contributes to well-being in ways that are not adequately reflected in aggregated income figures. This holds in particular true if one considers the poverty prevention contribution of healthy coastal and oceanic environments. Teh and Sumaila [9] report that 136 of 144 maritime countries engage in small-scale or artisanal fishing to a significant extent. In Oceania, small-scale fishers represent up to 82 percent of the total fisheries employment and in certain regions of Madagascar, 87 percent of adult population work in the small-scale fishery sector [10]. By this link, the ocean provides a significant source of income, food, and nutrition at the local level and therefore an important source of poverty alleviation and livelihood opportunities [11], [8]. Official statistics hardly reflect the ocean's contribution to poverty alleviation. Mill et al. [12] point out that marine catches are easily underestimated by 10 percent due to insufficient reporting on the contribution of the small-scale fishing sector in developing countries in official statistics; [6] show that the animal protein intake in several developing countries arising from fish is considerably larger than official statistics suggest. Additionally, in many developing countries the ocean generates significant government funding by revenues from exports, taxation, license fees and from payment for access to fishing grounds by foreign fleets [7], [13]. Ship dismantling, as problematic as current practices in many developing countries may be from the perspective of labour safety and coastal pollution, is another significant source of attaining scrap metal for reuse, local employment and revenues for South Asian States like India or Bangladesh. Consequently, the ocean provides a multitude of assets and services to humankind that are rarely reflected in the share of the ocean economy of national GDP [5], not only because of non-included linkages or insufficient statistics but also because of market prices used in official statistics often fail to take environmental stock and ecosystem effects into account, as appropriate regulations and markets are missing. For these reasons, the broader term "blue wealth" instead of "blue growth" or "blue economy" is used to refer collectively to the wealth created by the various services and assets provided by the ocean.

Human aspirations and economic growth have exerted major pressure on the ocean and the marine ecosystem and constitute therefore serious challenges for sustaining blue wealth. This is certainly true for the world's fish stocks, where only an increase in fishing effort and expansion to new species and new areas have maintained catch levels over the last twenty years. Although expert calculations of the degree of overfishing vary, official FAO [14] estimates show that more than a quarter of all stocks are overfished and more than half of all stocks are fished to maximum capacity. However, reliable figures on the state of stocks are only available for roughly 500 of the 1500 stocks currently exploited. The major impediments to sustainable fishery are non-existent or poor management even in developed regions such as Europe [15] in combination with an absence of compliance with existing regulations due to limited resources for control and enforcement. Illegal, unregulated, and unreported (IUU) fisheries are a major threat to which destructive fishing gear and practices add further pressure but existing international instruments addressing IUU fishing have been ineffective due to lack of political will, non-prioritization, insufficient capacities, and a lack of resources for ratifying and implementing them. Sustainable management is urgently needed, and it is needed now. Once fish stocks have collapsed, not even stringent protection measures will suffice to enable all the fish stocks to recover spontaneously, as the case of Canadian cod fishing indicates.

Overfishing is just one of a multitude of threats to marine ecosystems and ocean functions that are caused by human activities, both directly at sea and indirectly through land-based changes and poor

waste management. Specific examples include pollution by a broad range of chemicals such as heavy metals, oil, carbon dioxide, radioactive substances, and plastics, plus indirect effects like eutrophication. Transported by currents, they can cause harm even in areas quite remote from the source of pollution itself. A significant part of marine litter is made up of plastic with poor degradability [16], [17]. Thompson [18] estimates that ten percent of the global plastic production of roughly 250 million tonnes ends up in the ocean and either causes problems as large items or (a subject even less thoroughly investigated) accumulates in the food chain in the form of microplastics [19].

Another serious problem for coastal waters arises from eutrophication [20]. Caused by an accumulation of nutrients in coastal waters originating from agriculture, industry, and sewage discharged into surface waters, marine eutrophication can lead to frequent and long-lasting algae blooms. Such algae blooms may change the turbidity of seawater and limit light penetration into deeper layers of the water. As algae bloom recedes, degradation processes in the plant material stimulated by bacteria consume large amounts of oxygen, which in its turn can cause dead zones in deep-water layers. Furthermore, some microscopic algae can cause harmful algae blooms (HAB) if they occur in large numbers. These have a potential for producing toxins that have impacts on humans and animals [21].[1] At present, the most seriously affected areas are located in western Europe, the eastern and southern coasts of the U.S., and East Asia, particularly Japan [22]. Obviously, there is a *terrestrial side* to marine protection, notably in connection with agriculture, urbanization, and sewerage services implying that marine protection requires changes in agricultural policy and water pollution control. Although international treaties on marine pollution from land-based sources acknowledge this, these instruments are relatively weak because states lack the political will to agree on standards for regulating agriculture etc.

Furthermore, the continual increase in atmospheric carbon emissions causes significant ocean warming due to climate change and direct chemical stress from ocean acidification. An increase in ocean heat uptake leads to changes in the physical properties of the oceans, mainly direct increases in water temperature, stronger stratification, sea-level rise, and changes in ocean currents [23] with major impacts on the marine ecosystem and coastal communities. At the same time, warming and increased stratification lead to ocean deoxygenation and an expansion of subtropical oxygen-minimum zones [24]. The oceans provide the most important carbon sink in the global carbon cycle. The price for this, however, is increasingly acidic conditions in the marine environment (e.g. [25]). Ocean acidification has already reached measurability. It has lowered ocean-surface pH by 0.1 compared to pre-industrial values and by 2100 is expected to further decrease it by an additional 0.3-0.4 units (e.g. [26], [27], [28]).

Currently, it is uncertain to which extent marine species and ecosystems will be able to adapt to changes in ocean physics and chemistry but there is major concern that ocean acidification may pose a threat to the abundance, health, physiology, and biochemical properties of marine species (e.g. [26]). With a doubling of atmospheric carbon concentration relative to pre-industrial levels, coral calcification, structure, and growth could be reduced by up to forty percent [29], [30]. Combined with other stress factors affecting coral reefs such as extreme temperatures giving rise to coral

[1] Hypoxia and HAB impair the quality of water and can change or reduce species diversity or cause the death of fish, birds, and marine mammals when toxins are produced [21].

bleaching, viral attacks, overfishing, and pollution, this represents a dire prognosis for reef corals, which provide important ecosystem services for millions of people. Their degradation and loss of mass would reduce the protection of shorelines against erosion and flooding and affect local fisheries, tourism/recreation industries, and related maritime economies [31]. From the perspective of environmental aesthetics, coral reefs are a source of profound and intense experiences. The cultural value of coral reefs might be monetized in terms of travel costs but also via methods as contingent valuation. If many persons would give a high existence value to such ecological systems, the willingness to accept a loss of such systems will be very low.

As many of these ocean services are largely restricted to coastal zones, the implications of reduced ocean health will manifest themselves in terms of the impacts that make them felt there.[2] Accordingly, coastal development is a critical driver of change. It leads to increased utilization or even overexploitation of natural resources both on land and in the sea and exerts major pressures on the environment at the land-ocean interface [33]. Ninety percent of global fishing activities actually occur within coastal jurisdiction [34], and physical interactions along coasts and in the hinterland such as dredging, damming of rivers and river deltas, extraction of liquids and gases from the ground, land reclamation, habitat modification, and coastal engineering have a major impact on the coastal environment. Consequences range from changes in sediment supply and coastal dynamics to coastal erosion, subsidence, and decreases in drinking water supplies. Through land reclamation and other human activities, shallow-water coastal areas have also been greatly reduced. These areas are critical for ocean functions as they enable light to penetrate to the sea bed, furthering the growth of plants providing refuge for juvenile marine organisms. Other human interactions with the coastal zone that exert pressure on the environment include tourism and recreational activities.

Major seaports like Guangzhou, Shanghai, and Rotterdam are important industrial and maritime terminals for international trade. Here, smooth operation and efficient cargo handling are of major regional and economic importance. Damage or destruction of port infrastructure by extreme weather events can strongly affect regional supply chains, which in its turn poses a threat for the population's food security and health [35]. Given that this affects all dimensions of human security, combined effects could induce long-term migration [36], [37], [38]. Changes in storm patterns (intensity of hurricanes and typhoons, etc.) and storm surges caused by climate change and a rise in sea-level with its associated biophysical and socio-economic consequences impose significant pressures on the coastal zone, especially on low-lying coastal areas, deltas, and small islands [39], [40], [41], [42]. Moreover, severe natural disasters such as the hurricanes Katrina in 2005 and Sandy in 2012 not only directly endanger life and limb but can also cause psychological traumas and displacement-related social problems [43]. In addition, loss of, and damage to, valuable ecosystems like mangroves, tidelands, or marshes also lead to a reduction of natural coastal protection and may increase the vulnerability of coasts to erosion.

Climate change, natural disasters, and coastal development affect various aspects of human development, including an increase in poverty. Regions where observed impacts are especially

[2] There is no standard definition of coasts or the coastal zone. Commonly, the coastal zone is understood as the interface or transitional area between terrestrial and marine environments and their mutual influences [32]. Yet the coastal zone is strongly impacted by human activity and thus characterized by functional linkages and interactions between environmental and human systems, both on land and at sea. In our context, we understand the coastal zone as a complex human-environmental system that extends as far into the sea and onto the land as its key functional linkages and interactions extend.

severe include populated and urbanized coasts and megacities, river deltas, Arctic coasts, low-lying coasts, and small islands [44], [45]. In Arctic coastal regions, for example, climate change is already threatening the livelihoods of indigenous communities. The melting of permafrost and the withdrawal of sea ice in the Arctic directly threaten infrastructure, traditional lifestyles and human well-being in coastal communities, cause increasing coastal erosion, and have adverse effects on sensitive coastal habitats [46], [47], [48].

Along with climate change and coastal hazards, these manifold human interventions, complex interactions, and effects significantly increase the levels of risk, exposure, and sensitivity for coastal communities and their environment and thus exacerbate their vulnerability [39], [49]. At the same time, there is increasing human dependence on coastal resources, albeit with a globally unequal distribution of demands, provisioning, vulnerabilities, and threats. There is an urgent need for sustainable coastal development to address the various threats by increasing the resilience and adaptive capacity of both the human and natural coastal sub-systems, especially in developing countries.

3 Working Out a Sustainable Development Strategy for the Ocean

By definition, ocean management requires a global approach because the ocean is a global common that connects coastal and non-coastal societies on the planet. While many other global problems can be addressed by coordinating local action, sustainable ocean governance is too complex and involves too many potentially conflicting interests to be left to piecemeal approaches. While cooperative regional approaches are important for the implementation of law and policies they are not suitable to provide for the overarching framework. States should stop acting solely as flag states, as coastal states, as port states or as fishing nations. Interests involve such crucial issues as fishing, offshore oil and gas exploitation, alternative energy from the ocean, shipping and tourism but also actions undertaken on land to deal with the terrestrial side of ocean issues. Many of these aspects have already been addressed at an international level either by non-binding policy instruments or by international treaties. Any new approach to solving the remaining problems will have to be undertaken at the same global level.

The establishment of an *SDG Ocean and Coasts*, although legally non-binding, would be crucial in giving a new impetus to the international cooperation and negotiations required to protect the marine environment and use marine resources in such a way as to meet the needs of future generations. Also, a specific SDG dedicated to the *Ocean and Coasts* is inclusive in that it allows all nations to meet on par with each other and to mainstream and implement sustainable development at a global scale for an “integrated and essential component of the Earth’s ecosystem” [1, §158], no matter what their initial situation is. Other than a sole goal on poverty reduction, a specific *SDG Ocean and Coasts* does not prescribe the role of donors and donees and still allows capacity building and technology transfer. Such SDG would be “soft law” but such “soft law” might be the first step towards international legal institutionalization in the longer run.

The objectives of the SDG need to be institutionalized in terms of specific targets. An adequate set of indicators for measuring sustainable ocean and coast development should comprehensively monitor and assess progress over and against both the overall objective and the specific targets. An additional requirement is appropriate reflection of the interdependence between human development and blue wealth based on productive ocean ecosystems. To this end, the indicator set should reflect the

ecosystem approach and address with great care the substitution between human-made and natural capital stocks in order to capture the complexity of the *human-ocean system*[3] with its various forms of interaction and feedback. Accordingly, additional *safe minimum standards* should supplement the targets so as to keep future development trajectories within a safe operating space. The definition of specific targets at global, regional, and national levels and the measurement and monitoring of progress over and against these targets by the comprehensive indicator set could be achieved by a FOSP process.

3.1 Objectives of the *SDG Ocean and Coasts*

Suitable primary objectives of an *SDG* devoted specifically to the Ocean and Coasts are listed in Table 1.

Table 1. Primary objectives of an *SDG Ocean and Coasts*

Table 1 about here

3.2 Indicator set for ocean sustainability

Progress towards the realization of overall objectives and specific targets should be monitored by a set of indicators equal to the task of measuring sustainable ocean and coastal development. Comprehensive assessment of the state of the marine environment and its future development is still in its infancy. There are several initiatives under way, such as the World Ocean Assessment [50] or the Global Partnership for Oceans, launched in 2012 as an alliance of more than 100 governments, international organizations, civil society groups and private sector interests, committed to addressing threats to the health, productivity and resilience of the world's oceans [51]. There are also numerous regional organizations like HELCOM and OSPAR, which have been elaborating objectives and targets for the North-East Atlantic and the Baltic Sea.

However, none of these initiatives has yet come up with a comprehensive measure that would cover human-ocean systems and internal ocean interactions. A notable exception is the Ocean Health Index introduced by Halpern et al. [8]. The authors define ten public ocean-related goals and assess the performance of 171 states, including their EEZs, against these goals. Their assessment is not only based on the present status of the ten goals but also includes the future status derived from the assessment of the pressures on, and the resilience of, the human-ocean system. For that reason, the authors claim that their index also provides important information regarding the sustainability of the human-ocean system. Considering the large amount of data collected and applied, the study by Halpern et al. [8] represents a unique tool for assessing the human-ocean system. Nevertheless, the index as applied leaves out important issues such as the sensitivity of the result to the aggregation of conflicting goals and should therefore be seen as only one possibility for assessing the state of the human-ocean system.

[3] With the term *human-ocean system*, we summarize all interactions and linkages between humankind and the entire oceanic sphere, including coasts.

Developing a comprehensive indicator set for measuring the sustainability of the human-ocean system requires profound discussion of how the term sustainability can be operationalized in the context of the ocean. The seminal work by Meadows et al. [52] emphasizes that in the presence of finite resources a broad concept of growth and wealth is necessary. From an economic perspective, sustainable development can be measured by determining whether the economy's productive capacity is maintained or growing so that the wealth of future generations will not decrease (e.g. [53], [54], [55], [56]). However, the role and value of the ocean for this productive capacity has not yet been appropriately considered.

In defining a sustainability concept that encompasses the ocean, it needs to be beared in mind that in the *weak sustainability* approach referred to earlier the economic performance of a given society is sustainable if there are genuine savings and investments in productive capacity (e.g. [57]). This approach, however, allows for substitution between human-made and natural capital stocks, i.e., services stemming from machinery and artefacts can replace services of natural capital to some degree. Consequently, it is necessary to pay attention to the limits of substitution between the various capital stocks [58] because sustainable development trajectories might otherwise be identified that do not adequately account for the underlying trade-offs. It is for this reason that the distinction between *strong* and *weak* sustainability was introduced in the early 1990s (e.g. [59], [60], [61], [62]). This is however currently not reflected in the Halpern et al. [8] index framework. In principle, the concept of *strong sustainability* does not allow for substitution between different capital stocks. Accordingly, the requirement is that the remaining stocks of natural capitals be maintained independently of the way in which other capital stocks develop. The concept of strong sustainability implies a set of management rules with respect to natural capital that can make conservation and even restoration mandatory in many cases. For political purposes, these rules must be specified in terms of objectives and indicators. At all events, sustainability requirements are constraints on possible pathways for increased economic activities ("development"). This is also true of other similar approaches, such as *planetary boundaries* or *safe minimum standards*.

3.3 Definition of safe minimum standards

A high degree of complexity characterizes the human-ocean system. But humankind does not yet properly understand all the various kinds of interaction and feedback involved. The capital approach outlined above does not cover all possible linkages between economic capital and other capital stocks, for example environmental capital stocks, which have yet to be properly defined in terms of ocean-related capital stocks. The Earth, with its oceans, continents, ice masses, currents, animate and inanimate resources forms an extremely complex system whose sub-systems and interactions are as of yet poorly understood [63]. With its preference for linear projections, science is limited in its ability to reproduce the non-linear and interactive system dynamics that characterize the ocean of the future.

The general concept of *planetary (and ocean) boundaries* defines constraints on future development options within a *safe operating space* [3]. The boundaries discussed in Rockström et al. [3] are clearly not natural or *objective* boundaries but normatively defined limits imposed on human interference with nature. From the viewpoint of *strong sustainability*, such limits seem quite plausible, if not prudent. It is very unlikely that probabilities can be unanimously assigned to the consequences of all current actions pertaining to the future status of the oceans, and in some cases these consequences may in fact be completely unknown. System dynamics entail the possibility of irreversible

development, which may be associated with significant losses. Accordingly, prudent management of the human-ocean system has not only to deal with reliable cause-and-effect relations but it is also confronted with a contingency of effects as a consequence of human intervention to be guarded against [4]. Ensuring sustainable development under uncertainty therefore requires attributing sustainability criteria to current actions instead of unknown future conditions [64]. *Safe minimum standards* always enable us to ask how safe things have to be in order to be safe enough. Thus *safe minimum standards* provide more latitude for risk assessment and trade-offs than the rules of *strong sustainability,* even if both approaches may converge toward similar objectives. If our diagnosis is correct, then more ambitious safety standards are a close approximation of the rule of maintaining the natural capital of oceans and coastal zones.

For that reason, *safe minimum standards* of conservation can be achieved by avoiding potential critical zones for certain actions [4]. Proper timing and appropriate management imply relatively small costs for the maintenance of *safe minimum standards*—compared, at least, to the potential losses they are designed to obviate. The inclusion of such minimum standards is particularly important in view of the fact that neither complete understanding of the human-ocean system nor complete data availability for measurement will be available. For that reason, the process of developing suitable indicators to measure the human-ocean system should be supplemented by the discussion and definition of such *safe minimum standards* for interventions in the system. The concept of safe minimum standards in itself does not answer the question: "How safe is safe enough?" With respect to oceans, this question might be answered differently in different cultures. Since most people live a rather "terrestrial" life, the necessities of ocean sustainability might be underestimated from many cultural and lifeworld perspectives. If so, marine sciences should contribute to such discourse on SDGs. If they make their value-judgments explicit and open for revision and debate, they act in accordance with Max Weber's philosophy of value-judgments within sciences [65].

Finally, data availability, quality and regional and global integration restrict the selection of appropriate indicators. Accordingly, this selection is invariably a normative choice with important implications for the results (e.g. [66]). These limitations need to be balanced against the requirement that the status and development of the human-ocean system should be measured for the purpose of determining appropriate management activities. Consequently, the process of selecting, weighting, and aggregating appropriate indicators requires the involvement of various stakeholders in addition to the experts. For that reason, the inclusion of the initiatives referred to in Section 3.3 and the UN ocean initiative is essential.

3.4 *Future Ocean Spatial Planning* (FOSP): deriving, implementing, and monitoring specific targets

For the broad objectives of the *SDG Ocean and Coasts*, specific targets need to be developed, in some cases refined, negotiated, and implemented at global, regional, and national levels. Furthermore, progress needs to be monitored against these targets and safe minimum standards need to be defined. What is a good set of indicators? Where are potential hot spots of conflicting ocean developments? Which indicators can best help to manage those future conflicts?

A guiding framework for the development of specific targets is required which can be modelled on the *Marine Spatial Planning* (MSP) approach but needs to be extended to development scenarios at

the global level and with a focus in the future. Such a global process that understands the ocean as a finite resource with possibly conflicting future uses by different sectors, nations and regions could be termed *Future Ocean Spatial Planning* (FOSP). According to the UNESCO's Intergovernmental Oceanographic Commission, MSP seems suitable for achieving scientifically-based sustainable development by meeting social, economic, and ecological objectives for many local and possibly regional issues [67]. MSP can be realized in an ecosystem- and area-based fashion, while allowing for integrated, adaptive, and participatory strategies [67]. Building on the successes of the MSP methodology, a global FOSP process would focus on the opportunities and risks of future ocean use and development. Such a framework would assemble all current and future requirements for the ocean and coasts and facilitate the identification both of current and future crisis hotspots and of new opportunities for development. It would encourage a global perspective on the need, size, and number of protected marine areas and current and new ocean use levels and pinpoint areas in need of special regulation. FOSP will enable states to express and negotiate their ambitions and concerns in the context of regional and global developments. Furthermore, linking FOSP to MSP and *Integrated Coastal Management*[4] (ICM) would facilitate the incorporation of the transitional nature and interdependencies of coastal and marine systems on the national and regional scale. FOSP would inform MSP and ICM by providing longer-term perspectives and common goals, thus providing useful policy arenas to identify, frame, and resolve current and future spatial conflicts and conflicting interests in the pursuit of transparent and effective ocean governance and coastal resilience.

4 Conclusion and Outlook

At the Rio+20 Conference, the decision was taken to develop a new set of global SDGs for achieving sustainable development under balanced consideration of all three dimensions of sustainability and their interlinkages through "focused and coherent action on sustainable" [1, §246]. In this document, the UN sets clear criteria for these SDGs: They should be "action-oriented, concise and easy to communicate, limited in number, aspirational, global in nature and universally applicable to all countries" and address the thematic and cross-sectoral priority areas stated in the outcome document *The Future We Want* [1, §247]. Furthermore, the SDGs should be developed in an "inclusive and transparent intergovernmental process" [1, §248] and serve "as a driver for implementation and mainstreaming of sustainable development in the UN system as a whole" [1, §246].

The UN recognizes in this respect the critical role of oceans, seas and coastal areas in the Earth system and their importance for sustainable development [1, §158]. Additionally, several ocean-related challenges have been addressed in the Agenda 21, the JPOI and the Barbados Programme of Action [71]. Consequently, various proposals are being discussed about the integration of ocean issues into the framework of the SDGs. Basically, the existing proposals can be distinguished whether they argue for a stand-alone SDG on Ocean and Coasts or for addressing sustainable ocean development in a cross-cutting manner under different SDGs [71].

[4] Integrated coastal (zone) management (ICM/ICZM) aims to foster sustainable coastal development by integrating planning, decision-making, and concrete action in the coastal zone in a holistic way. The objective of ICM is to avoid one-dimensional or overly sectorial approaches and to facilitate participative management and consensus-building (cp. [68], [69], [70]).

Irrespective of the general structure of the SDG framework, it is obvious that the number of SDGs should be limited. The definition of extra SDGs is associated with cost in the sense that it lowers the attention devoted to the existing targets. For that reason, there needs to be a thorough and scrupulous discussion to determine which of the various global problems should be addressed by establishing a corresponding SDG.

These requirements will be met when dedicating a specific SDG to *Ocean and Coasts*. The sustainable use and development of the ocean and the coasts concern all countries, whether they are coastal states or not, due to the global nature and importance of the manifold functions and services delivered by the world's ocean and coasts, their relevance for the human society, and the interconnectedness with human activities. In addition, an *SDG Ocean and Coasts* is universal in that it implicitly covers several of the current MDGs such as Goal 1 (Eradicate Extreme Hunger and Poverty), Goal 7 (Ensure Environmental Sustainability) and Goal 8 (Develop a Global partnership for Development). It addresses the triple-bottom-line of the sustainability concept by fostering economic development while ensuring environmental sustainability and social inclusion, with "concerted global efforts to achieve all of them" through good ocean and coastal governance as a fourth determinant for success, as envisioned by [72] for the new SDGs. Also, it builds upon the new paradigm and nested concept of sustainable development put forward by [2] that—in the era of the Anthropocene—a post-2015 sustainable development agenda should meet "the needs of the present while safeguarding Earth's life-support system, on which the welfare of current and future generations depends". This definition modifies the famous WCED-definition by bringing an ecological safeguarding principle into the definition of sustainable development itself. This modification seems to be a conceptual improvement compared to the WCED-definition that solely focuses on (basic) needs.

Consequently, developing and agreeing on an *SDG Ocean and Coasts* would be essential for securing blue wealth by promoting a robust, healthy, and productive marine environment and encouraging the development of sustainable and resilient coastal communities. Given all the pressures exerted on the ocean and the many indispensable services it provides for the Earth system and humankind, there is an urgent need to make progress in coming to terms with specific rules, targets, and indicators. Potential examples of specific targets are: i) establishing marine protected areas covering 10 percent of the ocean by 2020, ii) reducing overfishing, stop illegal unregulated and unreported fishing, and curb marine pollution, iii) harmonizing local and regional MSP and ICM by 2020, and iv) developing adequate ocean governance, or, more ambitiously, to establish a "World Ocean Public Trust"[5] by 2030. The process of setting specific targets is an essential aspect of any SDG and needs to be accomplished via consultation between states, scientific and technical advisory bodies, and civil society. In this way, an effective set of targets could be developed in the broader context of FOSP approach to the evaluation of future development options in pursuit of the global goal of sustaining blue wealth.

[5] As early as 2002, Michael Orbach (Nicholas School of the Environment at Duke University) called for an urgent reappraisal of the freedom of high seas fishing, a call that has since been confirmed and supported by a growing number of ocean conservation and marine biology experts. In essence, Orbach espouses a new ocean ethic, a "World Ocean Public Trust" by virtue of which large sections of the high seas should be "enclosed" for the purpose of protecting the marine life therein through the adoption of public trust doctrines such as those applied to the protection of terrestrial wildlife.

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References

[1] UN, United Nations. The Future We Want. Resolution adopted by the General Assembly A/RES/66/288, 11 September 2012. URL: http://www.uncsd2012.org/thefuturewewant.html [Access date 2013-07-17].

[2] Griggs D, Stafford-Smith M, Gaffney O, Rockstrom J, Ohman MC, Shyamsundar P, Steffen W, Glaser G, Kanie N, Noble I. Sustainable development goals for people and planet. Nature 2013; 495(7441): 305-307.

[3] Rockström J, Steffen W, Noone K, Persson A, Chapin FS III, Lambin E, Lenton TM, Scheffer M, Folke C, Schellnhuber H, Nykvist B, De Wit CA, Hughes T, van der Leeuw S, Rodhe H, Sörlin S, Snyder PK, Costanza R, Svedin U, Falkenmark M, Karlberg L, Corell RW, Fabry VJ, Hansen J, Walker B, Liverman D, Richardson K, Crutzen P, and Foley J. Planetary boundaries: exploring the safe operating space for humanity. Ecology and Society 2009; 14(2): Art. 32.

[4] Ciriacy-Wantrup S von. Resource conservation: Economics and policies. University of California Press, Berkeley, US; 1952.

[5] Kildow JT, McIlgorm A. The importance of estimating the contribution of the oceans to national economies. Marine Policy 2010; 34: 367-374.

[6] Scholtens J, Badjeck M-C. Dollars, work and food: understanding dependency on the fisheries and aquaculture sector. Presented at: IIFET 2010: Economics of Fish Resources and Aquatic Ecosystems: Balancing Uses, Balancing Costs. Le Corum, Montpellier, France July 13-16, 2010.

[7] Allison EH. Aquaculture, Fisheries, Poverty and Food Security. World Fish Center Working Paper 2011-65.

[8] Halpern BS, Longo C, Darren H, McLeod KL, Samhouri JF, Katona SK, Kleisner K, Lester SE, O'Leary J, Ranelletti M, Rosenberg A, Scarborough C, Selig E, Best BD, Brumbaugh DR, Chapin FS, Crowder LB, Daly KL, Doney SC, Elfes C, Fogarty MJ, Gaines SD, Jacobsen KI, Karrer LB, Leslie HM, Neeley E, Pauly D, Polasky S, Ris B, St Martin K, Stone GS, Sumaila UR, Zeller D. An index to assess the health and benefits of the global ocean. Nature 2012; 488: 615-620.

[9] Teh LCL, Sumaila UR. Contribution of marine fisheries to worldwide employment. Fish and Fisheries 2013; 14: 77-88.

[10] Barnes-Mauthe M, Oleson KLL, Zafindrasilivonona B. The total economic value of small-scale fisheries with a characterization of post-landing trends: An application in Madagascar with global relevance. Fisheries Research 2013; 147: 175-185.

[11] Béné C, Hersoug B, Allison EH. Not by rent alone: Analysing the Pro-Poor Functions of Small-Scale Fisheries in Developing Countries. Development Policy Review 2010; 28(3): 325-358.

[12] Mills D, Westlund J, Graaf L, de Kura G, Willman Y, Kelleher R K. Under-reported and undervalued: small-scale fisheries in the developing world. pp. 1-15 Managing Small Scale Fisheries: Frameworks and Approaches, eds Pomeroy R, Andrew NL (CABI, Oxford), in: Pomeroy R, Andrew NL (eds.). Small-scale fisheries management: frameworks and approaches for the developing world. CABI, Oxford; 2011 pp 1–15.

[13] Zivin JG, Damon M. Environmental Policy and Political Realities: Fisheries Management and Job Creation in the Pacific Islands. Journal of Environment & Development 2012; 21(2): 198-218.

[14] FAO. The State of World Fisheries and Aquaculture 2010. Rome, FAO. 2010. 197 p.

[15] Quaas MF, Froese R, Herwartz H, Requate T, Schmidt JO, Voss R. Fishing Industry Borrows from Natural Capital at High Shadow Interest Rates. Ecological Economics 2012; 82: 45–52 .

[16] Derraik JGB. The pollution of the marine environment by plastic debris: a review. Marine Pollution Bulletin 2002; 44(9): 842-852.

[17] Cole M, Lindeque P, Halsband C, Galloway TS. Microplastics as contaminants in the marine environment: A review. Marine Pollution Bulletin 2011; 62(12), 2588–2597.

[18] Thompson RC. Plastic debris in the marine environment: consequences and solutions. In: Krause JC, Nordheim H, Bräger S (eds.). Marine Nature Conservation in Europe. Federal Agency for Nature Conservation, Stralsund, Germany; 2006; 107–115.

[19] Andrady A. Microplastic in the marine environment. Marine Pollution Bulletin 2011; 62: 1596-1605.

[20] Smith VH, Schindler DW. Eutrophication science: where do we go from here? Trends in Ecology and Evolution 2009; 24: 201-207.

[21] Gilbert PM, Anderson DM, Gentien P, Graneli, E, Sellner KG. The Global Complex Phenomena of Harmful Algae Blooms. Oceanography 2005; 18: 136-147.

[22] Selman M, Greenhalgh S, Diaz R, Sugg Z. Eutrophication and Hypoxia in Coastal Areas: A global Assessment of the State of Knowledge. WRI Policy Note 2008; 1: 1-6.

[23] IPCC. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. (eds) Stocker TF, Qin D, Plattner GK, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V and Midgley RM. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2013, 1535 pp.

[24] Stramma L, Johnson GC, Sprintall J, Mohrholz V. Expanding oxygen-minimum zones in the tropical oceans. Science 2008; 320: 655-658.

[25] Doney SC. The Growing Human Footprint on Coastal and Open-Ocean Biogeochemistry. Science 2010; 328: 1512-1516.

[26] Doney SC, Fabry VJ, Feely RA, Kleypas JA. Ocean Acidification, the other CO2 problem. Annual Review of Marine Science 2009; 1: 169-192.

[27] Anderson AJ, Mackenzie FT. Ocean acidification: setting the record straight. Biogeosciences Discussions. 2011; 8(3): 6161-6190.

[28] Porzio L, Buia MC, Hall-Spencer JM. Effects of ocean acidification on macroalgal communities. Journal of Experimental Marine Biology and Ecology 2011; 400: 278-287.

[29] Hoegh-Guldberg O, Mumby PJ, Hooten AJ, Steneck RS, Greenfield P, Gomez E, Harvell CD, Sale PF, Edwards AJ, Caldeira K, Knowlton N, Eakin CM, Iglesias-Prieto R, Muthiga N, Bradbury RH, Dubi A, Hatziolos ME. Coral reefs under rapid climate change and ocean acidification. Science 2007; 318: 1737–1743.

[30] Wood R, Collins M, Gregory J, Harris G, Vellinga M. Towards a risk assessment for shutdown of the Atlantic thermohaline circulation. In: Schellnhuber HJ, Cramer W, Nakicenovic N, Wigley T and Yohe G (eds.): Avoiding Dangerous Climate Change. Cambridge Univ. Press; 2008.

[31] Feely RA, Sabine CL, Fabry VJ. Carbon dioxide and our ocean legacy. Science brief 2006; 1-3. URL: http://www.pmel.noaa.gov/pubs/PDF/feel2899/feel2899.pdf [Access date: 2013-07-17].

[32] Woodroffe CD. Coasts: form, process and evolution. Cambridge University Press; 2002.

[33] Patterson M, Hardy D. Economic Drivers of Change and their Oceanic-Coastal Ecological Impacts. In: Patterson M, Glavovic B. Ecological Economics of the Oceans and Coasts. Edward Elgar Publishing Limited, Cheltenham, UK; 2008; 187-217.

[34] WOR (World Ocean Review). World Ocean Review 1. Maribus gGmbH, Hamburg, 2010.

[35] Hanson S, Nicholls R, Ranger N, Hallegatte S, Corfee-Morlot J, Herweijer C, Chateau J. A global ranking of port cities with high exposure to climate extremes. Climatic Change 2011; 104: 89-111.

[36] Black R, Adger WN, Arnell NW, Dercon S, Geddes A, Thomas D. The effect of environmental change on human migration. Global Environmental Change 2011; 21(Supplement 1): S3-S11.

[37] Black R, Bennett SRG, Thomas SM, Beddington JR. Climate change: Migration as adaptation. Nature 2011; 478(7370): 447-449.

[38] Seto KC. Exploring the dynamics of migration to mega-delta cities in Asia and Africa: Contemporary drivers and future scenarios. Global Environmental Change 2011: 21(Supplement 1), S94-S107. DOI: http://dx.doi.org/10.1016/j.gloenvcha.2011.08.005 [Access date 2014-02-24].

[39] Nicholls RJ, Wong PP, Burkett V, Codignotto J, Hay J, McLean R, Ragoonaden S, Woodroffe CD, Abuodha PAO, Arblaster J. Coastal systems and low-lying areas. In: Parry M, Canziani O, Palutikof J, van der Linden P, Hanson C (Eds.). Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK; 2007; pp. 315-356.

[40] Nicholls RJ, Cazenave A. Sea-Level Rise and Its Impact on Coastal Zones. Science 2010; 328(5985): 1517-1520.

[41] IPCC, Intergovernmental Panel on Climate Change. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA; 2012; 582 pp.

[42] Brown S, Nicholls R, Woodroffe C, Hanson S, Hinkel J, Kebede A, Neumann B, Vafeidis ATl. Sea-Level Rise Impacts and Responses: A Global Perspective. In: Finkl CW, editor. Coastal Hazards. Springer Netherlands; 2013: 117-49.

[43] Legerski JP, Vernberg EM, Noland BJ. A Qualitative Analysis of Barriers, Challenges, and Successes in Meeting the Needs of Hurricane Katrina Evacuee Families. Community Mental Health Journal 2012; 48(6): 729-740.

[44] Newton A, Carruthers TJB, and Icely J. The coastal syndromes and hotspots on the coast. Estuarine Coastal and Shelf Science 2012; 96: 39-47.

[45] Syvitski JPM, Kettner AJ, Overeem I, Hutton EWH, Hannon MT, Brakenridge GR, Day J, Vorosmarty C, Saito Y, Giosan L, Nicholls RJ. Sinking deltas due to human activities. Nature Geoscience 2009; 2(10): 681-686.

[46] Derksen C, Smith SL, Sharp M, Brown L, Howell S, Copland L, Mueller DR, Gauthier Y, Fletcher CG, Tivy A, Bernier M, Bourgeois J, Brown R, Burn CR, Duguay C, Kushner P, Langlois A, Lewkowicz AG, Royer A, Walker A. Variability and change in the Canadian cryosphere. Climatic Change 2012; 115: 59-88.

[47] Forbes DL (Ed.). State of the Arctic Coast 2010 – Scientific Review and Outlook. International Arctic Science Committee, Land-Ocean Interactions in the Coastal Zone, Arctic Monitoring and Assessment Programme, International Permafrost Association, Geesthacht, Germany, 2011; 178 p.

[48] Lantuit H, Overduin P P, Couture N, Wetterich S, Are F, Atkinson D, Brown J, Cherkashov G, Drozdov D, Forbes D L, Graves-Gaylord A, Grigoriev M, Hubberten HW, Jordan J, Jorgenson T, Odegard RS, Ogorodov S, Pollard WH, Rachold V, Sedenko S, Solomon S, Steenhuisen F, Streletskaya I, Vasiliev A. The Arctic Coastal Dynamics Database: A New Classification Scheme and Statistics on Arctic Permafrost Coastlines. Estuaries and Coasts 2012; 35(2): 383-400.

[49] Kron W. Coasts: the high-risk areas of the world. Natural Hazards 2013; 66: 1363-1382.

[50] UNEP/UNESCO-IOC, 2009. Regular Process for Global Reporting and Assessment of the State of the Marine Environment Including Socioeconomic Aspects, UNGA resolution 64/71.

[51] Global Partnership for Oceans (GPO). URL: http://www.globalpartnershipforoceans.org/ [Access date 2013-07-18].

[52] Meadows DH, Meadows DL, Randers J, Behrens WW. The Limits to Growth: A report for the Club of Rome's Project on the Predicament of Mankind. New York: Universe Books; 1972.

[53] Arrow KJ, Dasgupta P, Mäler K. Evaluating projects and assessing sustainable development in imperfect economics. Environmental and Resource Economics 2003; 26: 647–685.

[54] Alfsen K, Greaker M. From natural resources and environmental accounting to construction of indicators for sustainable development. Ecological Economics 2007; 61: 600–619.

[55] Dasgupta P. The welfare economic theory of green national accounts. Environmental and Resource Economics 2009; 42: 3–38.

[56] Arrow KJ, Dasgupta P, Goulder L, Mumford K, Oleson K. Sustainability and the measure of wealth. Environment and Development Economics 2012; 17: 317–353.

[57] Atkinson G, Dubourg R, Hamilton K, Munasinghe M, Pearce D, Young C. Measuring Sustainable Development: Macroeconomics and the Environment. Elgar, Cheltenham [a.o.]; 1997.

[58] Victor PA. Indicators of sustainable development: some lessons from capital theory. Ecological Economics 1991; 4: 191–213.

[59] Pearce D, Markandya A, Barbier E. Blue print for a green economy. Earthscan, London, 1989.

[60] Hartwick J. Natural resources, national accounts, and economic depreciation. Journal of Public Economics 1990; 43: 291–304.

[61] Daly H, Cobb J. For the common good. Boston: Beacon Press; 1989.

[62] Ott K, Döring R. Theorie und Praxis starker Nachhaltigkeit. Marburg: Metropolis; 2nd edition 2008.

[63] Sluijs J van der. Uncertainty and dissent in Climate Risk Assessment: A Post-Normal Perspective. Nature and Culture 2012; 7(2): 174-195.[64] Baumgärtner S, Quaas MF. What is sustainability economics? Ecological Economics 2010; 69(3): 445-450.

[65] Ott, K. Ipso Facto: Zur ethischen Rekonstruktion normativer Implikate wissenschaftlicher Praxis. Frankfurt/M.: Suhrkamp; 1997.

[66] Krellenberg K, Kopfmüller J, Barton J. How sustainable is Santiago de Chile? Current performance, future trends, potential measures. Synthesis report of the Risk Habitat Megacity research initiative (2007-2011). Umweltforschungszentrum UFZ, Leipzig; UFZ-Report 2010; 4.

[67] Douvere F. Marine spatial planning: Concepts, current practice and linkages to other management approaches. Ghent University; 2010.

[68] Sterr H, Colijn F. Perspectives for Integrated Coastal Zone Management: German and International Issues. In: Gee K, Kannen A, Sterr H (eds.). Integrated Coastal Zone Management: What lessons for Germany and Europe? Berichte aus dem Forschungs- und Technologiezentrum Westküste der Universität Kiel, Germany; 1999; 21 (ISSN 0940-9475).

[69] Glavovic BC. ICM as a transformational practice of consensus building: A South African perspective. Journal of Coastal Research 2006; SI 39: 1706 – 1710.

[70] Bruns A. Governance im Küstenraum, Europäische Umweltpolitik im Wandel; Die Umsetzung des Integrierten Küstenzonenmanagements und der Wasserrahmenrichtlinie an der Westküste Schleswig-Holsteins. Dissertation, Christian-Albrechts-Universität zu Kiel, Germany; 2010. URN:

urn:nbn:de:gbv:8-diss-50595. Available from: http://eldiss.uni-kiel.de/macau/receive/dissertation_diss_00005059 [Access date 2014-02-24].

[71] TST (Technical Support Team) (2013): TST Issues Brief: Oceans and Seas. Preparation of this issues brief has been co-led by DESA, ESCAP, FAO, UNDP, UNEP, UNESCO-IOC, World Bank, with contributions from CBD Secretariat, IAEA, ILO, IMO, OLA/DOALOS, OSAA, UNOOSA, UN Women, WMO and WTO. http://sustainabledevelopment.un.org/content/documents/2311TST%20Issues%20Brief%20Oceans%20and%20Seas_FINAL.pdf [Access date 2014-02-24].

[72] Sachs JD. From Millennium Development Goals to Sustainable Development Goals. The Lancet 2012; 379 (9832): 2206-2211.