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Towards Climate Resilient Ocean Economies in Africa

Africa Natural Resources Management and Investment Center
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ACRONYMS AND ABBREVIATIONS

ABNJ	Areas Beyond National Jurisdiction
ADB	Asian Development Bank
AfDB	African Development Bank
AIMS	Africa Integration Marine Strategy
AU	African Union
BBNJ	Biodiversity Beyond National Jurisdiction
BE	Blue Economy
BNCFF	Blue Nature Conservation Finance Facility
CBD	Convention on Biological Diversity
CBD	Ecosystem-Based Approaches
CEN–SAD	Community of Sahel–Saharan States
COMESA	Common Market for Eastern and Southern Africa
CPIC	Coalition for Private Investment in Conservation
EAC	East African Community
EC	European Commission
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EEZ	Exclusive Economic Zone
EIB	European Investment Bank
ESG	Environmental, Social and Governance
ESIA	Environment and Social Impact Assessment
EU	European Union
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GFCM	General Fisheries Commission for the Mediterranean
GMP	Gross Marine Product
GOAP	Global Ocean Accounts Partnership
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICZM	Integrated Coastal Zone Management
IGAD	Intergovernmental Authority on Development
IORA	Indian Ocean Rim Association
IOTC	Indian Ocean Tuna Commission
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
LME	Large Marine Ecosystems
MDTF	Multi-donor trust fund
MGR	Marine Genetic Resources
NM	Nautical miles
MSP	Marine Spatial Planning
NbS	Nature-based solutions
NCC	Natural Capital Coalition () and the
NCP	Nature's Contributions to People
O-A-F	Ocean Accounting Framework
OESA	Ocean Economy Satellite Accounts
OFI	Oceans Financing Initiative
ORRAA	Ocean Risk and Resilience Action Alliance
PI	Principles for Positive Impact Finance
PRB	Principles for Responsible Banking
PRI	Principles for Responsible Investment
PROG	Partnership for Regional Ocean Governance
PSI	Principles for Sustainable Insurance
REC	Regional Economic Commission
S&HCC	Social & Human Capital Coalition
SADC	Southern African Development Community.
SBE	Sustainable Blue Economy
SBEC	Sustainable Blue Economy Conference
SBEFI	Sustainable Blue Economy Finance Initiative
SDG	Sustainable Development Goals
SEA	Strategical Environmental Assessments
SEAFO	South East Atlantic Fisheries Organisation
SEEA	System of Environmental-Economic Accounting
SIDS	Small Island Developing States
SIOFA	Southern Indian Ocean Fisheries Agreement
SLR	Sea level rise
SNA	Systems for National Accounts
TEEB	The Economics of Ecosystems and Biodiversity
TNC	The Nature Conservancy
UMA	Arab Maghreb Union
UN	United Nations
UNCLOS	UN Convention Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WAVES	Wealth Accounting and Valuation of Ecosystem Services
WB	World Bank
WIO	Western Indian Ocean
WTW/GERF	Willis Towers Watson / Global Ecosystem Resilience Facility
WWF	Worldwide Fund for Nature

EXECUTIVE SUMMARY

Sustainable economic development based on the oceans and meeting the aspirations of individual countries, the African Union, economic actors and the African public has many different labels. The choice of either of the terms ‘blue’ or ‘ocean’ linked to ‘economy’ are used in different contexts, but the key attributes desired include minimizing damage to the environment and natural assets, generating benefits and opportunities equitably for people, and promoting resilience to climate change. This report uses the terms ‘blue economy’ and ‘ocean economy’ synonymously – as the business, local and national economies, citizens, beneficiaries and potential victims are the same.
Natural ecosystem assets generate goods and services which are the primary resources of the blue or ocean economy, with annual benefit flows estimated at $20.8 billion for ten Western Indian Ocean countries and $47 billion for the five North African countries bordering the Mediterranean. The national dependence on ocean economy sectors varies, with the highest levels for Small Island States, where the estimated ocean output may be as high as 50% of Gross Domestic Product (GDP). This paper explores the multiple dimensions of a climate resilient ocean or blue economy, focusing on aspects of climate change, resilience in natural and social dimensions, and emerging investment models. Africa is pivoting towards the blue economy as a new frontier for development, with strong imperatives to assure its profitability, sustainability and inclusivity, while facing the worsening threat of climate change and other global challenges. The purpose of this paper is to lay out key principles for climate resilience in the blue economy into the future.

At present African ocean economies are highly dependent on inshore resources and ecosystems within their Territorial Seas, with plans to extend economic developments across the Exclusive Economic Zones, Extended Continental Shelf claims, and into the High Seas. Historically the focus of ocean economic or maritime planning has been on security to protect boundaries and on investment in individual sectors such as fisheries or transport. Emerging challenges and priorities and global trade are all requiring a shift to a broader multi-sectoral focus and an increased use of knowledge and data on ocean and climate dynamics to shape policies and consider how these affect economic sectors and overall sustainability.

Climate change is a unique and pervasive challenge for sustainable ocean economic development. African ocean systems are impacted in multiple ways – experiencing for example increases in sea surface temperature, changes in ocean currents and acidity, shifts of species to higher latitudes, and ecosystem changes. A critical factor in the ocean is the dynamism and movement of whole systems, such as current regimes, increasing unpredictability and the magnitude of fluctuations and biodiversity responses and loss resulting from climate change. These climate-induced changes impact on entire economic sectors – for example, the change in productivity and dynamics of upwelling currents affects fishery stocks (e.g., in the Canary Current); and the collapse of coral reefs impacts on small scale fishers and tourism industries (e.g. in east and southern Africa). The consequences include direct losses (such as loss of fish catch, or tourism revenue) or increased uncertainty about future trends and thus of investments. These uncertainties are driven by many factors including the local context, the interactions between several factors at multiple scales, the interactions with climate change elements, and uncertainty about the carbon emissions scenario that may yet unfold. Economic sectors and individual actors must cope with these uncertainties and governments must deal with the threats emerging from climate change to build long term security and profitability and protect the interests of stakeholders and citizens.

The foundations for climate resilience lie in ensuring the natural assets on which economic activity depends are secured and even enhanced, and that economic production and consumption processes do not degrade them. Any practices that damage natural assets – e.g., overharvesting, pollution, invasive alien species, illegal wildlife use – need to be transformed so that the condition of nature can improve. Approaches to achieve improvements in ways that achieve a triple-win for people, economic activity and nature can be developed through Ecosystem-Based Approaches (EBA), appropriate Nature-based Solutions (NbS), and restoring ecological functions. These solutions can be designed to meet multiple objectives: conserving ecosystems and species, providing for climate mitigation and adaptation objectives, and allowing for specific economic and human welfare benefits. Essentially, solutions must not have negative impacts on nature or people, which has occurred in the past due to overly narrow planning perspectives. While it is undoubtedly a challenge to transform existing practices, investors increasingly see significant opportunities in doing so, particularly in addressing climate change and long-term sustainability challenges. Nurturing this interest requires enabling policies for innovation and forward thinking, and policies that incentivize protecting natural assets from damage.

In order to support such interventions at the scale needed, a wide range of institutional and investment innovations are necessary. A shift is required from a siloed approach to planning economic sectors to more integrated, multi-sectoral planning where the needs and risks of sectors and major stakeholders are considered together. The foundations for this were built through Integrated Coastal Zone Management (ICZM) processes in recent decades, and currently through expansion in Marine Spatial Planning (MSP) efforts across more countries to cover 100% of ocean space within national jurisdictions (across Exclusive Economic Zones) and potentially into the High Seas. New systems for measuring and monitoring natural assets and resources, to provide data into marine spatial planning processes and to account for them in national planning and economic frameworks are needed and are currently under development, under the general label of “Ocean Accounts”, with a community of practice (including an Africa-focused one) building through the Global Ocean Accounts Partnership (GOAP).

A wide range of investment options are already deployed in ocean sectors–innovations in ‘blue finance’ currently underway are developing blended instruments involving multiple partners, corresponding to the different levels of risk associated with ocean and climate opportunities. Initiatives led by multi-lateral development banks include the Asian Development Bank’s Oceans Financing Initiative (OFI) and Healthy Ocean Action Plan, the World Bank’s PROBLUE, a new multi-donor trust fund (MDTF) that supports “healthy and productive oceans” and the European Investment Bank (EIB)’s Blue Sustainable Ocean Strategy (Blue SOS). New funds are emerging that may support innovations, including the Green Climate Fund (GCF) and the Global Environmental Facility (GEF). Specific financing initiatives have been developed with the following foci: on coastal communities and Small Island Developing States (SIDS); bringing together civil society organizations; bringing together private and public sector financial institutions and academia; fostering investment in protecting, restoring and enhancing natural ecosystems; innovating in finance and risk management opportunities to develop resilience for vulnerable ecosystems; and integrating previously separate efforts to build and finance natural, social, and human capitals together. ‘Blue bonds’ have been developed: by the government of the Seychelles, combining debt conversion and protecting 30% of their ocean territory; by the Norwegian Investment Bank for water-related projects around the Baltic Sea; and in a private-sector bond involving the World Bank and Morgan Stanley, addressing marine plastic waste pollution.

These initiatives may serve as models or as future sources of funds or expertise in establishing climate resilient blue economy financing for Africa, for which the introduction of an umbrella fund, or a set of guiding principles or a regulatory framework will support or guide the growth of climate resilient, sustainable blue economy actors and sectors across African states.

1. A CLIMATE-RESILIENT OCEAN ECONOMY

This background paper explores the multiple dimensions of a climate resilient ocean or blue economy. Using a climate vulnerability perspective, and drawing upon a conceptual framework in systems thinking, the paper defines the multiple domains of the blue ocean economy and outlines emerging finance and investment approaches for the sector.

Section 1 focuses on exploring and defining the terms 'climate' and 'resilience', as well as 'ocean' and blue' in relation to economy, in order to align the terminology used by the African Development Bank (AfDB) (ocean economy) and the African Union (blue economy). Following this, section 2 specifies the scales and scope of the ocean that must be considered. Section 3 outlines the principal domains in which planning must occur for climate resilience to be meaningful – with regards to nature, economy, society, and the need for novel and expanding measures and governance approaches and principles. Section 4 focuses on some key ocean economy sectors, some of which are covered by companion background papers to this one. Some of these sectors impact on or are impacted by climate change and the health of ocean ecosystems, have different dimensions of resilience, and may enhance or undermine broader aspects of societal resilience to climate change. Section 5 outlines the current principles of finance and investment in the sustainable blue economy sector, emphasizing the urgent need for improved principles, guidance and praxis to guide the consistent expansion of sustainable blue economy finance. Section 6 concludes with a short synthesis and a summary of 'key arguments' from the main text. Given the complexity of the topic and immense variability of all aspects both among countries and among locations within countries, these arguments are intended to be illustrative, to stimulate a deeper consideration of these approaches for any individual location, sector or country that might also be planning a more climate resilient ocean economy.

1.1. CONTEXT

Scientists describe the coming decades as a new period in history, the Anthropocene (Zalasiewicz et al., 2017), when human actions are changing the global climate, and the physical state and productivity of natural ecosystems (e.g., savannah, forest, coral reefs, mangroves) and of human production ecosystems (e.g., farmland, pasture, aquaculture/fishery bodies). This has been caused by planetary-scale impacts of the human economy and way of life to earth systems such as the climate, to the cycles of carbon, nitrogen and other elements, to ozone in the atmosphere, and to biological diversity. Historical business and commercial responses to declining production resulted in additional investment in inputs such as fertilizers and chemical treatments against diseases and pathogens. In the short term these interventions may increase outputs and profits, but also increase both the investment costs, and inflict collateral damage on natural systems, often locking investors in a spiral of declining natural assets and narrowing margins. A new approach is emerging, recognizing the foundational role that nature and natural systems play in economic sectors, both on land and in the sea. This approach reduces pressures on natural systems, such as by lowering inputs of polluting fertilizers and balancing the offtake of resources to optimize the health of biological systems, on both land and sea.

Terrestrial ecosystems and production systems have faced much greater pressure than oceans and water bodies, but now attention is moving to the latter. In Africa, the ocean is under-utilized, though nevertheless strongly impacted by unplanned and damaging extraction and land-based impacts. The ocean is seen as a new frontier to support development, and calls for a new paradigm of sustainable and resilient practices are growing at all levels including in the African Union with its vision stated as "The overarching vision of the 2050 Africa Integrated Marine Strategy (AIMS) is to foster increased wealth creation from Africa's oceans and seas by developing a sustainable thriving blue economy in a secure and environmentally sustainable manner" (African Union, 2014), in individual countries, across sectors, and down to small businesses and communities. The challenge for African countries and businesses will be how to develop ocean assets sustainably and inclusively (Obura, 2018), to assure long term economic and livelihood security as continental population and economic demands grow rapidly over the next century.

The African Development Bank's 2013-2022 strategy created a strong focus on 'inclusive growth and transition to green growth' establishing a strong foundation for new opportunities and priorities for a 'sustainable and inclusive blue economy' in the next strategy and beyond. This paper presents some key foundations for the Bank and others to consider, to build on these foundations to develop a continental 'sustainable ocean or blue' economy that is resilient to climate change, and which remains productive and vibrant long into the future. Given the interlinkages between the global threats and pressures affecting natural systems, dealing effectively with climate change will also provide opportunities and pathways to tackle other major challenges. The zoonotic origins of the COVID-19 virus (Wong et al., 2019) is attributed to many of the same drivers as climate change, including human population and economic growth, habitat fragmentation, and unsustainable uses of nature. The COVID-19 pandemic represents one of the many possible threats that can emerge from unsustainable practices. In general, the solutions to it, if implemented holistically, are consistent with the Sustainable Development Goals (SDGs), which should put in place the infrastructure for addressing many of the sustainability threats the African continent will face in coming decades. Delivering a climate resilient ocean economy could transform the prospects for tens or even hundreds of

millions of Africans, lifting them from poverty and a systemic lack of opportunities to a 'Good Quality of Life' (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES], 2019).

1.2. CLIMATE CHANGE IN THE OCEAN

Climate change is comprehensively assessed by the Intergovernmental Panel on Climate Change (IPCC) in its periodic Assessment Reports. The fifth report was published in 2014 with the sixth due in 2022, with special reports on thematic topics such as on the oceans and cryosphere (IPCC, 2019), and on 1.5 degree warming (IPCC, 2018). The data tells us that carbon dioxide concentrations in the atmosphere reached 410.5±0.2 parts per million (ppm) in 2019, the global average temperature warmed 1.2 C by 2020, and the last five years have been among the warmest on record (World Meteorological Organization [WMO], 2020). The ocean absorbs 75% of carbon dioxide emissions and 90% of the excess heat from global warming, and the surface ocean has warmed about 0.7 C. The Indian Ocean has warmed faster than other oceans, by about 1.0 C (Roxy et al., 2020).

Climate shifts affecting African seas and oceans include rising ocean temperatures, ocean acidification, changes in cyclone and storm activity, the rise in sea level (affecting shorelines, but with little impact on ocean ecosystems), changing currents, altered river and sediment dynamics due to changes in rainfall and interactions with many terrestrial changes. The impacts of these climate shifts on biota include fundamental changes in traits including: growth rates and phenology; timing of major processes such as reproduction and spawning; physiological stress imposing metabolic costs on organisms and thereby reduced health or resistance to other factors; mortality of organisms such as reef-building corals sensitive to heat-waves; latitudinal shifts in species distributions as they track changing temperature belts; and other important changes in habitats and ecosystems.

Both physical climate changes and impacts to biota impact on people in many significant ways through: changing weather and climate patterns (such as heatwaves, floods, droughts); changes in growing cycles and the productivity of natural systems, crops and livestock; changes in the health, abundance and distribution of wild species such as fish or wildlife; changes in tourism attractions such as the changing presence or absence of charismatic species or of wildlife spectacles; and changes in the presence, distribution and activities of disease vectors and pathogens.

Tables 1 and 2 summarize information on African ocean-related climate impacts and vulnerabilities in two key IPPC reports – the Special Report on Oceans and the Cryosphere (IPCC, 2019) and the Fifth Assessment report chapter on Africa in relation to climate change impacts, vulnerability and adaptation (IPCC, 2014). Africa straddles the equator and extends north and south to warm-temperate waters. Its coastal seas are thus impacted by climatic shifts in two ways. Firstly, conditions are already warmest at the equator, with large movements of temperature belts, and thus species and ecosystems, northwards and southwards are expected (Burrows et al., 2014). Warming zones at the equator have no source regions for high temperature-adapted species to migrate in from, so ecological collapse and niche gaps may occur, with low productivity and little resilience for generating services or benefits to people. Secondly, at the northern and southern extremes of the continent cooler climatic belts will shift too far north and south, and coastal seas will lose the species and habitats that are characteristic of them. Thus, at the equator, and northern and southern limits, climate impacts to biota and people may be particularly high.

TABLE 1:

Summary of ocean-climate impacts to marine ecosystems and dependent communities.

	Text mentioning Africa	Section
01	A projected global mean SLR of ~1.2 m under the upper likely range of RCP8.5 by 2100 implies … a loss of 43% in the nesting area of green turtles in West Africa (Patrício et al. 2019)	5.3.3 Sandy beaches
02	Coastal fisheries in the Canary Current are an important source of micronutrients to nearby West African countries (Golden et al. 2016) that have particularly high susceptibility to climate change impacts and low adaptive capacity	Box 5.3 Upwelling systems
03	Challenges in food insecurity reside in low-latitude regions such as … West Africa where maximum fisheries catch potential is projected to decrease under climate change (Golden et al. 2016; Hilmi et al. 2017)	5.4.2.1.3 Food security
04	Modeling of seafood trade … Central and West African nations are particularly vulnerable to shocks from decrease in seafood supply from international imports … vulnerability to climate impacts on catches and seafood supply elsewhere (Gephart et al. 2016)	
05	In West Africa, the industrial fishery response to climate change induced reductions in landings was the expansion of fishing grounds, which increased operational costs (Belhabib et al. 2016)	5.5.2.2.3 Adaptation in fisheries
06	Coastal adaptation framework literature is dominated by Australian, North American and European cities, with fewer studies from African and Caribbean sites, least developed countries and SIDS (Kuruppu and Willie, 2015; Torresan et al. 2016)	5.5.2.3 Ocean-based adaptation

Adapted from IPCC (2019) IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. 2019.

TABLE 2:

Summary of ocean-climate impacts on Africa. Based on citation of the terms 'ocean', 'marine' and 'coastal' but excluding impacts related to non-ocean ecosystem areas – such as water resources and urban impacts.

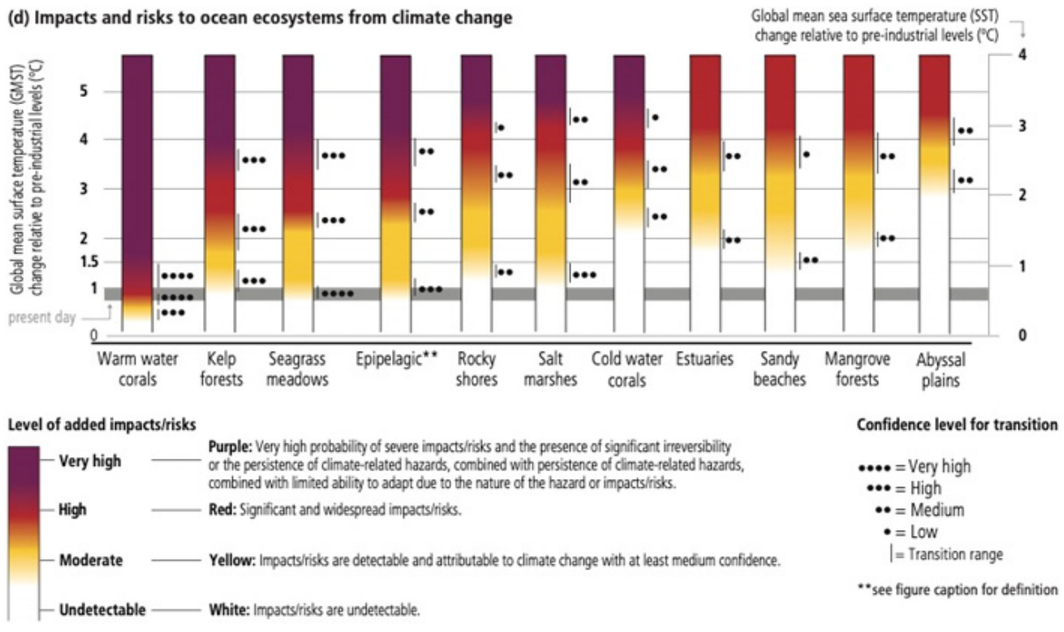
	Ocean, marine and coastal examples of climate change impacts in Africa	Section
01	Ocean ecosystems, in particular coral reefs, will be affected by ocean acidification and warming as well as changes in ocean upwellings, thus negatively affecting economic sectors such as fisheries (medium confidence).	Exec Summ, para 4.
02	Warming of the near surface temperature and an increase in the frequency of extreme warm events has been observed for countries bordering the western Indian Ocean between 1961 and 2008 (Vincent et al., 2011b)	22.2.1.1 Observed Trends
03	Impacts through high sea levels combined with storm swells … in Durban in March 2007, a storm swell up to 14 m combined with a high astronomic tide at 2.2 m, leading to damages estimated at US$100 million (Mather and Stretch, 2012)	22.3.2.3 Coastal and ocean ecosystems
04	Flooding of river deltas or an increased migration toward coastal towns due to increased drought induced by climate change (Rain et al., 2011), will also affect coastal zones	
05	Some South African sea bird species have moved farther south over recent decades, but land use change may also have contributed to this migration (Hockey and Midgley, 2009; Hockey et al., 2011)	
06	The Canary current has warmed since the early 1980s, and there is medium evidence and medium agreement that primary production in the Canary current has decreased over the past 2 decades	
07	Changing temperatures in the Canary current has resulted in changes to important fisheries species (e.g., Mauritanian waters have become increasingly suitable for Sardinella aurita)	
08	There is medium agreement despite limited evidence that the Benguela system will experience changes in upwelling intensity as a result of climate change	
09	In Africa, fisheries mainly depend on either coral reefs (on the eastern coast) or coastal upwelling (on the western coast) … both will be affected by climate change through ocean acidification, a rise in sea surface temperatures, and changes in upwelling	
10	Coastal countries of West Africa will experience a significant negative impact from climate change. Lam et al. (2012) projected that by 2050 (under an A1B scenario) the annual landed value of fish for that region is estimated to decline by 21%, resulting in a nearly 50% decline in fisheries-related employment and a total annual loss of $311 million to the region's economy.	22.3.4.4 Fisheries

Adapted from Intergovernmental Panel on Climate Change IPCC (2019) Special Report on the Ocean and Cryosphere in a Changing Climate. 2019.

The 'safer limit' for climate change, up to which climate change impacts could be more manageable, was identified by the IPCC as up to 1.5°C warming above pre-industrial levels. This warming is only 0.3°C higher than today, and already impacts are being experienced in coral reefs, the most sensitive of ocean ecosystems to warming, at regional and global scales as figure 1 shows. African coastal seas are among the most vulnerable to climate change on account of Africa's equatorial location and thus will experience high rates of species migration to higher latitudes. Significantly, there are no source regions of species already adapted to the new warmer conditions at the equator (IPCC, 2014). This may result in particularly high vulnerability of coastal communities dependent on activities such as fishing World Bank, 2019). Understanding the full dimensions of social and ecological vulnerability to climate change is essential to protect the majority of Africa's population living directly from ecosystem services, and hence the importance of climate resilience in planning for future development.

FIGURE 1:

The 'burning embers' illustration on the vulnerability of marine ecosystems shows the immediate threat to coral reefs at today's level of warming.



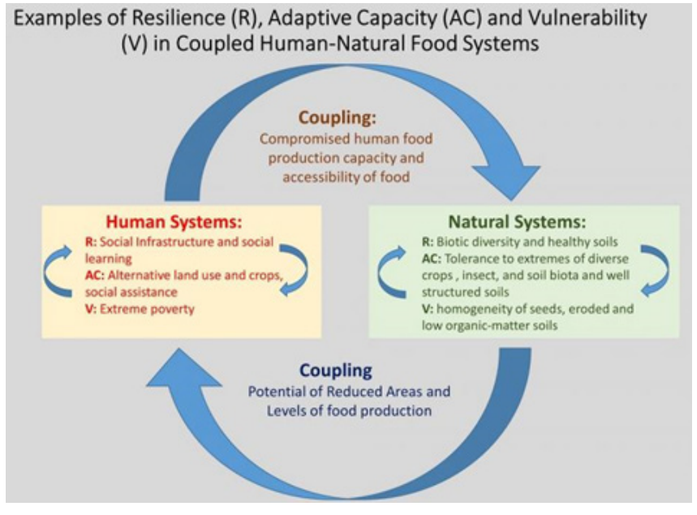
From Intergovernmental Panel on Climate Change. (2019). Summary for Policymakers. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. 2019. [H.- O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (Eds.)].

1.3. RESILIENCE – ECOLOGICAL, SOCIAL AND ECONOMIC

Resilience describes the response of complex natural, social and other systems to disturbances and threats. It relates to their ability to resist changes, and if impacted, to return to their prior state and 'normal' functioning (Holling, 1973; Folke, 2006;). People and economic activities dependent on nature are thus dependent on the degree of nature's resilience to climate change. A further level of social or economic resilience is also relevant – the degree to which people and economic practices can accommodate and adapt to changes in the natural system. This may include the ability to recover from unavoidable shifts, and to shift to alternative sources or activities to maintain economic or social wellbeing (figure 2). But current climatic shifts are moving the earth's climate outside of its recent envelope. Economic and business practices, and social and cultural systems, as well as ecosystems and species, must now evolve and cope with unprecedented changes in order to remain stable and productive.

FIGURE 2:

Concepts of social and ecological resilience in coupled agri-food systems.



From Karl Zimmerer and Steven Vanek, as cited in https://serc.carleton.edu/integrate/teaching_materials/food_supply/student_materials/1059.

An important factor for Africa's economic future is the high dependence of its people, and their economic welfare, on natural systems (Box A). Eighty percent of sub-Saharan agriculture and food production is rain-fed, and rural and low-income urban dwellers are entirely dependent on ecosystem services (such as freshwater provision, flood protection, climate regulation, pollination, and

shelter) or are highly exposed to weather and extreme events (such as floods, droughts, and storms). Maintaining and enhancing the ability of natural systems to continue to provide ecosystem services that support peoples' lives are fundamental pillars of a 'climate resilient' approach to development. This means that the sustainability of human-nature interactions and minimizing damage to nature's abilities to regenerate (such as growth of vegetation and crops, recovery of habitats from extreme events), are critical. For the vast majority of Africa's population, a 'climate resilient' economy must be an ecologically sustainable one – able to withstand climate shocks – and this is true for both ocean-dependent sectors and terrestrial ones.

Box A. Africa's dependence on natural capital/resources.

The United Nations Environmental Programme (UNEP) describes Africa's relationship with its natural resources: "In most African countries, natural capital accounts for between 30 per cent and 50 per cent of total wealth. Over 70 per cent of people living in sub-Saharan Africa depend on forests and woodlands for their livelihoods. Land is an economic development asset as well as a socio-cultural resource. A significant share of these resources is, however, used unsustainably while others are lost through illegal activities, meaning that the stream of benefits generated from these resources is being reduced over time. For instance, Africa loses an estimated $195 billion annually of its natural capital through illicit financial flows, illegal mining, illegal logging, illegal trade in wildlife, unregulated fishing, environmental degradation and loss among others." (UNEP, nd.)

1.4. OCEAN ECONOMY OR BLUE ECONOMY

Definitions of the terms 'ocean economy' and 'blue economy' have varied geographically, as well as over time (Garland et al., 2019). The Food and Agriculture Organization (FAO) contextualizes the potential for fisheries and aquaculture from the ocean under the term 'blue growth', with a particular focus on Small Island Developing States (SIDS) (FAO, 2014). In this framing, 'blue growth' focuses on economic growth and livelihood systems based on ecosystem services, with a particular focus on fishery and aquaculture stocks, and addresses sustainability, environmental and social protection factors through the corporate social responsibility policies of industry actors. The European Union initially focused on 'blue growth' in key economic production sectors (FAO, 2014) (e.g., fisheries and maritime trade) to support regional integration and alignment, then broadened its definition to include various benefits to society, including business services and arts (Garland et

al., 2019). With a broader development paradigm, the World Bank and United Nations, and organisations such as the Worldwide Fund for Nature (WWF) have developed blue economy principles further aligned with the broader social and environmental components of the SDGs rather than just an economy-focused approach, establishing explicit principles and practices (Box B).

Box B. Key principles for a 'sustainable blue economy'.

Sustainable blue economy (WWF 2014):

- provides social and economic benefits for current and future generations;
- restores, protects and maintains the diversity, productivity, resilience, core functions, and intrinsic value of marine ecosystems;
- is based on clean technologies, renewable energy, and circular material flows;
- is governed by public and private processes that are
  - *o inclusive;*
  - *o well-informed, precautionary and adaptive;*
  - *o accountable and transparent;*
  - *o holistic, cross-sectoral and long-term; and*
  - *o innovative and proactive.*

Actions and commitments from both public and private actors required for a sustainable and inclusive blue economy (EU, 2018):

- set clear, measurable, and internally consistent goals and targets;
- assess and communicate performance on these goals and targets;
- create a level economic and legislative playing field that provides the blue economy with adequate incentives and rules;
- plan, manage and effectively govern the use of marine space and resources, applying inclusive methods and the ecosystem approach;
- develop and apply supportive standards, guidelines and best practices;
- recognize that the maritime and land-based economies are interlinked and that many of the threats facing marine environments originate on land;
- actively cooperate and share information, knowledge, best practices, lessons learned, perspectives, and ideas.

The African Union has defined its perspective on the blue economy through its African Integrated Marine Strategy (AIMS) (African Union, 2014). In its Agenda 2063 'The Africa we Want' vision, the blue or ocean economy is identified as a key component for the delivery of prosperity, integration, good governance,

peace and security, strong and shared cultures, people-driven development and global influence (African Union, 2015)[1] . The AIMS further describes the blue economy as a "marine version of the green economy, one that improves African citizens' well-being while significantly reducing marine environmental risks as well as ecological and biodiversity deficiencies". Also relevant to African concepts of the blue economy are those developed by the Indian Ocean Rim Association (IORA), of which African countries are active members, building a clear perspective (Mohanty et al., 2015; Attri & Narnia Bohler-Muller, 2018) aligned with growth from ocean resources related to the blue economy policies of key countries such as South Africa, Mauritius and Malaysia, and articulating the need to focus on ocean health as a foundation for future sustainability (Obura, 2018).

Given the broad use of both the terms 'blue economy' and 'ocean economy' for Africa, it is important to make the case that they should be used synonymously – as the business, local and national economies, citizens, beneficiaries and potential victims are the same.

Further, this background paper points to the equivalence between the terms 'climate resilient' and 'sustainable and inclusive', used with the terms 'ocean economy' and 'blue economy'.

With irreversible climate change under way, the only way to assure resilience is through ecological sustainability based on inclusivity of all people. Key messages from this introductory section are synthesized in Box C in the form of general principles or 'take home messages or arguments' – important for influencing thinking in a forward-facing strategy for a climate-resilient blue economy for Africa.

Box C. 'Take home' arguments on climate vulnerability of natural systems in Africa.

Impacts on nature

- Climate change impacts all ecosystems, by changing basic environmental conditions. In the ocean, the key conditions being affected are temperature, pH, oxygen concentration, currents, and storm patterns.
- Some ecosystems and species are more obviously vulnerable, for example coral reef impacts are already clear to see. Many ecosystems and species appear less vulnerable and may not show impacts yet. By their nature biological systems resist and buffer change – but when their limit of resilience is reached a 'tipping point' may suddenly occur, and their status and health

[1]It is notable that the African Union specifies that blue economic approaches are inclusive of freshwater bodies. Though not addressed specifically in this document, the approaches identified here are also applicable to those with some adaptation, particularly for transboundary water bodies such as the Great Lakes of East Africa, or the major river systems and basins, where multi-scale issues must be addressed from regional scales down to local.

may alter suddenly and irreversibly. This may trigger other sudden and irreversible changes elsewhere in the ecosystem and effects may multiply. An apparent immediate lack of change should not be interpreted as a lack of impact – unless sound science and evidence indicate otherwise, a precautionary approach is essential to remain a safe distance from potential ecological and social tipping points.

- In the hottest equatorial climate belts, warming impacts are at their highest as natural systems are already near their upper temperature tolerance limits. With future warming there are no natural 'sources' of new species or ecosystems to take over. As a result, future biological systems will be more depauperate and less productive, and 'novel' systems will emerge with very little predictability of what they may be, or how beneficial they may be to people and livelihoods.
- In cooler climate belts to the north and south, species and habitats may migrate to stay with their climate belt, but there are likely to be two caveats: a) not all species or features will migrate at the same rate, so assemblages and habitats will break down and functions and ecosystem services will decline (some functions or services may increase, as predicted for some fisheries), and b) off the northern/southern extremes of the continent and islands the coolest climate belts will disappear altogether, and dependent species and ecosystems may become locally extinct or collapse.

Impacts on people

- Ecosystems and species provide important benefits to people, so these benefits are equally vulnerable to climate change. Natural resilience may hide a build-up of stress and proximity to tipping points, with profound consequences on security especially food and livelihood security. This is true for human dependence on natural systems and on agro-ecological systems such as traditional and rain-fed farming, pastoralism, and fishing.
- Climate change impacts on people and social and economic systems directly. In addition, systems may also respond to climate or other impacts in other domains or geographies. Thus, the resilience of people to adapt to climate impacts on local systems is affected, and may be undermined, by many other cascading and interconnected factors.

- Many people in Africa live directly on natural resources as income and their other material assets are low. A large proportion of Africa's population is classified as low income but a far higher number depends on nature's services in important ways such as for food, water, and transport infrastructure. Africa's population is thus highly vulnerable to climate impacts on natural services, more than is revealed by economic statistics based on financial or material assets.
- Climate responses affect costs, practices and the entire viability of economic activities and sectors, which may be more vulnerable than even biological systems. Thus activities or sectors may become uneconomical before the biodiversity on which they depend is devastated by climate change.
- Physical impacts from climate change such as sea level rise, weather, and availability of freshwater will directly affect the viability of coastal activities and in particular urbanization and human development on low-lying shorelines.

Recommended responses

- Certain systems are very high priorities for climate action, whether due to their intrinsic vulnerability, our social and economic dependence on them, or their extent and location. Prioritizing these systems for more immediate action will help mitigate pressures and improve the adaptation responses for lower priority systems in the future, justifying a sequenced focus on the actions.
- Certain climate impacts are certain – such as a sea level rise in the next decades to centuries. The only uncertainty is how much the sea will rise – so investment planning can take these changes into account, using a risk framework to address the uncertainty about how much sea level rise may occur.
- Research, data and knowledge on climate change, impacts, vulnerability and responses in Africa are all in short supply compared to other regions, so uncertainty about outcomes is higher. This requires an even more precautionary approach together with strengthened investment in further capacity.

2. OCEAN ZONES FOR THE BLUE ECONOMY

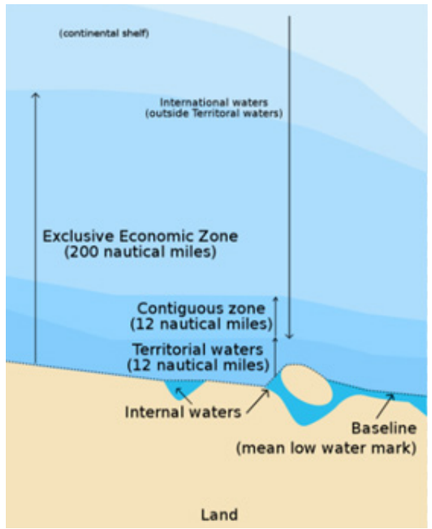
The ocean can be zoned into four bands for planning purposes (figure 3), based on zones established in the 1982 United Nations Convention on the Law of the Sea (UNCLOS, 2021). Extending from the coastline (or baseline of the mean low water mark) outwards, these are Territorial Seas adjacent to the coastline, the Contiguous Zone, Exclusive Economic Zones within the jurisdiction of countries, regional waters that combine the EEZs of multiple countries under varied regimes, and the High Seas or Areas Beyond National Jurisdiction (ABNJ). Each of these areas have different jurisdictional and access characteristics that affect which activities may occur in them, how the activities should be regulated, and which entity holds responsibility for their governance. While boundaries between them may be clear, multiple layers and issues can sharpen or blur these distinctions, and scoping these issues is critical in establishing governance for effective sustainability.

2.1. TERRITORIAL SEA AND CONTIGUOUS ZONE

The Territorial Sea (0-12 nautical miles (NM)[2]) and contiguous zone (12-24 NM) extend out from all national shorelines. The territorial sea is the sovereign territory of a state through which vessels are allowed 'innocent passage'. It forms a 'buffer' around the territorial seas where states can undertake certain actions, such as to pre-empt infraction of their territorial seas.

FIGURE 3:

Maritime zones relevant to the blue economy.



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Sub-national jurisdictions within countries (such as coastal provinces) usually have direct economic and management interests in the territorial seas, which is where most coastal fishing and coastal tourism occur, and also where direct impacts of land-based pollution are most intense. But most African countries have not clearly devolved legal rights or responsibilities in these areas to sub-national jurisdictions from the national government. This creates tensions and unclear jurisdiction on economic activities, planning, enforcement and taxation, and may become a source of increasing tension within national systems without the establishment of clear rules, particularly as ocean economies grow.

[2]A nautical mile is the distance covered by one minute of longitude at the equator and is a standard measure for maritime zones.

2.2. EXCLUSIVE ECONOMIC ZONES (EEZ) AND EXTENDED CONTINENTAL SHELF

National jurisdiction is based on the continental shelf extending out from shorelines. Geophysically the continental shelf ends at 200 metres depth, but under UNCLOS the continental shelf limit is extended to 200 nautical miles to define the EEZ. New regulations allowing for the extension of the continental shelf to 350 NM have come into force where the underlying geology supports this. Examples of this in Africa include the Seychelles-Mauritius Extended Continental Shelf Area over the Saya de Malha Bank in the Central Indian Ocean, and the Madagascar Plateau extending to the south of Madagascar.
Countries have control of all resources on or under the continental shelf and within the 200 NM EEZ boundary. Beyond 200 NM miles however, in extended continental shelf areas, countries have control only to what is on or under the bottom of the ocean (such as minerals or hydrocarbons), but do not have control of the water column or what it contains (such as fish).

2.3. MARINE REGIONS

Marine systems function at large scales, from ocean basin to major current scales. The basin scale of ocean processes is captured in the Regional Seas approach initiated by the United Nations Environment Programme (UNEP) in 1974 (Akiwumi & Melvasalo, 1998), of which there are four relevant to Africa (Table 3). Major currents have been used to define Large Marine Ecosystems (LME) (Sherman, 1993; Sherman & Duda, 1999) established in the late 1990s and focused on major systems of ocean productivity and of particular importance to fisheries (Table 3).

Both Regional Seas and LMEs provide operational contexts for planning ocean-based activities that cross national boundaries. The UNEP Regional Seas programme hosts secretariats for the Nairobi Convention and Abidjan Convention for coordinating marine environmental planning in those regions, while the Barcelona Convention and Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA) have independent secretariats. Through the World Bank and Global Environment Facility (GEF), support for major projects is guided through Strategic Action Programmes (SAPs) developed through the Regional Seas mechanisms guiding multilateral and bilateral cooperation and support programmes based on the

LME framework. Globally, the LME framework has been used to guide over $6 billion in aid from the GEF (Sherman, 1993). These regional frameworks are designed to align and integrate policies and activities among countries and across EEZs, but they do not include consideration of any high seas areas. Designed on the basis of regional scale biophysical factors, both regional seas and LME processes have adapted to include a strong focus on climate change, including through the development of regional climate strategies such as the Nairobi Convention (UNEP, 2016) to help drive aligned action among countries. Other key regional entities active around Africa of particular importance to the blue economy include economic and sectoral entities such as Regional Economic Communities (RECs, figure 4) and regional Fishery Management Organizations (RFMOs, figure 5). Regional Economic Communities are blocs of countries establishing varied levels of trade within their boundaries and develop common accords with external trading partners. The African Union recognises eight RECs, many with overlapping boundaries:

- Arab Maghreb Union (UMA)
- Common Market for Eastern and Southern Africa (COMESA)
- Community of Sahel–Saharan States (CEN–SAD)
- East African Community (EAC)

TABLE 3:

Regional Seas regions around the African continent and their corresponding Large Marine Ecosystems.

Region	Convention	State Parties	Notes (if relevant)	LME
West Africa, from South Africa to Mauritania	Abidjan Convention	Benin, Cameroon, the Republic of the Congo, Côte d'Ivoire, Gabon, Gambia, Ghana, Guinea, Liberia, Nigeria, Senegal, Sierra Leone, South Africa and Togo.	Angola, Cape Verde, the Democratic Republic of the Congo, Equatorial Guinea, Guinea-Bissau, Mauritania, Namibia, and Sao Tome and Principe are located in the Abidjan Convention area but have not yet ratified the Convention	Canary Current (6 countries, W and N Africa) Guinea Current (16 countries, W and Central Africa) Benguela Current (Namibia, Angola and South Africa)
Mediterranean	Barcelona Convention	African countries: Algeria, Egypt, Libya, Morocco, Tunisia.	Other parties: Albania, Bosnia and Herzegovina, Croatia, Cyprus, France, Greece, Israel, Italy, Lebanon, Malta, Monaco, Montenegro, Slovenia, Spain, Syria, Turkey, European Union.	Mediterranean Sea LME (North Africa)
Western Indian Ocean	Nairobi Convention	Comoros, France, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, Tanzania, Republic of South Africa		Agulhas and Somali Current
Red Sea and Gulf of Aden	Jeddah Convention	Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan and Yemen	Coordinated by the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA)	n/a

- Economic Community of Central African States (ECCAS)
- Economic Community of West African States (ECOWAS)
- Intergovernmental Authority on Development (IGAD)
- Southern African Development Community (SADC).

In addition, the Indian Ocean Commission unites the island countries of the Western Indian Ocean, including French territories. All RECs operate within State boundaries, so include EEZs but not ABNJ.

FIGURE 4:

The eight regional economic communities recognized by the African Union

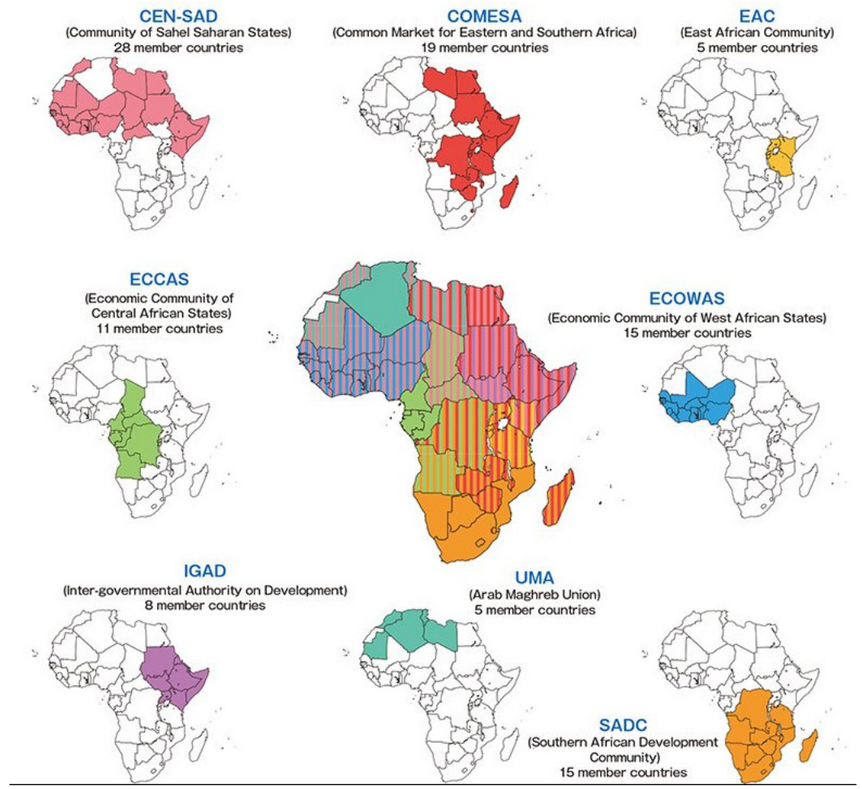
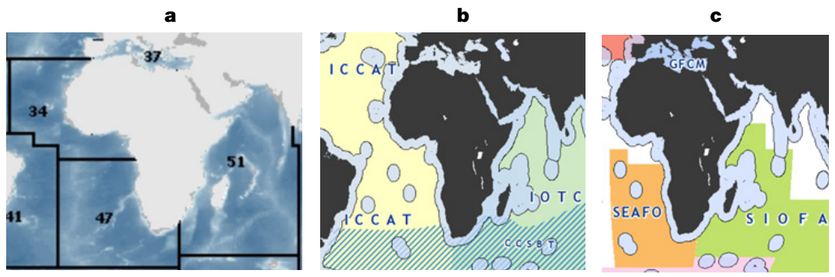


FIGURE 5:

Fishery regions bordering Africa.



a) FAO marine fishery regions bordering Africa and the jurisdiction of b) tuna and c) demersal fishery Regional Fishery Management Organizations (RFMOs). See main text for acronyms. Food and Agriculture Organization. (2020). State of the world's fisheries. http://www.fao.org/fishery/statistics/global-production/en.

Because of the transboundary nature of ocean fish stocks, Regional Fishery Management Organizations (RFMOs) have been established to manage them jointly, with mandates including ABNJ. The UN Food and Agriculture Organization (FAO) compiles fishery statistics on the basis of four regions around Africa. A wide range of smaller RFMOs and fishery support offices have been established, often with a focus on particular fisheries, managing the interests of a small number of adjoining states and limited to within their EEZs. Other specialized entities bring states together, over issues such as to promote blue economy development in the Indian Ocean through the Indian Ocean Rim Association (IORA). This association extends around the entire rim of the ocean from South Africa to Australia but has no jurisdiction over ABNJ.

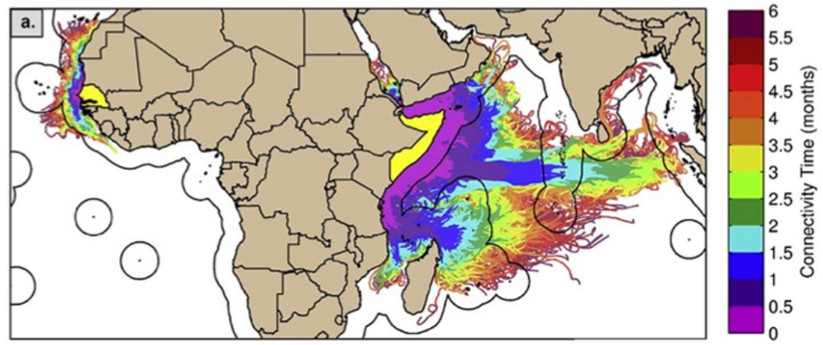
2.4. AREAS BEYOND NATIONAL JURISDICTION – THE GLOBAL COMMONS

The open ocean has historically been outside the jurisdiction of individual countries. The UN Convention on the Law of the Sea ratified in 1972 established a mechanism for governing this global commons. The 'high seas' are also referred to as Areas Beyond National Jurisdiction (ABNJ) and is currently subject to a review of UNCLOS, with a particular focus on Biodiversity Beyond National Jurisdiction (BBNJ) due to develop "an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction", (UN Intergovernmental Conference on marine biodiversity of areas beyond national jurisdiction, 2022) mandated by a decision of the UN General Assembly (resolution 72/249).

Different resources and sectors in the high seas have been under the mandates of different international bodies. The RFMOs shown in figure 6 include high seas dimensions, as fish stocks straddle boundaries between EEZs and high seas. A UN agreement on straddling fish stocks and highly migratory species is implemented by the FAO. The Convention on Migratory Species (CMS) concerns all species whose ranges are ocean-wide, including in the high seas, such as birds, marine turtles, cetaceans and fish, including tuna, swordfish, rays and pelagic sharks. Seabed and subterranean mining in the high seas is under the jurisdiction of the International Seabed Authority (ISA).

FIGURE 6:

The number of months (colour legend at right) it takes for ocean surface waters originated in the ABNJ to reach the coastal zone of Somalia and Senegal (countries are shown in yellow).



Reproduced from Popova, E., Vousden, D., Sauer, W.H.H., Mohammed, E.Y., Allain, V., Downey-Breedt, N., Fletcher, R., Gjerde, K.M., Halpin, P.N., Kelly, S., Obura, D., Pecl, G., Roberts, M., Raitsos, D.E., Rogers, A., Samoilys, M., Samaila, U.R., Tracey, S., Yool, A. (2019). Ecological Connectivity between the Areas beyond National Jurisdiction and Coastal Waters: Safeguarding Interests of Coastal Communities in Developing Countries. Marine Policy, 104 (2019), 90–102. <https://doi.org/10.1016/j.marpol.2019.02.050>

The importance of the high seas in the health and functioning of species and ecosystems within EEZs is growing, with clear demonstration recently of the degree to which many EEZs are highly dependent on inflow of waters from high seas areas (Popova et al., 2019). Figure 4 illustrates how the broad oceanic gyres affecting the Western Indian Ocean make its neighbouring countries (Somalia is shown as an example) among the most highly dependent globally on open ocean processes. By contrast, the strong Eastern Boundary Currents of the Atlantic coast (illustrated by Senegal) create narrow, more spatially defined highly productive upwelling systems adjacent to the coastline and are less connected to ABNJ processes. The potential of future resources, and the damaging impacts of extraction in ABNJ are at the core of current discussions, with particularly important considerations of sectors such as fisheries, seabed mining, shipping and offshore energy.

2.5. THE ADJACENT COASTLINE

The land adjacent to the sea at the shoreline is of critical importance in considering the ocean economy for two main reasons. Firstly, because the

natural interactions and dynamics between the land and sea are particularly forceful at their meeting on the shoreline and include coastal erosion by currents and weather, storm and wave interactions, and sea level rise and affect the flow of freshwater (whether surface or underground waters), and associated nutrients and material transport. Biological interactions are also important, such as those within estuaries between for example mangroves and terrestrial biota and mediated through birds that might transfer nutrients from sea to land or vice versa through their feeding patterns. Climate change interactions in this zone are also highly dynamic, with high levels of vulnerability of terrestrial and marine ecosystems to key dimensions, including sea temperature warming, sea level rise, seawater acidification, changes in rainfall, river flow and flooding regimes and storms or cyclones.

Secondly, much of the built infrastructure that supports ocean-going economic and other human activities is based on coastal land such as ports, transport infrastructure, cities, housing, and tourism facilities. The value of the 'adjacent coastline' when valuing ocean economy sectors is often higher than expected, and larger than many traditional sectors associated with the sea such as marine fisheries (see figure 7). Management of the land-sea interface has historically been in the domain of Integrated Coastal Zone Management and is also addressed through approaches variously termed as 'watershed management', 'ridge to reef' and 'source to sea'. This may now be subsumed under the broader scope of Marine Spatial Planning (MSP, see Section 4.4), which also extends seawards across many of the ocean zones, including to ABNJ.

2.6. DYNAMIC PROCESSES AND INTERACTIONS ACROSS SCALES

Ocean currents, ecosystems, species and genetic material move across all the ocean zones, and across country boundaries. Designing a foundation for a stable and resilient ocean economy thus requires these activities, processes, impacts and responses to be integrated across these scales.

Different zones, varying depth layers in the ocean, and the range of habitats and species within the ocean, respond in many different ways to climate change. In general terms oceanic systems are more stable in terms of fluctuations of physical characteristics such as temperature and pH, while closer into the coastline variations can increase by an order of magnitude through interactions with bottom topography and land-based influences. Climate fluctuations and changes may thus vary considerably, and accounting for these and how they impact on resources and economic activities is a key component of planning effectively for a climate resilient ocean economy.

2.7. SECURING AND GOVERNING OCEAN TERRITORY

Maintaining territorial security across ocean zones is a fundamental challenge for ocean states, as the remoteness and difficulty of accessing outer zones, and remote coastal areas, pose costly challenges. Controlling the access of vessels and how they are exploiting the seas within EEZs and national waters, and exploitation in ABNJ are challenges. The ocean is also a challenging environment, and the safety at sea of vessels and seafarers is a constant concern. Thus maritime security is important, requiring the investment of countries in surveillance, based on clear and legally binding plans, and managed by coastguards and enforcement capacity. Piracy has been a critical threat facing vessels on the seas since time immemorial, and only the recent expansion in the scope of electronic and satellite surveillance has reduced it. Even so, some ocean regions and the high seas remain risky, and in Africa in particular the coasts of Somalia and the Gulf of Guinea require significant investment to curb piracy.

Marine Spatial Planning provides spatial, participatory and integrative approaches to support cross-scale integration and a joined up approach to govern ocean spaces. It is a critical foundation for blue economy planning – for projects, local jurisdictions, countries and at regional, ocean basin and continental scales. Operationally, planning at the regional scale provides an optimal approach for considering cross-scale interactions that integrate ecological, oceanographic and geopolitical considerations at the large scale, as well as major patterns of climate change. Supplementary planning at national and local scales is then necessary where governance regimes are in places, and local context and variation are key considerations.

3. ELEMENTS OF A SUSTAINABLE INCLUSIVE BLUE ECONOMY

This section outlines the key components of a blue economy which are of immediate relevance to Africa in terms of establishing current and near-term opportunities and priorities and determining the considerations that need to be included in developing a 'climate resilient ocean economy'. In this section, these are broken down into the three pillars of sustainable development – natural, economic and social factors. Following these, the section addresses three critical areas for successfully implementing a sustainable blue economy – reducing drivers and pressures, establishing fit-for-purpose accounting and measurement systems and integrating national perspectives within regional and international governance approaches.

3.1. NATURE, CAPITAL AND ASSETS

The principal ecosystems relevant to African countries are summarized in Table 4, based on recent policy reports at regional (UNEP and WIOMSA, 2015) and global levels (IPBES, 2019). Open ocean systems are determined by basin-scale ocean currents and from the perspective of African coastal countries are viewed at a coarse resolution. Nearshore ecosystems have higher levels of interactions with users so are viewed at a finer resolution.

TABLE 4:

Coastal and marine habitats associated with blue economy options.

	Description	Climate change vulnerability and impacts	Blue economy relevance
Nearshore habitats			
Sandy beaches	Sandy beaches backed by dunes and shifting vegetation, highly dynamic and mobile shorelines.	Impacted by sea level rise (SLR), storms and extreme events.	Access to sea for fishers, tourism; coastal development; construction and mineral sands extraction.
Rocky shores	Rocky coastlines, generally with waves breaking on rocky cliffs, high energy conditions.	Low vulnerability to sea level rise, storms and extreme events.	Stable shorelines, but with difficult access to the sea except through creeks and estuaries.
Estuaries and coastal wetlands	Defined by a freshwater-sea interface that creates high habitat heterogeneity, high biodiversity and high productivity. Includes mangrove forests, seagrass beds, salt marshes, coastal lakes; associated with structuring vegetation.	Impacted by sea level rise and changing rainfall/flooding regimes, sedimentation; erosion; groundwater changes; water abstraction upstream and on the coastline. Interactions with coastal construction and urbanization, agriculture.	Fishing, shoreline dynamics and development, tourism, freshwater access and use. High carbon storage (blue carbon) in mangroves, seagrasses and salt marshes, nursery for marine species in inshore systems and fishery resources. Vulnerable to pollution from development.

TABLE 4: (CONTINUED)

Coastal and marine habitats associated with blue economy options.

	Description	Climate change vulnerability and impacts	Blue economy relevance
Nearshore habitats			
Coral reefs	Fringing, island and barrier reefs constructed by hard corals; creating high habitat heterogeneity and diversity, and associated productivity.	Impacted by rising temperatures, ocean acidification, storms and cyclones. Interactions with multiple local threats.	Tourism, fishing, coastal protection. Vulnerable to pollution from coastal development and increased population.
Offshore and deep-sea habitats and zones			
Shelf habitats	Submerged platform and slope to 200m deep, generally soft substrate/sand with rocky platforms and outcrops. Poorly known.	Impacted by changing temperatures, acidification, current regimes. Strongly impacted by terrestrial influences and fishing gear (e.g., bottom trawling).	Fishing in coastal zones for surface and bottom-species, trawling; potential for infrastructure (cables, pipelines, windfarm/ aquaculture structures). Vulnerable to pollution from development.
Eastern Boundary Upwelling Systems (EBUS)	Only exist on the Atlantic coast: Canary and Benguela upwelling systems.	Highly sensitive to climate change as controlled by wind, marine currents and ocean temperature gradients.	The most productive marine ecosystems globally, (producing 50% of the continent's marine fisheries catch).
Surface open ocean	The top 200m of the water column, from the edge of the continental shelf to the open ocean.	Primary absorption of CO^2 into the ocean, impacted by changing temperature, acidification, currents and other ocean processes. Physical interactions with atmosphere drive weather systems.	Waters in EEZ and High Seas depend on national boundaries, so potential use and jurisdiction vary – fishing, energy and transport.
Slope and deep sea	Continental slopes from 200m and deeper, including canyons, to abyssal plain at >4000 m and deeper trenches. Includes seamounts, mid-ocean ridges and other bottom features.	Settlement of carbon in organic detritus, impacted by changing acidification and oceanographic processes, and temperature.	Bottom fishing (particularly slopes and seamounts), seabed mining in national and High Seas waters.

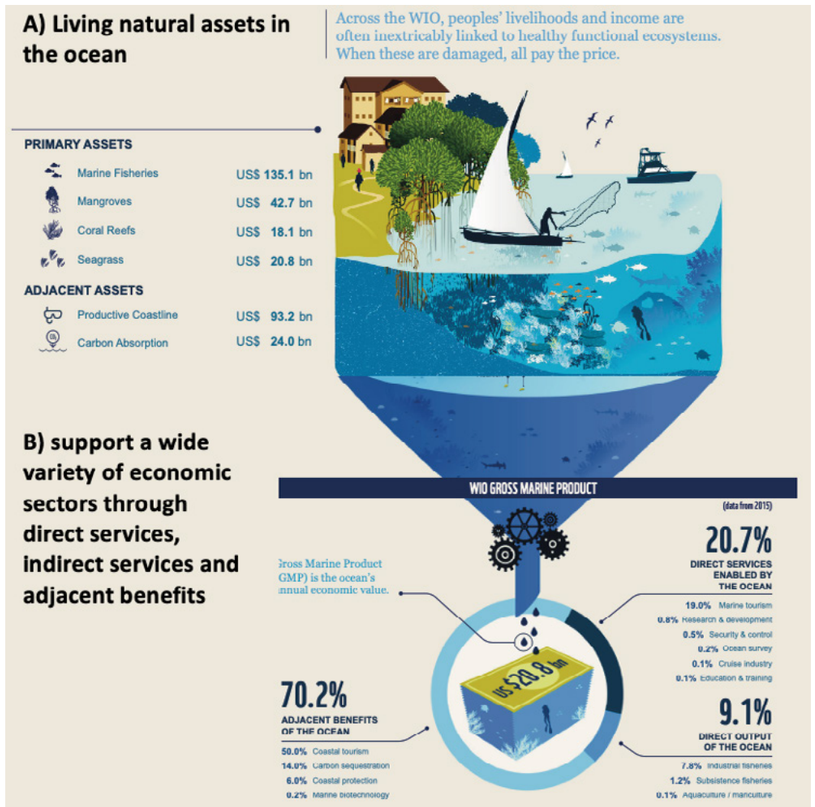
The focus of this background paper is on protecting the living natural assets that are the foundations for a blue economy (figure 7). Natural assets provide the primary inputs to many economic sectors. In the top panel of figure 7 mangrove, coral reef and seagrass ecosystems support the fish populations that sustain marine fisheries. Together with the adjacent coastline on which urban and tourism infrastructure is built, they support coastal and marine tourism. Mangrove and seagrass ecosystems capture carbon and sequester it, reducing the amount

of carbon dioxide in the atmosphere and oceans. Conventional planning and management such as in fisheries and tourism generally do not incorporate thinking about the implications for the complex ecological components and interactions that provide inputs to these value streams, such as nursery habitats and the associated interacting species that sustain healthy fish stocks.

To internalize these contributions into ocean economy planning, a broader frame is needed that incorporates inputs from multiple natural assets across a full value chain. This frame can be supported by Ecosystem-Based Approaches (EBA), where perspectives from the environment, the effects of activities along a value chain, and effluent or by-products and end products along and at the end of a value chain are also considered holistically. This approach takes

FIGURE 7:

The relationship between living natural ocean assets and the services they support in the Western Indian Ocean.



Adapted from Obura, D.O. (2017). Reviving the Western Indian Ocean Economy: Actions for a Sustainable Future. Madagascar: World Wide Fund for Nature.

externalities, which are costs traditionally not accounted for in market pricing, and internalizes them, including them on the balance sheet of an economic activity. EBA focuses on natural processes, particularly those of recovery and regeneration, thus can transform existing practices which may degrade natural systems, such as destructive fishing, into regenerative practices that build natural productivity, such as managed fishing with effective gears, and responsive to natural cycles.

The concept of Nature-based Solutions (NbS) emerged from considering the benefits natural assets generate for people and societies. This contrasts with the role of manufactured or man-made products or solutions, many of which may have significant externalities or impacts of their own. For example, mangrove or saltmarsh vegetation provides shoreline protection as does a seawall or dyke. But whereas seawalls can have multiple negative effects, such as intensifying fore-shore erosion and shifting erosion laterally along coastlines, mangroves don't have these effects sand provide multiple additional benefits such as habitat for other species and resources, sequester carbon and more. There have been a range of definitions of NbS from sectoral perspectives, such as in the context of climate mitigation for carbon storage, where an early narrow focus on carbon storage led to monocultural plantation forests being considered a solution, despite their considerable negative impacts on biodiversity and on local communities (Seddon et al., 2019). The broad definition of NbS by the International Union for the Conservation of Nature (IUCN) is now the one currently used (IUCN, 2020) in both biodiversity and climate conventions and emphasizes realizing multiple benefits from nature to people: "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits".

The broader perspectives on NbS and EBA as core tools in building sustainable economies based on natural assets can be central to successfully bringing ocean health into the heart of economic planning, as introduced by the Dasgupta Review in 2010. Existing case studies of comprehensive EBA/NbS exist and can be projected as examples for replication and advancing similar principles in other settings. For example, re-planting mangroves forests in the Mikoko Pamoja project in Gazi Bay, Kenya, not only generates carbon finance through sequestering carbon, but the mangroves also support the resilience of the coastal zone (with seagrass beds and coral reefs), are a nursery for and directly provide fish for food, provide wood for shelter and protect the coastline from erosion.

The role of ecosystem restoration in rebuilding natural capital degraded by historic uses is becoming increasingly important, with the decade 2021-2030 designated by the United Nations as a “Decade of Restoration” (UN decade on restoration, nd.). A standard practice in terrestrial biomes and some freshwater systems, restoration of marine ecosystems is still in its infancy. Only mangrove forests have well developed and effective restoration methods (Bayraktarov, Saunders, & Abdullah, 2016; Basconi, Cadier, & Guerrero-Limón, 2020), including those applicable in community contexts and that can scale to meaningful areas. Coral reef and seagrass restoration methods are under rapid development but are still at experimental and ‘demonstration’ scales. A critical concern with climate change is that future conditions are uncertain and unlikely to be like past or present conditions (Martin, 2017). Thus, restoration actions must also consider which habitats may be appropriate for future climatic conditions, not just those of today. Accordingly, the restoration of ecosystem functions and integrity may be more appropriate goals than the restoration of prior species assemblages.

3.2. ECONOMIC SECTORS – VALUE FROM NATURAL ASSETS

Current and emerging blue economy sectors are supported by different parts of the marine environment and access different ecosystem services (Table 5). Some sectors have been part of ‘traditional’ maritime economies for decades or centuries, while new and developing sectors are in rapid growth phases in recent years. An important change in terminology is underway that may affect sustainable blue economy discussions. The ‘ecosystem services’ concept coined by the Millennium Ecosystem Assessment (2005) identified four classes of services – regulating, provisioning, cultural and supporting. However, it has been broadened through the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) to incorporate multiple cultural perspectives on nature as well as less tangible benefits from nature to the ‘Nature’s Contributions to People’ (NCP) concept (Pascual et al., 2017), comprising 18 classes (Annex 1). In general, these are synonymous with one another, and here the more modern and inclusive IPBES NCP framing is used.
The degree to which each sector is dependent on or impacts the health of ocean ecosystems is an important consideration in determining its resilience to climate change, as well as the broader resilience of other ocean economy sectors. Those that are dependent on ecosystem health are highly vulnerable to climate change due to the alterations and instabilities climate change induces in nature, but physical aspects of climate change (see Section 1.2) can also greatly impact sectors not dependent on ocean health. Thus, determining the vulnerability of all sectors to different (and often interacting) aspects of climate change is essential in planning for climate resilience.

TABLE 5:

Blue economy sectors classified by their dependence on ecosystem health and the type of ecosystem services.

	Ecosystem service type	Ocean or blue economy sectors
Dependent on ecosystem health	• Harvesting of living marine resources NCP 12, 13, 14,	• Capture fisheries and seafood processing • Aquaculture • *Biotechnology (both pharmaceutical and agrichemical)
	• Climate regulation NCP 4, 5	• Blue carbon (carbon storage in mangroves, seagrass and saltmarsh)
	• Protection NCP 9, 1, 3, 6, 7	• Coastal protection and flood defences • Marine ecosystem protection • Water resource protection
	• Social, cultural and religious values NCP 16, 17	• Maritime and coastal tourism and recreation • Cultural and religious practices • Sense of place and wellbeing
	• Knowledge and information NCP 15	• Biophysical, socioeconomic and political research • Education and training, research and development • High-tech marine products and services
Not dependent on ecosystem health	• Extraction/generation of energy from non-living resources NCP 11	• *Ocean energies - wind, wave, tidal, ocean thermal (OTEC) • Desalination • Extractives/ mineral production and deep sea mining • Offshore oil and gas
	• Commerce and trade in/around ocean	• Boat building and marine manufacturing • *Shipping and port activity • Marine business and other services (e.g., insurance, inspection) • Maritime safety and surveillance

Nature’s Contributions to People (NCP) types are listed in Annex 1.

*Developed from African Ministerial Conference on the Environment. (2019). Advancing the Sustainable Blue (Ocean-Based) Economy in Africa 15/11. p13. Sectors marked with an * are addressed in the current set of Background Papers.*

The economic value of blue economy sectors dependent on nature in two marine regions of Africa have been estimated by the Boston Consulting group and WWF. A total ocean asset value of $338 billion was estimated for the Western Indian Ocean (Obura, 2017) (comprising fisheries, mangroves, coral reefs, seagrasses and adjacent assets on the productive coastline, and carbon absorption) producing annual flows of $20.8 billion per year for the 10 countries of the region (figure 7b). The annual ocean-based production for five North African countries bordering the Mediterranean was estimated at $47 billion (Randone, DiCarlo & Costantini, 2017). Notably, these estimates do not include any of the sectors which are not dependent on living ocean ecosystems, such

as shipping and maritime trade, or the energy sector (Table 5). Unexpectedly for many, given the prominence of fisheries, marine and coastal tourism provide a much greater economic return than do fisheries, emphasizing the need to consider unconventional and novel sectors to gauge the full breadth of the blue economy. Dependence on the ocean is proportionately higher for island states, as high as 50% of GDP for the Seychelles (Table 6), due to tourism and fisheries combined.

TABLE 6

Comparison of Gross Domestic Product and Gross Marine Product for WIO countries and territories and North African countries.

Country	Gross Marine Product		National GDP	
	($ Mill)	(%)	($ Mill)	GMP/GDP
Western Indian Ocean				
South Africa	6,738	32%	349,800	1.9%
Mozambique	2,740	13%	16,400	16.7%
Tanzania	2,732	13%	49,200	5.6%
Mauritius	2,411	12%	12,600	19.1%
Kenya	2,392	12%	60,900	3.9%
Madagascar	1,625	8%	10,600	15.3%
Reunion (France)	901	4%	-	
Seychelles	686	3%	1,400	49.0%
Somalia	345	2%	-	
Comoros	189	1%	600	31.6%
Total	**20,760**			
North Africa				
Egypt	18,242	39%	311,411	5.9%
Algeria	10,306	22%	233,977	4.4%
Morocco	9,320	20%	110,552	8.4%
Libya	4,746	10%	37,753	12.6%
Tunisia	4,432	9%	48,871	9.1%
Total	**47,047**			

Adapted from Obura, D.O. (2017). Reviving the Western Indian Ocean Economy: Actions for a Sustainable Future. Madagascar: World Wide Fund for Nature and Randone, M., DiCarlo, G & Costantini, M. (2017). Reviving the Economy of the Mediterranean Sea: Actions for a Sustainable Future. WWF Mediterranean Marine Initiative, 2017, p. 64.

This perspective of the economic dependence on natural assets makes the case for nurturing natural assets like any other business or financial asset – by ensuring it is not degraded by use and abuse, and instead is progressively improved through investment, for greater or more efficient production (Obura et al., 2020). Thus, those economic sectors based on natural resource productivity will require regulation, incentives and practices that promote sustainable off-take, resource- and wider regeneration capabilities, and ecological balance that maximizes not only productivity, but the long-term security and sustainability

of any enterprise. Those economic sectors that do not depend on natural productivity but can impact it negatively need regulations, incentives and practices that limit their impact on natural assets and consequent harm to other sectors of the economy and also to social and livelihood aspects. At the macroeconomic scale, a paradigm shift, albeit slow, is underway, recognizing that damage to natural assets represents a market failure, where economies externalize their impacts. This was presented in 2006 in relation to climate change by the Stern Review (2006) and in 2020 for biodiversity by the Dasgupta Review (2021), the import of these documents being that they were published by official Treasury offices, not environmental ones.

At finer scales there are significant challenges to understanding the scope of the blue economy. Most countries do not compile data in an integrated fashion nor across multiple sectors, resulting in the need for geospatial analyses based on varied land cover datasets, such as mangroves and forest for estimation of issues such as carbon sequestration, or population and infrastructure maps, for estimation of tourism intensity (Ghermandi et al., 2019). Growing interest in the blue economy and integrated accounting (Gleeson-White, 2015) is also generating interest in improved data on the economic value generated from nature, even if significant challenges remain (see Section 3.6).

Complementing these top-down approaches in understanding and promoting the economic aspects of the blue economy, bottom-up business-focused approaches are needed to address the interests and profitability of business and corporate entities, while ensuring minimal damage to nature and to social dimensions. In recent years interest in circular economy principles has grown (Gleeson-White, 2015), where businesses minimize inputs extracted from nature and end- or by-products (pollutants) discharged into the environment, while maximizing the use and re-use of material already in manufactured form. These circular economy principles are highly consistent with blue economy and climate resilience principles and can promote alignment between the needs and realities of businesses on the ground, and of higher-level sustainability and limits at broader scales and are to be supported.

3.3. SOCIAL DIMENSIONS – EQUITY, JUSTICE AND INCLUSIVITY

The dominant economic paradigm leading to the recent surge of interest in the blue economy is of economic growth and market-oriented systems. In recent decades that has resulted in increasing concentration of wealth; disparities between the income and wealth in the top and bottom income classes across the globe is growing (AfDB, 2020). The economic opportunities and incentives highlighted in the previous section are more accessible to those with greater capital, thus the sustainable development framework recognizes the need to

balance economic gains with social gains as well, and to invest in actions to increase equity and access for the poor. The concept of the blue economy has emerged with this dynamic at the forefront, and the discourse expanded from the SDG 14 Oceans Conference in New York in July 2017 where 'sustainable blue economy' was the key term, to the Sustainable Blue Economy Conference in Nairobi in November 2018 (SBEC, 2018), where 'sustainable AND INCLUSIVE blue economy' became the new key term. This shift manifested itself through the participation of a wide variety of citizens' groups including indigenous peoples, women's representatives and youth representatives. The literature on addressing social rights in development, conservation and marine resource use has grown rapidly in recent years (Bennett, 2021).

In East Africa countries have taken active steps to foster the participation and empowerment of communities in resource co-management, such as in coastal fisheries and the establishment of spatial and temporal protection for fish, to promote reproduction and regrowth of stocks to enhance fisheries (Rocliffe et al., 2014). A rule of thumb has emerged, that the industrial fishing sector (involving large commercial vessels operating in offshore waters) earns 80% of the total value of marine fisheries, while employing 20% of the workforce. By contrast, the small-scale fisheries sector earns 20% of the total value but provides jobs and livelihoods to 80% of the workforce. These two sectors each have their roles in national economies, and the 'inclusive' component of the blue economy is focused on ensuring they are balanced, and that a determination to drive growth and income favouring the industrial sector does not undermine the livelihoods, jobs and quality of life of most beneficiaries in the small-scale sector. An extreme example of the excessive swing to industrial fisheries has been the emergence of modern slavery in fisheries (Tickler, 2018), in which the rights of small-scale and labouring fishers are subsumed to commercial interests of boat owners and financiers (Maritime Executive, 2019).

TABLE 7:

Injustices and potential solutions identified for an inclusive blue economy.

Ten injustices	Solutions
1. Dispossession, displacement and ocean grabbing;	Recognize and protect resource and spatial tenure and access rights;
2. Environmental justice concerns from pollution and waste;	Take a precautionary approach to reduce pollution and ensure that environmental burdens are not placed on marginalized populations; enact laws implementing the polluter pays principle;
3. Environmental degradation and reduction of availability of ecosystem services;	Minimize the impacts of development on habitats, resources, and ecosystem services; use of environmental impact assessments and safeguards;
4. Livelihood impacts for small-scale fishers;	Consider and safeguard the access rights and livelihoods of small- scale fishers;
5. Lost access to marine resources needed for food security and well-being;	Maintain and promote access to marine resources needed for food security and well-being, and additional options for livelihoods;
6. Inequitable distribution of economic benefits;	Develop policies and mechanisms to foster and ensure the equi- table distribution of economic benefits;
7. Social and cultural impacts of ocean development;	Monitor, mitigate and manage the social and cultural impacts of ocean development;
8. Marginalization of women and other vulnerable groups;	Recognize, include and promote the equal role of women in the ocean economy;
9. Human and indigenous rights abuses; and	Recognize and protect human and indigenous rights,
10. Exclusion from decision-making and governance.	Develop inclusive and participatory planning and governance processes for ocean development.

Adapted from Bennett, N. J., Blythe, J., Sandrine White C., & Campero, C. (2021). Blue Growth and Blue Justice: Ten Risks and Solutions for the Ocean Economy. Marine Policy, 125. <https://doi.org/10.1016/j.marpol.2020.104387>

TABLE 8:

Key policy recommendations for advancing social justice in the blue economy.

Recognitional Justice	Procedural Justice	Distributional Justice
• Identify and differentiate rights holders and stakeholders; • Acknowledge pre-existing rights and tenure; • Incorporate pre-existing practices, institutions, and knowledge systems; • Integrate diverse worldviews, perspectives, and values.	• Facilitate inclusive, participatory, transparent, and accountable planning and management; • Ensure that participants perceive that institutions, policies, managers and management actions are legitimate; • Create adaptive and context-appropriate decision processes; • Support local capacity for participation and co-management; • Ensure stakeholders have access to justice and conflict resolution mechanisms.	• Consider equity in distribution of costs and benefits over time, space, and between groups; • Design fair compensation and mitigation mechanisms; • Adapt management to improve social and distributional outcomes.

Adapted from Bennett, N. J., Blythe, J., Sandrine White C., & Campero, C. (2021). Blue Growth and Blue Justice: Ten Risks and Solutions for the Ocean Economy. Marine Policy, 125. <https://doi.org/10.1016/j.marpol.2020.104387>

The small -scale fishery and conservation literature has built up a series of guardrails in relation to social injustices in blue or ocean economic development, which may facilitate planning appropriate investments (Table 7) as part of a commitment to 'blue justice'. Solutions to these challenges are complex and relate to considering multiple types of justice, which can be classed as recognitional, procedural and distributional (Table 8).

These considerations may be novel for certain levels or types of investment and planning, but they are increasingly embedded into national processes that call for balance between economic and social considerations in the sustainable development agenda. The 17 Sustainable Development Goals (SDG) and their targets include these considerations for inclusivity – particularly in goal 5 on gender equality, goal 10 on equality among countries and goal 16 on justice. While apparently lofty even at national levels, the SDGs and their theory of change are very relevant to local contexts, and processes for generating local 'sustainability narratives' framed by the SDGs (Obura, 2020) may help companies and business sectors identify their individual contributions and obligations to broader sustainability, within a viable business model.

3.4. REDUCING PRESSURES AND DRIVERS

Drivers of biodiversity decline in Africa were summarized in the IPBES Regional assessment for Africa (2017) and are expected to increase with the anticipated doubling of the continental population by 2050 (Table 9) and are relevant to blue economy sectors (Table 5, figure 8). Alarmingly, all drivers show increasing trends across all subregions and marine and terrestrial ecosystems. All drivers listed appear significant – climate change, habitat conversion, overharvesting, pollution, invasive alien species, and illegal wildlife trade, with demographic change as an indirect driver. Protected areas were the only positive indirect driver assessed, as they play a unique role in sequestering parts of nature away from damaging or intensive economic activity, only allowing regulated and nature-oriented activities such as those in relation to tourism. However, the scale and effectiveness of protected area management is inadequate globally (GBO5, 2020) as well as on the continent (IPBES, 2017) to address all drivers of decline that impact them, and historical equity issues in their identification and establishment (Agrawal & Redford, 2009) limit how well they address the equity issues addressed in section 3.3.

The mainstream approach to reducing the pressures and drivers of decline on environmental and social domains from economic activities is based on the use of Environment and Social Impact Assessments (ESIA) and more broadly, Strategical Environmental Assessments (SEA). These apply the mitigation hierarchy to avoid and reduce pressures and impacts as far as possible, and

where these reach a limit, to find ways to restore and offset impacts. However, a full implementation of ESIA in marine and terrestrial systems is far from uniform or universal in African countries and they are of insufficient scope to reduce impacts to the environment. More stringent standards and improvements in policy, practice and enforcement are widely needed to enable any real reversal of the drivers. Implementation of SEA at a sufficiently broad and strategic scope may also improve practice, whereas typically SEA is employed as a 'big ESIA', insufficiently addressing the strategic and multifaceted value and opportunities that natural systems provide (Partidário, 2007). New marine planning approaches have emerged to address this challenge of multiple threats from different economic sectors, in the form of MSP such as the Nairobi Convention (UNEP, 2016) and UNESCO planning initiatives (DG-MARE, 2017). African countries are rapidly establishing national MSP frameworks, often within the mechanism of a regional umbrella, and covering 100% of their marine jurisdiction, providing significant scope for improved planning and more sustainable implementation of ocean economy sectors.

TABLE 9:

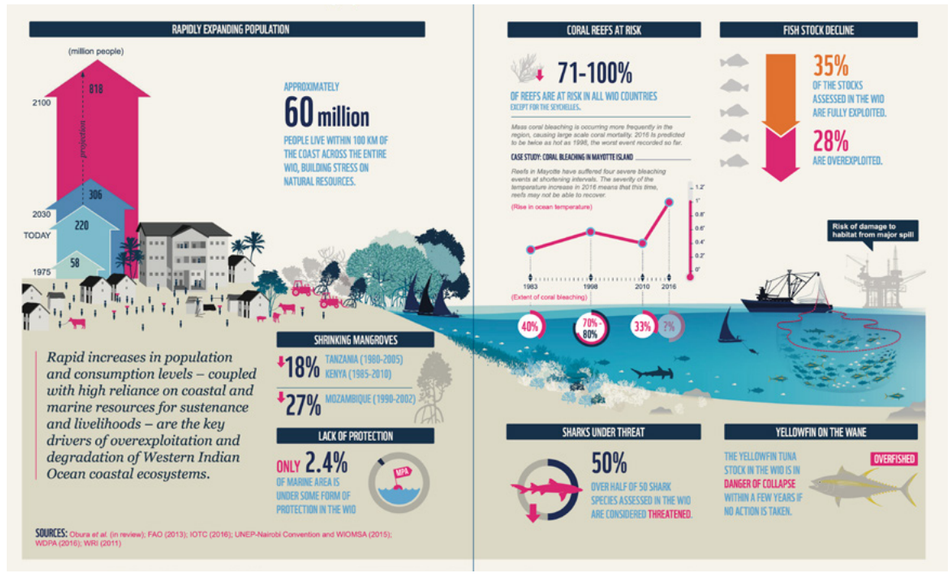
Key drivers of coastal marine biodiversity change in Africa shown per sub-region.

	DRIVERS OF BIODIVERSITY CHANGE							
	Direct drivers						Indirect drivers	
	Climate change	Habitat conversion	Overharvesting	Pollution	Invasive alien species	Illegal wildlife trade	Demographic change	Protected areas
Central	↗	↑	↑	↗	↗	↑	NI	↔
East & islands	↑	↔	↗	↗	↗	↑	↑	↔
North	↗	↗	↗	↗	↑	NI	→	→
Southern	↗	↗	↗	↗	↑	↗	↗	↗
West	↑	↗	↗	↗	→	↑	↗	→

From: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. (2017). Regional and Subregional Assessment of Biodiversity and Ecosystem Services for Africa (IPBES secretariat.)

FIGURE 8:

Illustration of key drivers and pressures affecting blue economy natural assets in the Western Indian Ocean.



From: Obura, D.O. (2017). Reviving the Western Indian Ocean Economy: Actions for a Sustainable Future. Madagascar: World Wide Fund for Nature.

However, it is not clear that any conventional economic and development approaches can achieve the reduction in pressure required. Increasingly, 'transformational change' in economic and societal processes is being called for, such as by the IPBES regional and global assessments (IPRES 2019), as well as other processes such as the High Level Panel on Oceans (see Section 3.6). The Dasgupta Review on the economics of biodiversity identifies 'impact inequality' as a key measure, where the relative size of economic impact (measured by total population, income levels and a technology or efficiency term) must not exceed the biotic potential or regenerative and productive capacity of ecosystems (2021). Transformation is needed to bring this inequality down to zero, but the challenge is how to make that tangible and implementable for the sectors and businesses that are the source of the increasing stressors.

Within financial and business circles, it is important to note that even in ocean sectors, investor awareness of impacts to the ocean is low. A recent assessment by Credit Suisse found that three in four respondents have not assessed their investments for ocean impacts or risk exposure (2020). Attention to Environmental, Social and Governance (ESG) considerations are growing in importance as measures of corporate performance, and in response to demand from shareholders or government (Busch, Bauer & Orlitzky, 2015);

Taliento, Favino & Netti, 2019) as well as to advance more complete concepts of sustainability (Beattie, 2019). Science-based targets applicable to companies (and cities) (science-based targets network, n.d.) are under development by various entities to facilitate target-setting and tracking progress in bringing threats and pressures down to levels that avoid harm to nature while achieving sustainable business practice. First developed purely in relation to carbon emissions and climate change (science-based targets, n.d.), these are now being developed in relation to biodiversity impacts, and in the future in relation to social processes. From the perspective of companies and local jurisdictions (particularly cities), the concepts of circular economy and 'doughnut economics' (Raworth, 2012) help, with the latter identifying safe environmental maxima (ceilings) and just social minima (floors).

It is important to reiterate that climate change intensifies and exacerbates pressures, with compounding effects on natural systems, as well as production systems dependent on nature and social systems. Thus, while reducing pressures, such as climate pressures, may appear costly now, the cost will increase exponentially as climate change worsens.

3.5. ACCOUNTING FOR THE SUSTAINABILITY AND INCLUSIVITY OF OCEAN ASSETS AND OCEAN RESOURCE USES

Ocean economies incorporate production, consumption, income generation and employment opportunities, and are most often valued as the contribution of ocean sectors to GDP. But GDP metrics provide no or little information on the distribution of income or welfare benefits to people (inclusivity), changes in ocean wealth, or the sustainability of natural or non-produced capital that often underpin the ocean economy sectors. Approaches that include measures of sustainability and inclusivity are better serviced through more holistic ocean accounting frameworks, that can incorporate large volumes of novel data from across economic, social and environmental domains in standardized frameworks to produce indicators required for decision-making processes (Fenichel, 2020).

Initiatives to account better for environmental values and how they are impacted by economic activity have grown over the last few decades, in particular through The Economics of Ecosystems and Biodiversity (TEEB) and Wealth Accounting and Valuation of Ecosystem Services (WAVES) (Table 9). Ocean Accounts are being further developed in an Ocean Accounting Framework (O-A-F) by the Global Ocean Accounts Partnership (GOAP), using existing standards for national accounting frameworks, including the Systems for National Accounts (SNA), and ocean economy satellite accounts (OESA) and the System of Environmental-Economic Accounting (SEEA) Central Framework

and Ecosystem Accounts (a revision of which was released by the UN in early March 2021). These existing frameworks are supplemented by the development of risk, social and governance accounts. The GOAP O-A-F is being viewed as a SEEA-Oceans framework into the future.

TABLE 10:

Innovative tools for measuring nature-based economics extend on which Ocean accounts can build, providing a framework for customized accounting of ocean systems.

The Economics of Ecosystems and Biodiversity (TEEB)	A global initiative focused on drawing attention to the economic benefits of biodiversity. Its objective is to highlight the growing cost of biodiversity loss and ecosystem degradation. TEEB presents an overarching approach that can help decision makers recognize, demonstrate, and capture the values of ecosystems and biodiversity, including how to incorporate these values into decision making. Run by a partnership involving UNEP, UNDP and the World Bank. http://teebweb.org/
Wealth Accounting and Valuation of Ecosystem Services (WAVES)	Wealth accounting measures assets and capital goods that are inputs to economic well-being, including manufactured assets such as machinery and infrastructure. but also natural assets (fish, mangroves forests) and human and social capital. Hosted by the World Bank. https://www.wavespartnership.org/
System of Environmental-Economic Accounting (SEEA) – Ecosystem Accounting	An integrated and comprehensive statistical framework for organizing data about habitats and landscapes, measuring ecosystem services, tracking changes in ecosystem assets, and linking this information to economic and other human activity. Can generate a wide range of statistics, accounts and indicators that can be adapted to countries' priorities and policy needs while at the same time providing a common framework, concepts, terms and definitions. https://seea.un.org/ecosystem-accounting
System of National Accounts (SNA)	An internationally agreed standard set of recommendations on how to compile measures of economic activity. Provides a comprehensive conceptual and accounting framework for compiling and reporting macroeconomic statistics for analysing and evaluating the performance of an economy. https://unstats.un.org/unsd/nationalaccount/sna.asp. Of particular importance is the ocean economy satellite accounts - https://coast.noaa.gov/data/digitalcoast/pdf/oesa.pdf.

The GOAP O-A-F (figure 9) is under development to address the burgeoning need for actionable data to guide blue economic development (Fenichel et al., 2020), particularly with respect to expanding the accounting approach towards inclusivity and sustainability. The GOAP O-A-F has a strategic focus to adapt national accounting frameworks to deliver inclusivity and sustainability through distributing income and aspects of ocean wealth. Ocean accounting addresses the three pillars of sustainability, expressed as ocean production, the distribution of benefits and welfare (inclusivity) and sustainability measured through changes in ocean wealth. A key focus of ocean accounting frameworks is to shift from general concerns of ocean sustainability or the blue economy (as expressed earlier) to more precise questions relevant for planning and economic development (Box D), relating to ocean production (questions 1 and 2); the

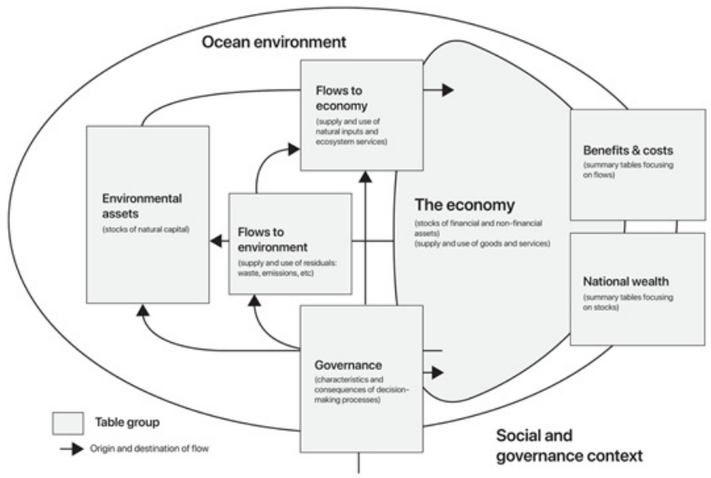
[37]Nairobi Convention UNEP and

distribution of benefits (questions 3 and 4); ocean wealth and sustainability (question 5), and ocean resource – use governance in these areas (question 6). A further value of ocean accounting frameworks is the development of open principles for standardized and consistent data sharing and access across a wide variety of indicators. These may overlap with monitoring indicators developed for investment purposes, such as those already identified by institutions such as the African Development Bank (AfDB, 2013), those used for Marine Spatial Planning, or with indicators that might be developed further to support the blue economy investment environment or required as contributions to national commitments. Appropriate development of ocean accounting frameworks may provide a principal mechanism for keeping blue and ocean economy sectors on track towards climate resilience.

The participation of African countries in ocean accounting is being coordinated through the Global Ocean Accounts Partnership (GOAP) (n.d), and its Africa Community of Practice, established to create awareness, interest and an appetite for ocean accounting and to streamline and fast-track the development of standards and procedures, and alignment amongst partners across countries and ocean sectors. This is being carried out anchored in the Africa Natural Capital Accounting Community of Practice (n.d) hosted by the WAVES programme at the World Bank. Together, these initiatives are building capacity for ocean accounting among African countries and developing tools and approaches applicable to African contexts and blue economy aspirations (South African Institute of International Affairs, n.d).

FIGURE 9:

The Ocean Accounts Framework: an integrated structure for ocean data and statistics. From: Ocean Accounts Partnership. (n.d) Africa Community of Practice. https://www.oceanaccounts.org



Box D. Specific questions that ocean accounting can address, for planning ocean sustainability (Fenichel et al. 2020)

1. How do industries, connected in some way to the ocean, create resources and products for use elsewhere? What jobs do these industries provide?
2. How do biological, chemical and physical ocean processes contribute to products for use elsewhere?
3. How does the ocean contribute to livelihoods and for whom?
4. How does the ocean provide welfare directly and for whom?
5. Is the ocean economy being developed sustainably?
6. How will a policy change affect aspects of the ocean economy? How will changes in the ocean affect the economy, or how will a use of the ocean in one location influence other industries and residents?

4. SECTORAL TOPICS

This section touches on specific sectoral areas of the ocean or blue economy, including some from other background papers in this series. The focus here is how they relate to climate resilience and may impact on it. Greater detail is contained in the original documents and the reader is referred to them.

4.1. MARINE EXTRACTIVE RESOURCES (MINING)

The extraction of minerals from, on or under the seabed, and on the shoreline or beaches is addressed in this section. By harvesting mineral and non-living matter, mining is not subject to the regeneration and sustainability dynamics of sectors based on living resources and ecosystem services. However, mining and extraction of minerals can have profoundly damaging impacts on ecosystems and living resources, through direct physical damage or removal to access the mineral, resuspension of sediments resulting in smothering or light diminution, pollution through mobilization of chemicals or minerals previously inaccessible to the biota and pollution through any chemical processing that may occur. Typical minerals include sand and pebble or stone aggregates for construction, iron, manganese and other metals, rock for construction, and sub-surface hydrocarbons and fossil fuels. Harvesting minerals from hydrothermal vents, seeps and mid-ocean ridges takes advantage of natural processes that bring these minerals from deep in the earth's crust or mantle to the surface, in molten lava or water flowing through deep deposits.

Onshore and shallow (< 50 m) mining tends to focus on sediments for construction and zirconium (ore containing titanium and other heavy metals) in beach dune and reef- or shelf slope sands. These activities generally scrape up the entire surface layer (both in the sea and on land) so are fully destructive to the biota. Mitigation on land currently involves restoration plans involving placing processed material back in place (after zirconium extraction) and regrowing terrestrial vegetation. Reducing collateral damage to adjacent high value systems is critical. Sand extraction adjacent to coral reefs has been shown to be possible with active mitigation by the dredging vessel and with strictly controlled monitoring (Obura et al., 2020) Preventing adjacent ecosystem damage extraction processes has strong implications for maintaining their climate resilience, and thus the resilience of the economic activities dependent on them.

Deep sea mining is focused on valuable metals such as manganese in nodules scattered on the seabed, and in chemicals transported to the surface in hydrothermal vents and seeps. Exploration is focused on abyssal plains and mid-ocean ridges, in Areas Beyond National Jurisdiction, where the International Seabed Authority has jurisdiction. There is great concern about the very slow life histories and ecological dynamics of deep sea biota, the lack of clarity around

environmental safeguards by countries prospecting for deep sea minerals, and no information on the recovery abilities of deep benthic communities from damage. Many calls for moratoria on deep sea mining have been made (Hunt, 2020), to prevent mining activities until likely impacts and mitigation are better understood, and mining can be reliably done with adequate controls.

Fossil fuel mining is a dominant marine extractive sector and has direct impacts on climate resilience through carbon emissions from the burning of fossil fuels, as well as through other pollutants and activities along the extraction chain. Transitioning away from highly polluting fossil fuels (such as coal and heavy oils) is underway and many believe no fossil fuels should now be used, including the cleanest varieties such as natural gas. The realities of economic growth, development and foreign investment indicate that certain fossil fuels will still be sought and extracted by African governments (e.g., of natural gas in northern Mozambique). But actively pivoting towards the most efficient and least-polluting fossil energy sources like natural gas and developing hybrid models to progressively increase the use of renewable energies and phase out fossil fuels should become an increasing deliberate strategy for Africa.

4.2. OCEAN ENERGY

The climate crisis has been driven by the use of fossil fuel and exponential growth in demand for energy in the global economy. A primary pillar for decarbonizing the global economy and making progress towards carbon neutrality to achieve the Paris Agreement by 2050 is transforming the energy sector away from fossil fuels. Renewable energy sources are a key source of clean energy to substitute for fossil fuel-based ones, and thus an essential component of national strategies to achieve climate resilient development. Ocean-based (offshore) renewable energy sources have great potential (Hammar, Mavume & Francisco, 2021) and include wave power, tidal stream power, ocean current power, ocean thermal energy conversion (OTEC), offshore wind power and floating solar power (FPV). While there are many challenges in realizing ocean energy sources in cost-effective ways, technical advances are expected and Hammar ‘s research project greatest potential in Africa for wave power, followed by ocean wind (see their Table 8). The other sources all currently show significant barriers.

The environmental impacts of major energy infrastructure will have a significant bearing on whether these technologies can sustainably support economic development. On the whole (considering wave and wind installations primarily) infrastructure does not involve major pollution risks other than from construction and transport-related operations. The major impact factor is the scale of the physical infrastructure, what this does to affected ecosystems and marine communities and any installation and decommissioning impacts.

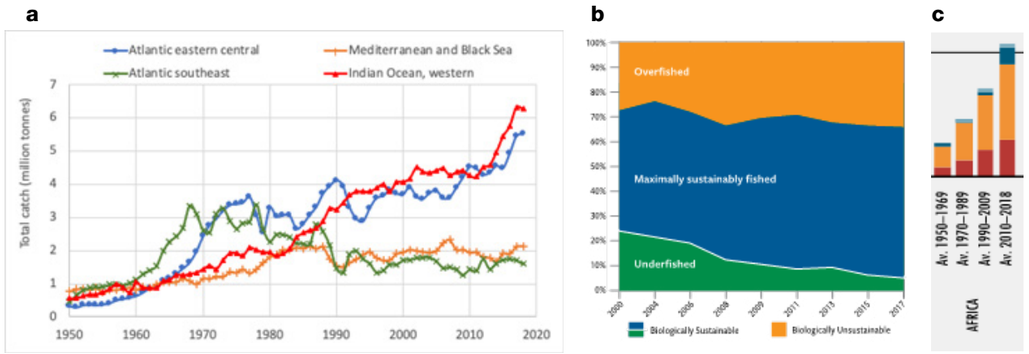
In many cases potential negative environmental impacts (such as wind turbine masts transforming an area of bottom and waters) can be turned to positive advantage through providing novel substrate for new communities (e.g. algae and invertebrates and three dimensional shelter), or integrating multiple uses, such as developing aquaculture facilities integrated in the space among wind turbines (see section ‘Marine Spatial Planning).

4.3. FISHERIES AND AQUACULTURE

The production of fish in Africa’s four FAO regions (figure 10a) was highest in the Atlantic regions into the 1980s, but then continued to increase only in the eastern central Atlantic (West Africa) and Western Indian Ocean, which continued increasing up to 2018. By contrast, fish catch declined in the southeast Atlantic and plateaued in the Mediterranean and Black Sea. The status of fisheries globally has progressively shifted over the last 20 years from about 25% overfished to 30% overfished, and from 50% maximally fished to 60%, and from 25% underfished to 5% (figure 10b). Understanding the status of individual stocks for fisheries to contribute to sustainable blue economies is necessary, to assure the proportion overfished is reduced and all stocks are managed at maximum sustainable yield or lower.

FIGURE 10:

Fisheries statistics showing the current state of fisheries.



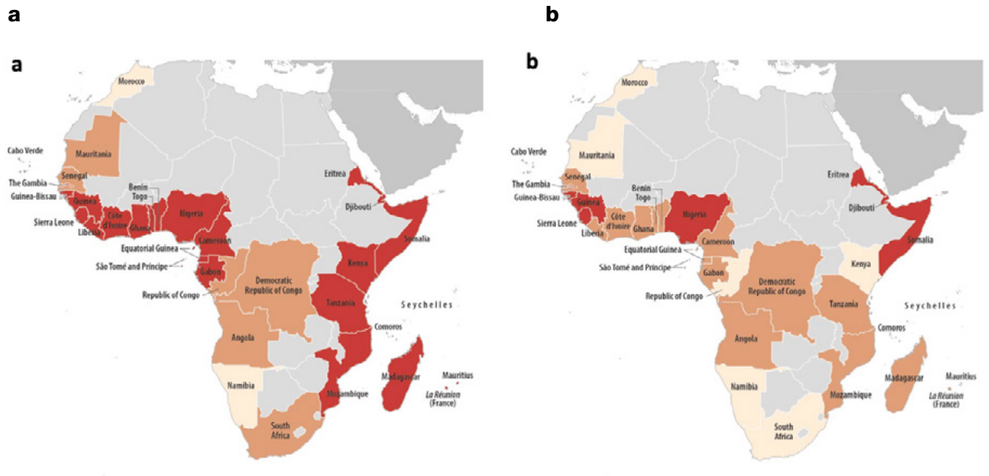
a) total catch (millions of tonnes) in the four African FAO regions from 1950 to 2018; b) proportions of global fish stocks that are overfished, maximally sustainably fished (at Maximum Sustainable Yield (MSY), and c) production of capture and aquaculture fisheries in Africa over four periods from 1950 to 2018. Source: Food and Agriculture Organization. (2020). State of the world’s fisheries. http://www.fao.org/fishery/statistics/global-production/en.

Data quality and provision is a challenge in ocean fisheries, given the vast expanse of the ocean, long and remote coastlines, the frontier mentality of fishers and many incentives to avoid reporting accurately. National fisheries data is reported to the UN Food and Agriculture Organization (FAO) by states, but due to challenges in reporting in artisanal fisheries, and Illegal Unregulated and Unreported (IUU) fishing, some countries (for example in East Africa) may have actual catch levels 1.5 to 4.5 times higher than the official records (Le Manach et al., 2012). To support climate resilient fisheries, investing in improved capacities for data collection, stock and other fishery surveys and management, as well as building the capacity of fishers to participate in fishery management, will be critical for achieving sustainability and inclusivity in fisheries.

With more fisheries becoming overexploited, aquaculture is increasingly viable economically, and is increasing as a proportion of the total global production of fish and aquatic food (figure 10c). While there are many risks associated with aquaculture, such as those of pollution and disease through intensive mono-culture production, and displacing fishing activity to catch food for culture fish, there are many benefits to aquaculture when it is done right. For example, by lowering the trophic level of targeted species from predators to primary consumers, great energy, nutrient and material savings can be made per unit of food or calorie produced. For inclusivity, aquaculture policies should promote small scale household, village and cooperative group production rather than industrial scale operations.

FIGURE 11:

Ecological risk score associated with climate change (a) and socio-ecological risk indicator (b) for coastal African countries.



The scales are different in the two maps, but colours indicate medium (tan), high (orange) and very high (red) risk levels for each. From: World Bank. (2019). Climate Change and Marine Fisheries in Africa: Assessing Vulnerability and Strengthening Adaptation Capacity. Washington, DC. <https://openknowledge.worldbank.org/handle/10986/33315>

Of particular concern for both fisheries and aquaculture is the impact of climate change on the environment and on the biology and resilience of resource stocks and the vulnerability of the fishery sector to these changes (World Bank, 2019; Barange et al., 2018). Climate impacts may include spatial shifts in distribution, fluctuations in productivity, changes in migration patterns and timing, and invasion by alien species. Tropical west and east African marine fisheries are most vulnerable ecologically (fig. 11a), compared to lower losses or even potential fishery gains farther north. In West Africa, a potential decline in catch of 30% is estimated, due to the importance of small pelagics in the region's catches and the potential changes in the Eastern boundary current on which they depend. However, an even greater factor is high socio-ecological risk (figure 11b) and low capacity within national fisheries to cope with climate impacts to fisheries and other socio-economic and indirect impacts of climate change. Climate change adaptation measures that could be trialled include: 1) the use of efficient surveillance and climate prediction systems to provide early warning; 2) supporting sustainable fishing, aquaculture and ecotourism activities; and 3) strengthening the institutional framework (legal, regulatory and organizational) to ensure sustainable management of fisheries and marine resources.

A key finding is that by acting urgently on the socioeconomic and other risk factors and assuring the rights of small-scale fishers to their resources, the vulnerability of fisheries to climate change can be largely mitigated, providing a key rationale for fully incorporating fisheries into sustainable and climate resilient blue economy approaches.

4.4. MARINE GENETIC RESOURCES AND BIOTECHNOLOGY

The genes and genomes of marine species, in the domains of biotechnology and bioprospecting, are referred to as Marine Genetic Resources (MGR). MGR fall under two legal instruments depending on their location. In national waters (EEZs) they fall under the Convention on Biological Diversity's third objective on Access and Benefit Sharing, and thus the Nagoya Protocol. However, in Areas Beyond National Jurisdiction (ABNJ) they fall under the legal framework of the UN Convention Law of the Sea (UNCLOS), but it is only in recent years through negotiations to develop an international legally binding instrument on marine biodiversity in areas beyond national jurisdiction (BBNJ) that a framework for MGR in BBNJ is being drawn up. In Africa, the potential for MGR is nascent and yet to be developed (Wynberg, 2016). The African Development Bank's background paper on Marine Genetic Resources (Yentcharé, 2021) takes a social science perspective, focusing on benefit-sharing of MGR in ABNJ and elaborating beneficial strategies African nations might take in the final stages of the BBNJ negotiations.

With respect to climate resilience and sustainability, prospecting for MGR faces the same major risk as other resource extraction sectors, that of over-exploitation. However, this is likely small, particularly in such early steps of prospecting, and may only become significant for high-value natural products from very rare or highly vulnerable species or habitats. In this case the risk of driving down species populations and damage to marine ecosystems while capturing the species may become very high. Spatially limited highly specific ecosystems, such as hydrothermal vents, may be extremely vulnerable to harvesting of heat-resistant bacteria (Mossop, 2015). The potential for using indigenous knowledge to source active compounds may be promising for African countries, however appropriate legislation and contracting standards to meet access and benefit-sharing requirements and commitments (Bhatia & Chugh, 2015) is universally lacking and urgently needed.

In terms of climate resilience, MGR may be just as vulnerable to climatic shifts as species and ecosystems. Thus, any investments in MGR must be held to the same conditions of impact assessment and determining vulnerability to climate changes, to assess sustainability.

4.5. MARITIME TRANSPORT (PORTS AND SHIPPING)

Ports are the primary nodes linking ocean and land-based transport networks, and process 90% of goods transported around the world. African ports handle just 4% of global container trade, a proportion that must inevitably rise with rapidly growing human population and economic development on the continent. As a result, ports will become even more intense sources of marine pollution, coastal transformation and human settlement than they are today. Key impacts associated with ports include: discharge of ballast water and as a result the release of invasive species; ship-generated wastes, which can promote potentially harmful algae blooms and significant decrease in marine biodiversity; oil spills; and the suffocation and smothering of marine habitats by sedimentation. In recent years, the ‘Green Port’ concept has grown, to integrate port economic activities with environmental considerations. The background paper on Ports and the blue economy (ANRC, 2021) shows considerable alignment with this paper on climate resilience, looking at four key areas to promote a ‘blue’ agenda for ports:

1. Establishing a conceptual frame for blue economy governance of ports;
2. Reviewing institutional dynamics around the blue economy nexus;
3. Exploring factors enabling and constraining blue economy governance in African ports; and
4. Identifying opportunities for institutionalizing blue economy governance for African ports, particularly through transnational (or regional/international) approaches.

In general, the background paper finds that African ports are constrained in their freedom to act independently from State machinery and priorities and have a narrow understanding of blue economy and related environmental matters (primarily related to sanitation, landscaping on land, and classic pollution and oil spill issues on the water), and they currently have limited agency to assimilate new concepts on blue economy (and thus climate resilience) and act on them. The ‘Green Ports’ initiative being adopted by ports clearly has the potential to also accommodate ‘Blue Ports’ or blue economy standards and criteria into the future. The vulnerability of ports to climate change, in particular sea level rise and intensifying storms and waves is critical. Many ports may be able to resist sea level rises of half to one meter in the coming decades, but sudden larger increases that may occur with ice-sheet instability in Greenland and Antarctica, and the importance of the salinization of water tables and destabilization of berths and handling yards prior to full inundation, are poorly known. Ports face all the standard challenges of growing cities, but with generally higher levels of population growth, and thus intensification of challenges, than inland areas (Neumann et al., 2015).

Climate resilience in the ports and shipping sectors of the blue economy will have to involve a mix of grey/concrete infrastructure (and thus of Nature-Based Solutions) for coastal defence and increasing the height of some berths, seawalls and other structures. The degree to which green infrastructure, or blended green-grey infrastructure, may play a role will likely be very site-specific, requiring detailed local assessments. The potential for ports and shipping to undermine climate resilience in other aspects of the blue economy is very high, particularly in relation to shipping, port construction and operations and dredging. Dredging, both for initial construction and ongoing maintenance of access in ports, has very high environmental and social costs when done inappropriately, and regulating this adequately is a top priority for maintaining climate resilience in ecosystems in and adjacent to ports, and in resource use sectors.

4.6. INTEGRATING SECTORS AND DECISION-SUPPORT

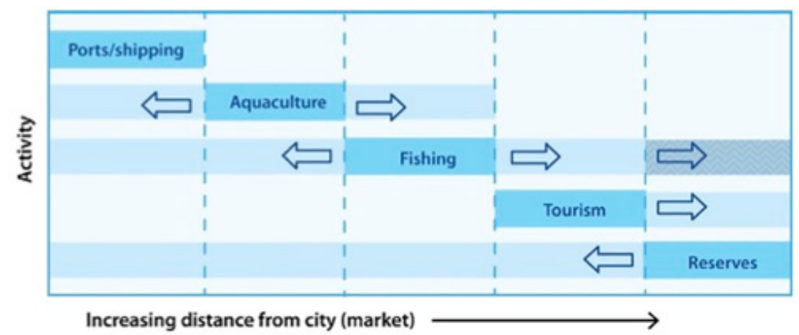
In past decades, each of the sectors above have operated independently, but there is greater crowding in heavily used seas such as the North Sea, and increasing and often synergistic impacts on ocean ecosystems, resulting in an increasing need for integration. Integrated Coastal Zone Management (ICZM) has been at the forefront of integrating sectors since the 1970s, with a focus in the coastal zone and on land-sea interactions, while Marine Spatial Planning (MSP) has grown in prominence (Lombard et al., 2019) as attention extends farther offshore to open ocean areas, to manage the impacts and crowding from multiple activities. Zoning activities to separate incompatible ones is

critical, and a natural distance-function from highly impacted urban zones to intact remote zones provides a first-order principle for zoning (figure 12) (Sale et al., 2014).

Marine Spatial Planning is now being extended to cover EEZs of many countries and the use of spatial decision-support tools is under investigation in both Areas Beyond National Jurisdiction and in the context of the BBNJ negotiations (De Santo, 2018). A range of countries in Africa have already completed national MSP processes, including South Africa, the Seychelles and Mauritius in the Western Indian Ocean – all three being strongly motivated by the potential for the blue economy to play a growing role in national development. Responding to this interest, growing regional networks and capacity to align national efforts are important, with a first regional MSP process underway in East and southern Africa (UNEP, n.d.) Heads of state in the High Level Panel on Ocean Sustainability have identified 'Sustainable Ocean Plans' for 100% of national waters as a top priority. Early descriptions of what a 'Sustainable Ocean Plan' is (Table 11) indicate it goes a step beyond MSP in specifying sustainability goals and reaching towards sustainable and inclusive blue economy planning.

FIGURE 12:

First-order zoning of activities in tropical coastal waters, based on distance from an urban center or market.



Lighter blue shading and arrows indicate potential 'nesting' of activities from second-order planning. Note that small-scale fisheries will usually be possible in all zones, although with restrictions. From: Sale, P. F., Agardy, T., Ainsworth, C.H., Feist, B.E., Bell, J.D., Christie, P., Hoegh-Gulberg, O., Mumby, P., Feary, D., Saunders, M., Daw, T.M., Foale, S.J., Levin, P.S., Lindeman, K.C., Lorenzen, K.,Pomeroy, R.S.Allison, E.H., Bradbury, R.H., …..Sheppard, C.R.C. (2014). Transforming Management of Tropical Coastal Seas to Cope with Challenges of the 21st Century. Marine Pollution Bulletin, 2014, 1–16. <https://doi.org/10.1016/j.marpolbul.2014.06.005>

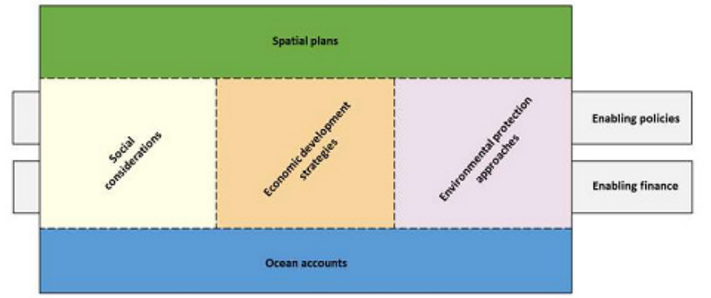
Of particular note here is the need for climate change vulnerability or resilience assessments, which currently may occur under a range of different titles and have origins in different disciplines. From ecological and socio-ecological perspectives a variety of climate change vulnerability assessment tools have been developed (GIZ, 2014), from which specific tools may be selected to apply to specific contexts and questions. Similarly, the vulnerability of a value chain or investment opportunity to climate change can be assessed (Surminski, et al, 2018). The contribution of ocean accounting frameworks (Section 3.5) is also highlighted in the Sustainable Ocean Plan schematic (Table 11), helping to integrate data flows and analyses across sectors to assess performance of the overall model.

TABLE 11:

Attributes and components of a Sustainable Ocean Plan as described by initial discussion documents.

Process	Content	Impact
Inclusive	Place-based	Endorsed
Integrative	Ecosystem-based	Financed
Iterative	Knowledge-based	Capacitated

Potential components:



For more details see https://www.oceanpanel.org/.

5. POLICIES, GOVERNANCE AND INVESTMENT MODELS

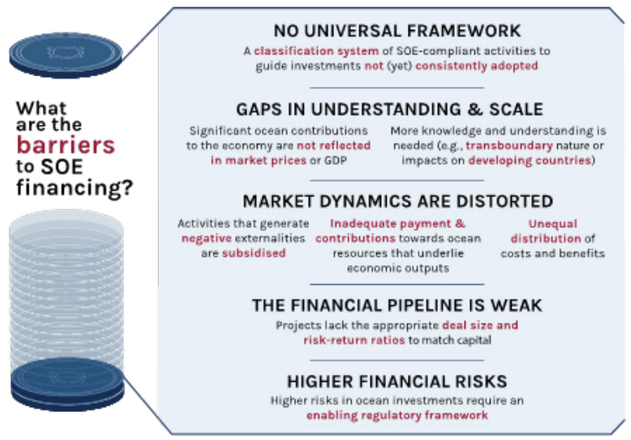
The prior sections of this paper have outlined the key aspects of the blue economy in terms of climate resilience – ecological, social and economic viability. Investor interest in the blue economy is extremely high today, but as a new paradigm there are many uncertainties. This chapter outlines basic aspects of policy governance and finance or investment models that are currently in operation, to set the stage for new options to be explored.

5.1. BARRIERS TO FINANCING THE BLUE ECONOMY – A NEW FRONTIER

Financing the sustainable blue economy faces many barriers (figure 13), as the scope, scale and uncertainties are novel. As a result, firms and investors lack the experience and expertise to address these challenges (Credit Suisse, 2020). To overcome the barriers, global institutions are investing in new analyses to guide countries, development banks and investors, with a strong focus on precaution. The reason for the degree of prudence is the widespread evidence of the declining health and productivity of living natural resources, and the understanding that there is in essence just one ocean. As a consequence, the ocean development pathway for the coming decades must be managed correctly, as getting it wrong will mean not only destroying options for redirecting ocean economy development, but also accelerating biodiversity loss, climate change and other global challenges to global prosperity.

FIGURE 13:

Barriers to financing a sustainable Blue Economy.



Reproduced from Sumaila, U. R., Walsh, M., Hoareau, K., Cox, A., Abdallah, P., Akpalu, W., et al. (2020). Ocean Finance: Financing the Transition to a Sustainable Ocean Economy (High Level Panel for Ocean Sustainability: World Resources Institute). www.oceanpanel.org/blue- papers/ocean-finance-financing-transition-sustainable-ocean-economy.

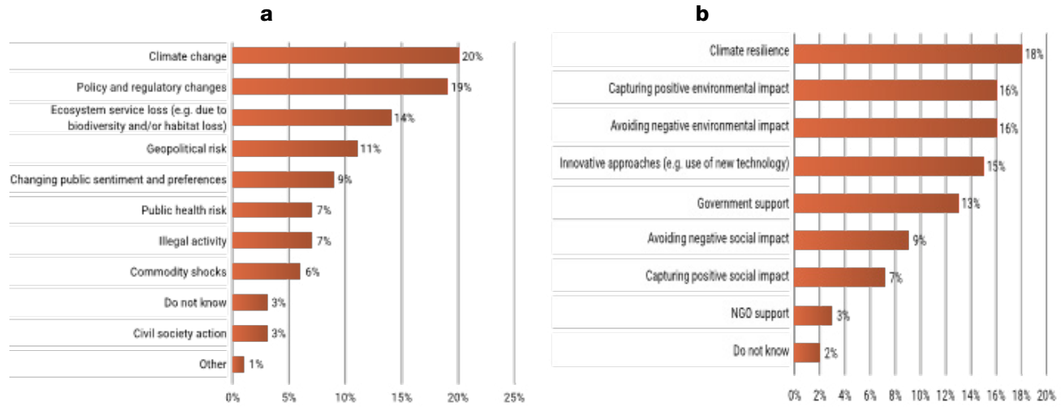
Thus, the High Level Panel on a Sustainable Ocean and UNEP's Sustainable Blue Economy Finance Initiative (UNEPFI, 2020), bringing together global leaders in finance, economics and ocean health, independently released a series of publications in 2020 that provide a blueprint for future action (Annex 2). At the same time, innovative examples of new financial instruments and investment models are being prototyped around the world, and there are some best case examples of what has worked to date. Applying the latest principles, drawing lessons from these case studies, and considerations of African development needs and socio-ecological contexts should be a starting point for developing a new Africa-focused approach to financing blue economic developments.

Lastly, given the challenges of this new frontier of engagement, it is unlikely, and in fact unproductive, for countries to develop new approaches in isolation. Thus the regional approach, focused on ocean regions, and continental approach, for consistent continental policy and trade, are essential for progress on the blue economy in Africa.

5.2. ADDRESSING RISK IN THE BLUE ECONOMY AND CLIMATE SPACE

FIGURE 14:

a) Main areas of perceived risk and b) main non-financial considerations across blue economy sectors



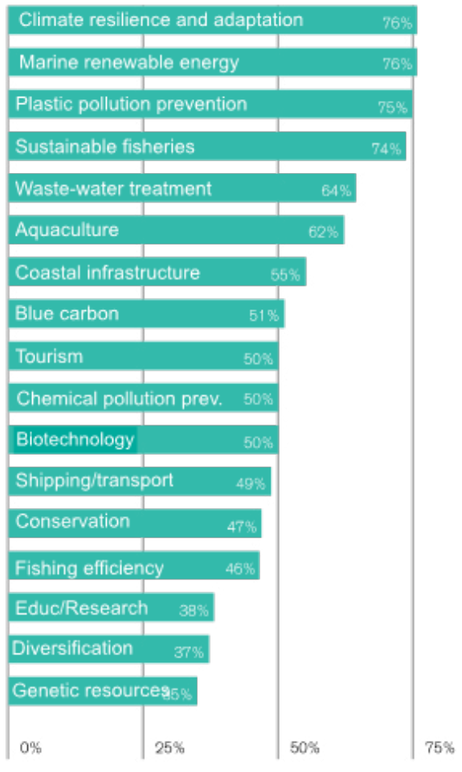
From: UNEPFI. (2020). Rising Tide: Mapping Ocean Finance for a New Decade. UNEP Sustainable Blue Economy Finance Initiative/European Commission, p. 79. <https://www.unepfi.org/publications/rising-tide/>

Risk is a key concern for economic investment, applying equally to the blue economy and particularly in relation to climate change and resilience as longer-term concerns. Risk assessment offers a framework for institutions to understand their general exposure to climate risk, and guidance for assessing this in relation to disclosure for investors has been developed (UNEPFI, 2020). In a global survey of risk in blue economy sectors, climate change rated as

the highest risk factor, and both climate resilience and positive environmental impacts were rated as the two most important non-financial considerations (figure 14). Assuring climate risk is addressed in blue economy planning is thus essential for this sector to grow in Africa; ensuring climate resilience and minimizing environmental impacts are thus among the most critical design factors.

FIGURE 15:

Frequency of investors citing these opportunities in the sustainable blue economy.



From: Credit Suisse, 2020. Investors and the Blue Economy: Geneva.

Interestingly, however, climate risk should not necessarily only be viewed as a barrier. A survey of investors by Credit Suisse found that investor interest in the blue economy reflects the perspective of 'turning challenges into opportunities' (Credit Suisse, 2020). They found that investors (whether owners or fund managers) viewed the blue economy as presenting great practical opportunities to resolve challenges of decline in ocean health and worsening climate change,

over and above interest in traditional sectors such as shipping, fisheries, and even marine genetic resources (figure 15).

This highlights an important argument supporting the pivot to sustainable and circular economic models over current growth ones, that there are more opportunities in this shift than are commonly perceived, and they may in fact outweigh business opportunities in the current model, particularly as attitudes shift. To support this, firms seeking to develop blue economy activities, and the investors considering them, are asking for concessions to overcome barriers to entry (Table 12) that centre around climate change and its uncertainties and opportunities. That is, investors are calling for enabling conditions for future opportunities that may not yet be clear, not just calling for protection for 'traditional' business opportunities. This provides a strong environment for innovation and forward thinking in developing a sustainable blue economy and creating 'new wealth' and opportunities.

TABLE 12:

Solutions identified by investors to overcome the barriers to blue economy investing.

Asset owners are calling for:	Asset managers are calling for:
• Sustainable blue economy investment criteria • De-risking of investments • Education / network of stakeholders • Pooled funding opportunities • Metrics for evaluating success. • General awareness raising	• Long-term holding periods mandated by clients • More expertise, knowledge sharing and awareness raising, especially around the investment case for the sustainable blue economy • Taxonomy • Case studies and reports • Creation of banks focusing on the ocean • Investments with track record • Public-private-partnerships • Show risk to investments of not taking action

Source: Credit Suisse (2020) Investors and the Blue Economy: Geneva.

TABLE 13:

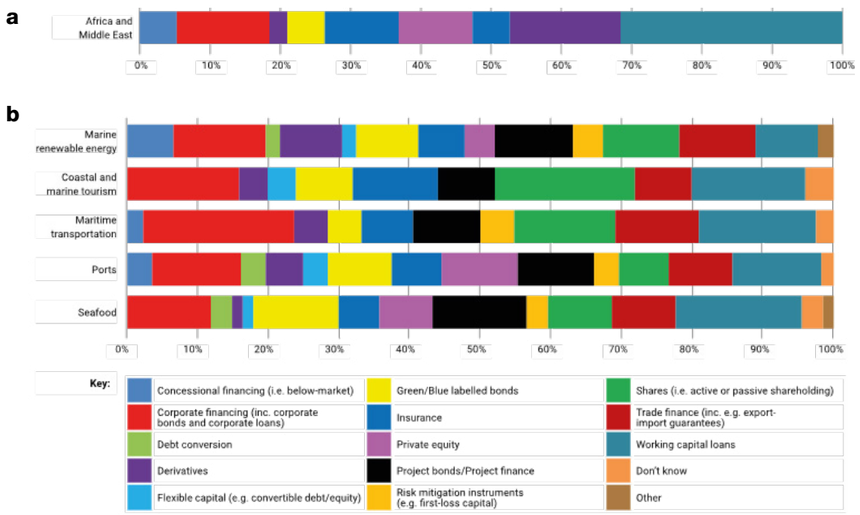
Example of policy objectives and performance thresholds to be met for an investment to quality for sustainable blue economy finance. Derived from the EU Taxonomy as reported in UNEPFI (2020a).

Green/blue policy objective	Performance threshold
Does the intervention address: 1. Climate change mitigation; 2. Climate change adaptation; 3. Sustainable use of water and marine resources; 4. Transition to a circular economy; 5. Pollution prevention and control; or 6. Protection and restoration of biodiversity and ecosystems?	Does the intervention address: 1. Does the investment: 2. a) substantially contribute to one of the six objectives? 3. b) do no significant harm to the others? and 4. c) comply with minimum standards?

From a more traditional 'impact assessment' perspective, any funder will need to assess at the very least whether proposed actions increase environmental or climate risk or reduce them. A process for identifying environmentally sustainable economic activities that meet 'green' criteria established by the EU (Europa, n.d) may be adapted to this purpose, applying six principles and three performance thresholds (Table 13) to assess whether specific projects qualify for financing.

FIGURE 16:

Financial instruments used in a) Africa and the Middle East, and b) in different blue economy sectors (globally).



From: UNEPFI. (2020). Rising Tide: Mapping Ocean Finance for a New Decade. UNEP Sustainable Blue Economy Finance Initiative/European Commission, p. 79. <https://www.unepfi.org/publications/rising-tide/>

5.3. INVESTMENT MODELS

The landscape of finance instruments deployed across multiple ocean sectors in the sustainable blue economy is already complex and varies by sector (figure 16). However, these instruments are principally siloed in traditional sectoral boundaries. Finance for traditional 'ocean economy' versus 'sustainable ocean economy' sectors varies among both donors and recipients, with an increasing trend towards sustainable sectors. In addition, there is a growing set of initiatives emerging around key aspects of financing to deliver on sustainability goals, such as risk, or on thematic areas such as natural capital (Table 14). A significant challenge in this novel landscape is the lack of established frameworks and taxonomies of sustainable blue economy finance (Sumaila et al., 2020). Initial steps have been made with the Blue Economy Finance Principles (WWF, 2014)

in 2014, supplemented in the last two years through the UNEP Sustainable Blue Economy Finance Initiative (UNEPFI, 2020), the European Taxonomy (2019) of finance instruments (Europa, n.d) and by the Asian Development Bank (Development Asia, n.d.). UNEP FI has also developed Principles for Sustainable Insurance (PSI), Principles for Positive Impact Finance (PI), Principles for Responsible Banking (PRB) and Principles for Responsible Investment (PRI). Deeper analyses for five key sectors (seafood, ports, maritime transportation, renewable energy, and coastal and marine tourism, see Section 4) provide for greater nuances on investment pathways that may or may not work in each case (UNEPFI, 2020b).

TABLE 14:

Overview of current sustainable blue economy financing initiatives.

Type of finance	Examples
Specific financing initiatives established focused on key aspects of financing, such as risk, or a collection of sectors or themes, such as natural capital.	• Reduce exposure and vulnerability in coastal communities and Small Island Developing States (SIDS) (ORRAA, G20 members plus Fiji, India, Mexico and Norway); • A coalition bringing together civil society organizations, private and public sector financial institutions and academia for increasing investment in conservation-linked projects (CPIC); • Blended financing models to foster investment in protecting, restoring and enhancing natural ecosystems, such as blue carbon (BNCFF); • Innovative finance and risk management opportunities to develop resilience for vulnerable ecosystems, such as coral reefs and mangroves (WTW/GERF); • Integration of previously separate efforts to build and finance different capitals – including nature, social, and human (Natural Capital Coalition (NCC) and the Social & Human Capital Coalition (S&HCC)).
Multi-lateral development banks (MDBs). Established financing efforts for the development of the sustainable blue economy.	• The Asian Development Bank (ADB) Oceans Financing Initiative (OFI) and Healthy Ocean Action Plan, • The World Bank's PROBLUE, a new multi-donor trust fund (MDTF) that supports "healthy and productive oceans" (World Bank, 2020) focused on fisheries and aquaculture, marine pollution, developing key sectors sustainably (e.g., tourism, transport, energy) and building capacity in governments; • The European Investment Bank (EIB)'s Blue Sustainable Ocean Strategy (Blue SOS) focused on coastal development and protection, seafood production, transport and biotechnology.

From: UNEPFI. (2020). Rising Tide: Mapping Ocean Finance for a New Decade. UNEP Sustainable Blue Economy Finance Initiative/European Commission, p. 79. <https://www.unepfi.org/publications/rising-tide/>

TABLE 15:

A Taxonomy of Conservation Finance Mechanisms.

A. Return-Based Investments	☐ Microfinance ☐ Peer-to-Peer (P2P) Investing and Crowdfunding ☐ Angel Investing, Incubators and Venture Capital ☐ Private Equity ☐ Debt: Leasing, Bank Loans, Notes, and Trade Finance ☐ Capital Markets ☐ Sustainable Investment Strategies
B. Economic Instruments	☐ Environmentally Related Taxes ☐ Fees and Charges ☐ Tradable Resource Use Permits ☐ Fines and Penalties ☐ Compensation and Offsets ☐ Deposit-refund Schemes ☐ Environmentally Motivated Subsidies
C. Grants and Other Transfers	☐ Official Development Assistance (ODA) ☐ Private and Corporate Philanthropy ☐ Remittances ☐ Conservation Trust Funds / Environmental Funds
D. Business and Markets	☐ Supply Chain Resilience ☐ Conservation Businesses ☐ Corporate Social Responsibility and Sustainability ☐ Voluntary Offsets
E. Public Financial Management	☐ Public Fiscal Planning, Budgeting and Disbursement ☐ Fiscal Transfers ☐ Government Grants ☐ Reforming Harmful Subsidies ☐ Earmarking Revenues for Nature
F. Risk Management	☐ Insurance Products ☐ Pay for Success ☐ Blended Finance
G. Financial Efficiency	☐ Management Effectiveness ☐ Public Private Partnerships ☐ Integrated Accounting ☐ Mainstreaming Biodiversity in Development

From: Meyers, D., Bohorquez, J., Cumming, T., Emerton, L., vann den Heuvel, O., Riva, M., & Victurine, R. (2020). Conservation Finance: A Framework. Conservation Finance Alliance, www.cfalliance.org<10.13140/RG.2.2.14186.88000>

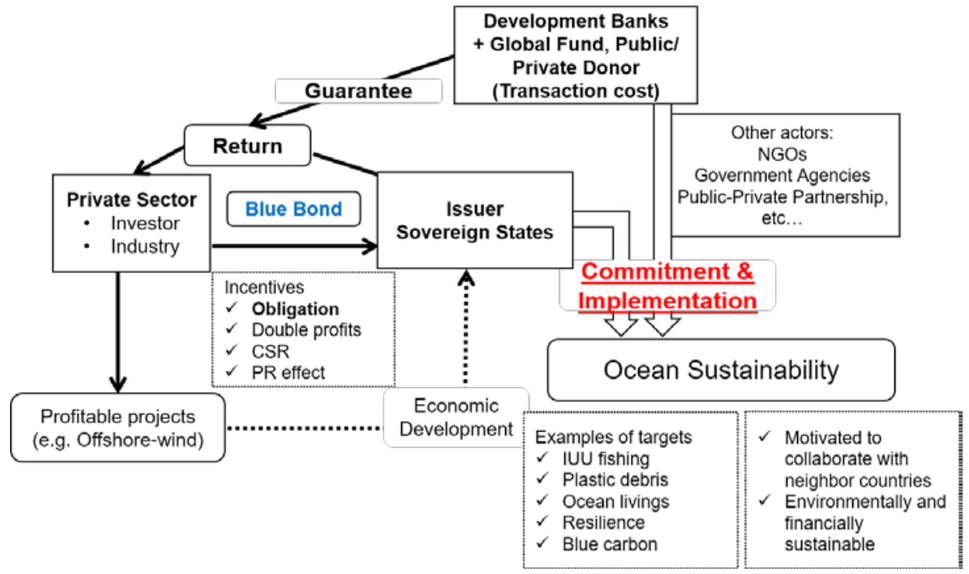
Finance models for sustainable development, being premised on sustainable ecological systems, are similar to those developed for conservation, particularly in recent years as conservation models increasingly include social and viability outcomes (Meyers et al, 2020). A useful taxonomy of finance models is summarized in Table 15 that is helpful for considering options in ocean economy finance. Which options may be used in a particular context depends on multiple contextual factors, the stakeholders and investors involved.

A number of focused studies are emerging to promote blue economy investments, including under the European Union (van Aalst et al., 2018), and the Asian Development Bank (Yoshioka et al., 2020). They survey existing experiences to identify promising pathways for policy support to bridge the financing gap. The European Union study identified several funding types that are relevant to expand the blue economy, including grants for early stage

developments, blended capital where complex risks require investors across a range of risk-return profiles, investment instruments suited to different blue economy sectors, corporate investors that have specific strategic focus, and state aid. Each has its strengths and weaknesses. They also consider a range of 'platform structures' for channelling blue economy investment. These include a dedicated blue economy fund; or focusing the fund through a variety of lenses or perspectives which might include: by sub-sectors that allow for specialization and subject focus, by the stage of operations (i.e. start-up, venture capital, expansion funds, etc`), or by geographic focus. They conclude though, that a broad umbrella platform better matches the needs in the European market at the time of the study as this would *"allow the support of wider focus funds that focus on commonalities between Blue Economy sectors as well as funds that focus on niches requiring more specialist sector and/or investment knowledge" (van Aalst et al., 2018, p.82).*

FIGURE 17:

Conceptual Framework of a proposed Blue Finance Mechanism that includes the private sector seeking profitable blue economy ventures.



From: Yoshioka, N., Hao Wu, H., Huang, M.C., & Tanaka, H. (2020). Proposing Regulatory-Driven Blue Finance Mechanism for Blue Economy Development, ADBI Working Paper 1157. Asian Development Bank Institute, p. 19. <https://www.adb.org/publications/proposing- regulatory-driven-blue-finance-mechanism-blue-economy-development>

The ADB study looked at current blue economy financing initiatives which are growing rapidly with a focus on ocean activities, conservation and climate change. It notes in particular the Green Climate Fund (GCF), the Global Environmental Facility (GEF), the World Bank and the Nature Conservancy. 'Blue bonds' have been announced by Seychelles (Box E) and the Norwegian Investment Bank (to raise $200 million for water-related projects around the Baltic Sea) and a first private-sector bond involving the World Bank and Morgan Stanley addressing marine plastic waste pollution. Noting that Sovereign blue bonds do not yet stimulate private sector and economic activity, the study identifies five key stakeholder groups each with differing and complementary objectives and strengths: a) developing states and SIDSs; b) organizations (national and international); c) development banks and global funds; d) private sectors and industries; and e) private investors and the general public. To involve the private sector successfully, the study proposes a structure (figure 17) and regulatory model that would involve them in the blue bond financing mechanism, and serve to ensure their compliance with legal obligations around environmental and social impacts, climate resilience and sustainability. The first example of a financing vehicle involving a blue bond is presented in Box E – the Seychelles Blue Bond – illustrating how finance can be generated in a specific context to support the sustainable and climate-resilient blue economy.

Box E. Seychelles' blue bond and debt conversion, raising finance for blue economy ventures

The Seychelles established a series of world firsts, by restructuring a $21.6 million debt and raising $15 million in finance through a debt for nature swap for ocean conservation and sovereign blue bond respectively, on the back of protecting 30% of its over 1 million km2 EEZ through a national marine spatial plan (illustration). The debt conversion was facilitated through The Nature Conservancy, while the blue bond was capitalized by private investors (Nuveen, Prudential and Calvert Impact Capital) and supported by a partial guarantee by the World Bank (IBRD) and a concessional loan from the GEF to bring down interest costs, with $11.6 million/US$ 3 million of the finance going into the Seychelles' Conservation and Climate Adaptation Trust (SeyCCAT) and US$12 million to the Development Bank of Seychelles (DBS). SeyCCAT oversees grants to local organizations and NGOs implementing conservation and sustainable development projects in line with the national sustainable blue economy plan. Links between the financial instrument and actions on the ground are moderated through the Marine Spatial Plan, though which biodiversity conservation, climate adaptation and blue economy actions are integrated.

Image credit: Seychelles Marine Spatial Plan.

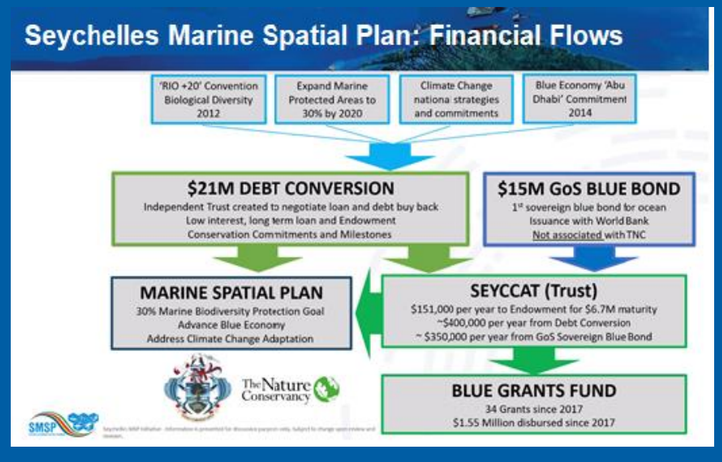


Image credit: Seychelles Marine Spatial Plan.

6. REGIONAL AND INTERNATIONAL GOVERNANCE PERSPECTIVES

The United Nations Economic Commission on Africa kickstarted discussions in Africa on blue and ocean economy development through a policy handbook (UNECA, 2016), from which two key points are relevant here. The first is its attention to mainstreaming climate change and environmental stability as core concerns, as has been covered in the bulk of this study. Secondly is the importance of regional entities such as Regional Economic Commissions (RECs) and international organizations in establishing alignment among neighbouring countries (see Section 2.3).

The need for regional and international integration was emphasized in the Sustainable Blue Economy Conference in Nairobi in November 2018, as part of the United Nations Oceans Conference/SDG14 processes (SBEC, 2018). Regional integration can be further strengthened through the top-level political attention to blue economy opportunities promoted by the African Union (2015). The African Ministerial Conference for the Environment (AMCEN) has spearheaded a process since its fifteenth session in 2015, culminating in a draft African strategy for ocean governance (UNEP, 2021) for States to consider. It contains several scenarios for an ocean governance model, including a financial facility or mechanism for African ocean governance, mirroring the 'general blue economy fund' or 'broad umbrella platform' highlighted in section 5.3, for hosting by a relevant continental body such as AfDB.

Transboundary cooperation is bolstered by the Head of State level interest in blue economy shown in many countries in Africa, such as South Africa, Seychelles, Mauritius, Kenya and others, which can help to forge regional and continental integration across broad economic and government scopes. The High Level Panel on Ocean Sustainability (Ocean Panel, n.d.) established in 2019, comprised of 14 sitting Heads of State including three African ones - Ghana, Kenya and Namibia – provides further opportunities for international cooperation, founded on a wide science basis, a coalition of private sector actors and an agreed agenda for transformations. The Marine Regions Forum, part of the Partnership for Regional Ocean Governance (PROG, n.d.), is an emerging forum promoting the regional approach to addressing sustainable development related to the oceans with a focus on SDG 14, focusing on regions as a strategic nexus for addressing all these cross-scale issues.

The importance of international governance and policy processes is also highlighted by the two global conventions relating to climate and biodiversity – the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD), respectively. Both convention processes have gained in importance internationally as both the climate and biodiversity crises have risen to the top of political agendas in the last decades. Both conventions have important Conferences of Parties (COPs) that were delayed from 2020 into 2021 due to the Covid-19 pandemic[3], and both have important decisions to take that will influence the coming decades of action on both climate and biodiversity conservation, and the complex inter-relations between them. Building on the major assessment reports of the two conventions – the Intergovernmental Panel on Climate Change (IPCC) Assessment Reports of the UNFCCC and the regional and global assessments of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) for the CBD – which outline in detail climate and biodiversity trends and vulnerabilities globally as well as for Africa, a joint workshop report by the two bodies released in June 2021 provides the latest science on biodiversity-climate interactions (Portner et al., 2021). The context set by the two bodies provides the key foundations for establishing climate resilience in blue economy processes, and regional entities play a critical role in making it concrete and ready for implementation within national systems.

To deliver on climate resilient blue economy aspirations, African countries and interested parties need to push for the delivery of high ambition in both climate and biodiversity spheres due to the high vulnerability of African countries to both climate change and biodiversity loss, and then strongly urge strong implementation of measures. While implementation will be costly and will require initially lower gains in revenue and benefits within individual economic sectors, the long term economic and sustainability benefits will far outweigh these costs (Sumaila et al., 2020; Hoegh-Guldberg et al., 2019) and represent the only viable pathways to climate resilience in ocean and national economies. To help navigate this complex landscape of policy decisions and governance across scales, a small set of principles can be outlined (Box F).

Strong regional alignment among countries for joint action and mutual support, and to negotiate more beneficial terms with foreign investors, trading partners and donors will play a critical role in delivering outcomes beneficial to countries and regions alike. In moving forward, it is likely that at the continental level, an umbrella blue economy fund (van Aast et al., 2018), or at least set of guiding principles or regulatory framework (Yoshioka et al., 2020) to which all continental actors agree to be held accountable, may most efficiently develop climate resilient, sustainable blue economies across African states.

[3]COP 26 of the United Nations Framework Convention on Climate Change (UNFCCC) (https://unfccc.int/process-and-meetings/conferences/glasgow-climate-change-conference) and COP 15 of the Convention on Biological Diversity (CBD) (https://www.cbd.int/cop/).

Box F. Five principles for governing a sustainable blue economy (Source: Bennett et al. 2019, 201).

- at the regional (and continental) level, prioritization of sustainability and equity in international negotiations and instruments pertaining to shared resources and challenges across EEZs, and links to the global commons in the high seas and deep ocean.
- at national levels comprehensive legislation and effective regulatory agencies to manage EEZs, building on integrative approaches such as Marine Spatial Planning and Integrated Coastal Zone Management (ICZM).
- within countries the equitable treatment and inclusion of local, coastal and indigenous populations with direct dependence on ocean resources, and establishment of relevant rights-based regimes for them.
- cutting across these scales promoting the inclusion of civil society (comprising scientists, media, non-governmental organizations (NGOs) and marginalized groups) in decision-making processes, noting the importance of representation and coalitions or blocs of interest groups participating in planning processes (such as marine spatial planning).
- Informing all these processes, the use of science and evidence-bases, and where faced by gaps in knowledge, application of precautionary principles informed by intergenerational equity.

7. CONCLUSION

This background paper is prepared in parallel with a set of sector-specific blue economy papers for the African Development Bank and attempts to show that the key elements for ensuring climate resilience and sustainability for the blue economy (Section 3) map across multiple sectors (Section 4). Developed in sectoral silos, which has been the practice to date, these sectors undermine the broader goals of a sustainable blue economy. This paper attempts to show how innovative approaches supported by novel finance models are needed to ensure each sector is pursued in ways compatible with sustainability and climate resilience principles.

A ‘climate resilient blue economy’ requires that a country, and economic actors preserve and grow assets, maintain cash and resource flows, and at the same time ensure inclusion (equity, social requirements), environmental sustainability and transition to low carbon energy sources. Africa has a high number of citizens dependent on nature including in the coastal zone, and thus the nexus of climate, nature and economy is particularly important. In pursuing blue economic development, true sustainability and security of investments and income will only be achieved through assuring climate resilience.

Box G extracts key messages from each section of the report, selected to highlight the ‘joined up’ approach that will be necessary to achieve a sustainable blue economy. Focusing on narrow sectoral domains, even if done with ‘good’ technologies (such as in renewable energies), risks having significant negative impacts and thus fail to achieve climate resilience and sustainable and inclusive development. The threads in Box G are presented as an illustration of how to approach any proposal for action/investment in a blue economy sector.

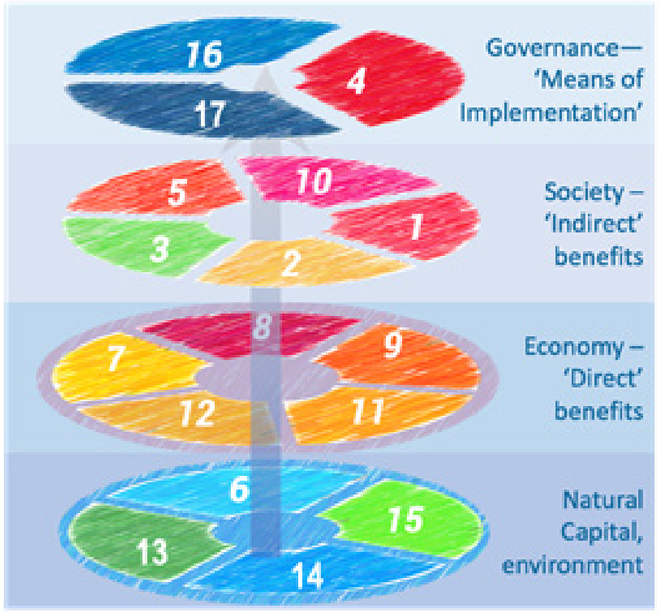
The broader dimensions of the climate resilient ocean or blue economy relate to its equivalence with the Sustainable Development Goals (SDGs) applied to the ocean. The importance of the three pillars of Sustainable Development – environment, economy, society – align with the three main types of capital – natural, manufactured and human – that must be nurtured and built for economic prosperity and sustainability, as well as the translation from natural capital through direct benefits (economic goods and services) to indirect benefits (societal) (figure 18). When any one of the goal domains is undermined, the potential for balanced growth and sustainability is diminished.

The SDG framework also highlights the important enablers of knowledge, governance, partnerships and finance, in the top tier of figure 18 in SDGs 4, 16 and 17, in guiding and maintaining the complex interactions involved. Establishing supporting instruments and mechanisms to manage the system will be essential, requiring appropriate legislation within countries, as well as the supporting regional frameworks to link across countries and assure coherence

and minimal negative impacts. Investing in data – monitoring, research, professionals, archiving and sharing infrastructure – and in processes to use the data for decision-support – in marine spatial planning and ocean accounts, as well as in specialized areas – will never be more critical.

FIGURE 18:

The Sustainable Development Goals arranged in a blue economy framework.



From:https://davidobura.medium.com/coral-reefs-sdgs-and-the-post-2020-biodiversity-framework-9cc552b647ddhttps://www.sciencedirect.com/science/article/abs/pii/S0308597X19309340

Box G. Synthesis and key findings

Vulnerability to climate change

- Climate change poses a profound challenge to African countries as both livelihoods and economic systems are strongly tied to nature's productivity and resilience.
- Straddling the equator, Africa is particularly vulnerable to climate change due to already-high temperatures in equatorial/tropical marine and coastal regions, and limits to migration north and south at the limits of the continent.
- High dependence on marine, coastal and nearshore ecosystems and resources imposes vulnerabilities as these are highly dynamic and large shifts can be expected due to climate change, but peoples' dependence is highly localized and specific.

Nature and benefits

- The open ocean and deep sea around Africa are overall poorly or inefficiently utilized, or are exploited more intensively by foreign actors, presenting both an opportunity for domestic expansion, but also risks from uncertainty and of historical exposure to unregulated or lightly-regulated use.
- The adjacent coast is a key asset for blue economy development – its use and development are poorly regulated in Africa, undermining future options.
- To streamline future discussions, a globally-accepted definition of Nature Based Solutions (NbS) must be adopted. As prescribed by the IUCN this is "Nature Based Solutions (NbS) are actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits". Accordingly, any action that has negative impacts on aspects of biodiversity, or on people, can be classed as a Nature Based Solution.
- Ecosystem Based Approaches (EBA) and Nature Based Solutions (NbS) are already deployed widely in Africa given the high dependence on nature, but often with poor practices that undermine natural assets. Investing in correctly designed EBA/NbS can leapfrog technological dependence on grey or manufactured infrastructure and materials by jumping straight from extractive to regenerative practices, and to provide multiple benefits.
- Benefit flows from nature underpin most of Africa's economic sectors – recognizing this to invest in and rebuild natural assets, particularly to build resilience to climate change is a key solution. Valuing multiple benefit flows, particularly ones traditionally outside of markets, can provide the incentives and processes for protecting and nurturing them.

People and economy

- Inclusivity, equity and justice are key dimensions of the blue economy. For historical reasons Africa has faced high levels of inequalities. Climate resilience and blue economy principles provide strong incentives and mechanisms to redress these imbalances.
- The need for economic growth in Africa is very high, but the multiplier effect of growing population and incomes may undermine all aspects of climate resilience, unless transformations are initiated in economic and production practices to prevent further environmental damage.

- The integration of all major economic sectors into joint planning and identification of sustainable solutions will be essential for successful implementation of sustainable blue economy approaches.

Investment models

- The novelty of blue economy opportunities, blended with climate uncertainties and risk, mean that innovative investment instruments are necessary. This results in high levels of risk, and the need to both cushion investors but also assure zero impacts to critical blue economy assets.
- Risk is a key factor influencing finance for blue economy endeavours, given the high impacts of climate change. But equally, investing in solutions and innovations to address multiple risks provides promising opportunities for development.
- Emerging principles for investment in the climate resilient blue economy point towards blended instruments involving multiple actors, underpinned by regional, continental and international standards and platforms enabling consistency among countries and individual ventures. The Seychelles Blue Bond is a world-first, providing a model for adaptation and replication elsewhere.

Governance

- Regional and continental/international frameworks can play an essential role in building capacity, setting standards and supporting alignment among national processes, particularly relevant to the shared assets/ common property aspects of ocean ecosystems and resources. Regional Economic Commissions will likely play the key role here, supported by sectoral bodies, such as for the environment, fisheries and others. At the continental scale, both the African Union and the African Development Bank will likely play critical roles.
- Lack of regional and local data and low capacity in technical fields undermines decision-making ability, so decisions must be made assuming high uncertainty and maximum precaution which is particularly important for long term investments.
- Strict adherence to Environmental Impact Assessments (EIA) and Strategic Environmental Assessments (SEA) in planning and development processes, and Environment, Social and Governance (ESG) and sustainability processes in corporate and business practices will be essential to assuring climate resilient pathways are embedded in business and corporate sectors.
- Integrated and Ocean Accounting systems can serve to streamline and standardize data and enable its use – from company to national levels – in quantifying value and assuring the sustainability of ecosystem assets.

- Global policy processes are essential for setting limits and a common vision in relation to planetary limits. In this decade (2020-2030) the Sustainable Development Goals (SDGs) provide the primary overarching framework, with the climate and biodiversity conventions playing pivotal roles for setting targets in their respective sectors and for integrating between them. For Africa, the AU's Agenda 2063 'the Africa we want', plays a guiding role.

8. REFERENCES

van Aalst, P., Adams, M., Paterson-Jones, G., Poulsen, M., Pucher, J., Jeffrey, P.,Belicka, D., Lonsdale, J.,Kisielewicz, J., Glowacki, K., Barreto, R. (2018). Study to Support Investment for the Sustainable Development of the Blue Economy (Brussels: Executive Agency for Small and Medium-sized Enterprises (EASME) European Maritime and Fisheries Fund, European Commission. <https://webgate.ec.europa.eu/maritimeforum/en/system/files/d13_investmentplatformrecommendation_24092018.pdf>

African Development Bank. (2020). African Economic Outlook 2020. <https://www.afdb.org/en/documents/african-economic-outlook-2020>

African Development Bank (2013). At the Center of Africa's Transformation. Strategy for 2013–2022. Abidjan, Côte d'Ivoire.

African Natural Resources Centre. (2021). African Ports and the Blue Economy Nexus: Institutional, Policy and Governance Arrangements. African Development Bank. https://www.afdb.org/en/documents/african-ports-and-blue-economy-nexus-institutional-policy-and-governance-arrangements

African Union. (2014). 2050 AIM Strategy. <https://au.int/en/documents/20130401-2>
African Union. (2015). Agenda 2063. The Africa We Want. Final Edition. <https://au.int/en/documents/20141012/key-documents-agenda2063>

Agrawal, A., & Kent, R. (2009). Conservation and Displacement: An Overview. Conservation and Society, 7.1, 1. <https://doi.org/10.4103/0972-4923.54790>

Akiwumi, P. & Melvasalo, T. (1998). UNEP's Regional Seas Programme: Approach, Experience and Future Plans. Marine Policy, 22.3, 229–34. <https://doi.org/10.1016/S0308-597X(98)00009-8>
African Ministerial Conference on the Environment. (2019). Advancing the Sustainable Blue (Ocean-Based) Economy in Africa 15/11. <https://wedocs.unep.org/bitstream/handle/20.500.11822/30676/AMCEN_176.pdf?sequence=1&isAllowed=y>

Attri, V.N., (2014). An Emerging New Development Paradigm of the Blue Economy in IORA. A Policy Framework for the Future. Indian Ocean Rim Association/University of Mauritius.

Attri, V.N., & Bohler-Muller, N. (2018). The Blue Economy Handbook of the Indian Ocean Region. Indian Ocean Rim Association (IORA), Economic and Social Research Council, South Africa.

Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F., eds. (2018). Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper No. 627.

Basconi, L., Cadier, C., & Guerrero-Limón, G. (2020). Challenges in Marine Restoration Ecology: How Techniques, Assessment Metrics, and Ecosystem Valuation Can Lead to Improved Restoration Success. In S. Jungblut, V. Liebich, & M. Bode-Dalby (Eds.)YOUMARES 9 - The Oceans: Our Research, Our Future: Proceedings of the 2018 Conference for YOUng MArine RESearcher in Oldenburg, Germany Cham: Springer International Publishing., pp. 83–99. <https://doi.org/10.1007/978-3-030-20389-4_5>

Bayraktarov, E., Saunders, M.I. & Abdullah, S. (2016). The Cost and Feasibility of Marine Coastal Restoration. Ecological Applications: A Publication of the Ecological Society of America, 26, 1055–74. <https://doi.org/10.5061/dryad.rc0jn>

Beattie, A. (2019). The 3 Pillars of Corporate Sustainability. Investopedia. <https://www.investopedia.com/articles/investing/100515/three-pillars-corporate-sustainability.asp> [accessed 10 March 2021].

Bennett, N. J. (2018). Navigating a Just and Inclusive Path towards Sustainable Oceans. Marine Policy, 97, 139–46. <https://doi.org/10.1016/j.marpol.2018.06.001>

Bennett, N. J., Blythe, J., Sandrine White C., & Campero, C. (2021). Blue Growth and Blue Justice: Ten Risks and Solutions for the Ocean Economy. Marine Policy, 125. <https://doi.org/10.1016/j.marpol.2020.104387>

Bhatia, P., & Chugh, A. (2015). Role of Marine Bioprospecting Contracts in Developing Access and Benefit Sharing Mechanism for Marine Traditional Knowledge Holders in the Pharmaceutical Industry. Global Ecology and Conservation, 3, 176–87. <https://doi.org/10.1016/j.gecco.2014.11.015>

Burrows, M. T.,. Schoeman, D.S., Richardson, A.J., García Molinos, J., Hoffmann, A.,. Buckley, L.B., Moore, P.J., Brown, C.J., Bruno, J.F., Duarte, C.M., Halpern, B.S., Hoegh-Guldberg, O, Kappel, C.V., Kiessling, W., O'Connor, M.I., Pandolfi, J.M., Parmesan, C., Sydeman, W.J., Ferrier, S.,…Poloczanska, E.S. (2014).Geographical Limits to Species-Range Shifts Are Suggested by Climate Velocity. Nature, 507.7493, 492–95. <https://doi.org/10.1038/nature12976>

Busch, T., Bauer, R., & Orlitzky, M. (2015). Sustainable Development and Financial Markets: Old Paths and New Avenues. Business and Society, 2015, 1–27. <https://doi.org/DOI: 10.1177/0007650315570701>

Convention on Biological Diversity. (2020). Global Biodiversity Outlook 5.<https://www.cbd.int/gbo5>

Credit Suisse. (2020). Investors and the Blue Economy. Geneva: Credit Suisse. Responsible Investor Research.

Dasgupta, P. (2021). The Economics of Biodiversity: The Dasgupta Review, 606.

De Santo, E.M. (2018). Implementation challenges of area-based management tools (ABMTs) for biodiversity beyond national jurisdiction (BBNJ)Marine Policy. Marine Policy, 97, 34–43. <https://doi.org/10.1016/j.marpol.2018.08.034>

Development Asia. (n.d.) The role of Ocean Finance in Transitioning to a Blue Economy in Asia and the Pacific. https://development.asia/explainer/role-ocean-finance-transitioning-blue-economy-asia-and-pacific

DG-MARE. (2017, 15 March). The 2nd International Conference on Marine/Maritime Spatial Planning, IOC Workshop Reports Series, UNESCO, Paris: Intergovernmental Oceanographic Commission and European Commission – DGMARE. <https://unesdoc.unesco.org/ark:/48223/pf0000260881/PDF/260881eng.pdf.multi> [accessed 10 March 2021]

Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N. et al. (2015). The IPBES Conceptual Framework — Connecting Nature and People', Current Opinion in Environmental Sustainability, 14, 1–16. <https://doi.org/10.1016/j.cosust.2014.11.002>

Directorate-General for Maritime Affairs and Fisheries (European Commission). (2018). The 2018 annual economic report on EU blue economy. https://op.europa.eu/en/publication-detail/-/publication/79299d10-8a35-11e8-ac6a-01aa75ed71a1

Europa. (n.d.) EU taxonomy for sustainable activities. https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en#why

Food and Agriculture Organization. (2014). Global Blue Growth Initiative and Small Island Developing States (SIDS). (Rome, Italy).Fisheries and Aquaculture Resources Use and Conservation Division (FIR), pp. 1–8. <http://www.fao.org/fishery>

Food and Agriculture Organization. (2020). State of the world's fisheries. http://www.fao.org/fishery/statistics/global-production/en.

Fenichel, E. P., Milligan, B., Porras, I., Addicott, E.T., Árnasson, R., Bordt, M., et al. (2020) National Accounting for the Ocean and Ocean Economy. (High Level Panel for Ocean Sustainability).

Folke, C. (2006). Resilience: The Emergence of a Perspective for Social–Ecological Systems Analyses. Global Environmental Change, 16.3, 253–67. <https://doi.org/10.1016/j.gloenvcha.2006.04.002>

Garland, M., Axon, S., Graziano, M., Morrissey, J., & Heidkamp, C.P. (2019). The Blue Economy: Identifying Geographic Concepts and Sensitivities. Geography Compass, 13.7, e12445. <https://doi.org/10.1111/gec3.12445>

Ghermandi, A., Obura, D., Knudsen, C., & Nunes, P.A.L.D. (2019). Marine Ecosystem Services in the Northern Mozambique Channel: A Geospatial and Socio-Economic Analysis for Policy Support. Ecosystem Services, 35, 1–12.<https://doi.org/10.1016/j.ecoser.2018.10.009>
Gesellschaft für Internationale Zusammenarbeit (GIZ). (2014). A Framework for Climate Change Vulnerability Assessments.

Gleeson-White, Jane. (2015). Six Capitals: Or, Can Accountants Save the Planet? Rethinking Capitalism for the Twenty-First Century. <https://www.nlb.gov.sg/biblio/201580637>

Global Mangrove Alliance. (n.d.) Mikoko Pamoja= 'mangroves together.' h t t p : / / w w w . mangrovealliance.org/mikoko-pamoja/

Global Ocean Accounts Partnership. (n.d) Africa Community of Practice. https://www.oceanaccounts.org

Hammar, L., Mavume, A.F., Francisco, F. (2021). Assessing the Science and Potential of Offshore Renewable Energy for Africa's Blue Economy. Africa Natural Resources Center / African Development Bank.

Hoegh-Guldberg, O., Caldeira, K., Chopin, T., Gaines, S., Haugan, P., Hemer, M., et al. (2019). Five Opportunities for Action. High Level Panel for Ocean Sustainability.

Holling, C.S. (1973). Resilience and Stability of Ecological Systems. Annual Review of Ecology and Systematics, 1–23. <http://www.jstor.org/stable/2096802>

Hunt, L. (2020, May 20). NGOs and Scientists Urge Moratorium on Deep Sea Mining in the Pacific. The Diplomat. https://thediplomat.com/2020/05/ngos-and-scientists-urge-moratorium-on-deep-sea-mining-in-the-pacific/

InTeGrate. Retrieved from: https://serc.carleton.edu/integrate/teaching_materials/food_supply/student_materials/1059

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. (2019). Global Assessment Report - Summary for Policy Makers. <https://ipbes.net/sites/default/files/2020-02/ipbes_global_assessment_report_summary_for_policymakers_en.pdf>

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. (2017). Regional and Subregional Assessment of Biodiversity and Ecosystem Services for Africa (IPBES secretariat.)

Intergovernmental Panel on Climate Change. (2014). Climate Change 2014 - Working Group II - Impacts, Adaptation and Vulnerability.

Intergovernmental Panel on Climate Change. (2018). Global Warming of 1.5°C An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty. <https://www.ipcc.ch/sr15/download/>

Intergovernmental Panel on Climate Change. (2019). Summary for Policymakers. In: H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (Eds.) IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. 2019. https://www.ipcc.ch/site/assets/uploads/sites/3/2019/12/SROCC_FullReport_FINAL.pdf

International Union for Conservation of Nature. (2020). IUCN Global Standard for Nature-Based Solutions. A User-Friendly Framework for the Verification, Design and Scaling up of NbS. <https://portals.iucn.org/library/sites/library/files/documents/2020-020-En.pdf>

Le Manach, F., Gough, C., Harris, A., Humber, F., Harper, S., & Zeller, D. (2012). Unreported Fishing, Hungry People and Political Turmoil: The Recipe for a Food Security Crisis in Madagascar? Marine Policy, 36.1, 218–25. <https://doi.org/10.1016/j.marpol.2011.05.007>

Lombard, A. T.,. Ban, N.C., Smith, J.L., Lester, S.E., Sink, K.J., Wood, S.A., Jacob, A.L., Kyriazi, Z. Tingey, R. & Sims, H.E. (2019). Practical Approaches and Advances in Spatial Tools to Achieve Multi-Objective Marine Spatial Planning. Frontiers in Marine Science, 6. <https://doi.org/10.3389/fmars.2019.00166>

Marine Spatial Planning of the Western Indian Ocean Blue Economy. (2017). Nairobi Convention, WIOMSA & CSIR, 2017. UNEP/NC/FP/2017/4/Doc/13. https://wedocs.unep.org/bitstream/handle/20.500.11822/25679/annex11_MSP_BlueEconomy.pdf?sequence=1&i

Maritime Executive. (2019, June 6). Blood and Water: Slavery in the Fishing Industry Revealed.https://www.maritime-executive.com/article/blood-and-water-slavery-in-the-fishing-industry-revealed

Martin, David M. (2017). Ecological Restoration Should Be Redefined for the Twenty-First Century. Restoration Ecology, 25.5, 668–73. <https://doi.org/10.1111/rec.12554>

Meyers, D., Bohorquez, J., Cumming, T., Emerton, L., vann den Heuvel, O., Riva, M., & Victurine, R. (2020). Conservation Finance: A Framework. Conservation Finance Alliance. www.cfalliance.org. <10.13140/RG.2.2.14186.88000>

Millennium Ecosystem Assessment. (2005). Millennium Ecosystem Assessment - Ecosystems and Human Wellbeing. Washington DC, Island Press. <http://www.millenniumassessment.org/en/Global.html>

Mohanty, S.K., Dash, P., Gupta, A., & Gaur, P. (2015). Prospects of Blue Economy in the Indian Ocean. RIS - Research and Information System for Developing Countries. <http://ris.org.in/pdf/Final_Blue_Economy_Report_2015-Website.pdf>

Mossop, J. (2015). Marine Bioprospecting. The Oxford Handbook of the Law of the Sea. <https://doi.org/10.1093/law/9780198715481.003.0036>

Nairobi Convention. (2016). Climate Change Strategy for the Nairobi Convention (UNEP.) <https://wedocs.unep.org/bitstream/handle/20.500.11822/25676/annex8_climate_strategy.pdf?sequence=1&isAllowed=y>

Neill, A.M., O'Donoghue, C. & Stout, J.C. (2020). A Natural Capital Lens for a Sustainable Bioeconomy: Determining the Unrealised and Unrecognised Services from Nature. Sustainability, 12.19, 8033. <https://doi.org/10.3390/su12198033>.

Neumann, B., Vafeidis, A.T., Zimmermann, J. & Nicholls, R.J. (2015). Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding - A Global Assessment. PLoS ONE, 10.3, e0118571. <https://doi.org/10.1371/journal.pone.0118571.s004>

Obura, D.O. (2017). Reviving the Western Indian Ocean Economy: Actions for a Sustainable Future. Madagascar: World Wide Fund for Nature.

Obura, D. O. (2018). Ocean Health in the Blue Economy. In Professor VN Attri (Ed.) A Handbook on the Blue Economy in the Indian Ocean Region. (Indian Ocean Rim Association (IORA), Economic and Social Research Council, South Africa,), pp. 410–35.

Obura, D. O. (2020). Getting to 2030 - Scaling Effort to Ambition through a Narrative Model of the SDGs. Marine Policy, 117, 103973. <https://doi.org/10.1016/j.marpol.2020.103973>

Obura, D.O., Gudka, M. et al. (2020). Reducing Impacts of Sand Harvest Offshore of a Fringing Coral Reef, Kwale County, Kenya. Technical Advisory Services On Environmental Management For Marine Environment (Coral Reef) Protection During Offshore Sand Harvesting Period, 24.

Ocean Panel. (n.d). Give it 100%. https://www.oceanpanel.org/

Oldekop, J. A., Holmes, G., Harris, W. E., & Evans, K.L. (2016). A global assessment of the social and conservation outcomes of protected areas. Conservation Biology, 30.1 (2016), 133–41. <https://doi.org/10.1111/cobi.12568>

Partidário, M. R. (2007). Strategic Environmental Assessment Good Practices Guide. Methodological Guidance Portuguese Environment Agency, p. 63. <http://content-ext.undp.org/aplaws_publications/1703425/SEA_guide_Portugal.pdf>

Partnership for regional ocean governance. (n.d.). Marine Regions Forum. https://www.prog-ocean.org/marine-regions-forum/

Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., Watson, R.T., Basak Dessane, E., Islar, M., Kelemen, E., Maris, V., Quass, M., Subramanian, S. M., Wittmer, H., Adlan, A., Ahn, S., Al-Hafedh, Y. S., Amankwah, E., Asah, S.T……Yagi, N. (2017.) Valuing Nature's Contributions to People: The IPBES Approach. Current Opinion in Environmental Sustainability, 26–27 (2017), 7–16. <https://doi.org/10.1016/j.cosust.2016.12.006>

Popova, E., Vousden, D., Sauer, W.H.H., Mohammed, E.Y., Allain, V., Downey-Breedt, N., Fletcher, R., Gjerde, K.M., Halpin, P.N., Kelly, S., Obura, D., Pecl, G., Roberts, M., Raitsos, D.E., Rogers, A., Samoilys, M., Samaila, U.R., Tracey, S., Yool, A. (2019). Ecological Connectivity between the Areas beyond National Jurisdiction and Coastal Waters: Safeguarding Interests of Coastal Communities in Developing Countries. Marine Policy, 104 (2019), 90–102. <https://doi.org/10.1016/j.marpol.2019.02.050>

Pörtner, H. O, Scholes, R.J., Obura, D.O., & Ngo, H.T. (2021). IPBES-IPCC Co-Sponsored Workshop Report on Biodiversity and Climate Change (IPCC/IPBES, 2021), p. 299. <DOI:10.5281/zenodo.4659158>

Randone, M., DiCarlo, G & Costantini, M. (2017). Reviving the Economy of the Mediterranean Sea: Actions for a Sustainable Future. WWF Mediterranean Marine Initative, 2017, p. 64.

Raworth, K. (2012). A Safe and Just Space for Humanity: Can We Live within the Doughnut? Oxfam Policy and Practice. https://policy-practice.oxfam.org/resources/a-safe-and-just-space-for-humanity-can-we-live-within-the-doughnut-210490/

Raworth, K. (2017). A Doughnut for the Anthropocene: Humanity's Compass in the 21st Century. The Lancet Planetary Health, 1.2 (2017), e48–49. <https://doi.org/10.1016/S2542-5196(17)30028-1>

Roxy, M. K., Gnanaseelan, C., Parekh, A., Chowdary, J.S., Singh, S., Modi, A., and others. (2020). Indian Ocean Warming, in R. Krishnan, J. Sanjay, Chellappan Gnanaseelan, Milind Mujumdar, Ashwini Kulkarni, and Supriyo Chakraborty (Eds.) Assessment of Climate Change over the Indian Region: A Report of the Ministry of Earth Sciences (MoES), Government of India.) pp. 191–206. <https://doi.org/10.1007/978-981-15-4327-2_10>

Sale, P. F., Agardy, T., Ainsworth, C.H., Feist, B.E., Bell, J.D., Christie, P., Hoegh-Gulberg, O., Mumby, P., Feary, D., Saunders, M., Daw, T.M., Foale, S.J., Levin, P.S., Lindeman, K.C., Lorenzen, K.,Pomeroy, R.S.Allison, E.H., Bradbury, R.H., …..Sheppard, C.R.C. (2014). Transforming Management of Tropical Coastal Seas to Cope with Challenges of the 21st Century. Marine Pollution Bulletin, 2014, 1–16. <https://doi.org/10.1016/j.marpolbul.2014.06.005>

Science based targets networks. (n.d.) Global Commons Alliance. https://sciencebasedtargetsnetwork.org

Seddon, N., Chausson, A., Berry, P., Girardin, C.A.J., Smith, A., & Turner, B. (2020). Understanding the Value and Limits of Nature-Based Solutions to Climate Change and Other Global Challenges. Philosophical Transactions of the Royal Society B: Biological Sciences, 375.1794, 20190120. <https://doi.org/10.1098/rstb.2019.0120>

Sherman, K., Alexander, D.G. & Gold, B.D. (1993). Large Marine Ecosystems as Global Units for Marine Resources Management-an Ecological Perspective. Large Marine Ecosystems: Stress, Mitigation and Sustainability, Volume 5. <http://books.google.com/books?hl=en&lr=&id=OhYF9grM4nMC&oi=fnd&pg=PA3&dq=sherman+large+marine+ecosystems&ots=eJvXN21Xj-&sig=FGBzOdu50Sv-j_A2Q6ceaXxiVLU>

Sherman, K., & Duda, A.M. (1999). Large Marine Ecosystems: An Emerging Paradigm for Fishery Sustainability. Fisheries, 24, 15–26. <https://doi.org/10.1577/1548-8446(1999)024<0015:LME>2.0.CO;2>

Sherman, K. (2016). The Large Marine Ecosystem Programme and Marine Monitoring.

South African Institute of International Affairs. (2020). Ocean Accounts: A Seachange Approach in Ocean Decision-Making, SAIIA, 2020. <https://saiia.org.za/research/ocean-accounts-a-seachange-approach-in-ocean-decision-making/>

Stern, N. (2006). The Economics of Climate Change: The Stern Review. (Her Majesty's Treasury.) <https://webarchive.nationalarchives.gov.uk/20100407172811/http://www.hm-treasury.gov.uk/stern_review_report.htm>

Sumaila, U. R., Walsh, M., Hoareau, K., Cox, A., Abdallah, P., Akpalu, W., et al. (2020). Ocean Finance: Financing the Transition to a Sustainable Ocean Economy (High Level Panel for Ocean Sustainability: World Resources Institute). www.oceanpanel.org/blue- papers/ocean-finance-financing-transition-sustainable-ocean-economy.

Surminski, S., Di Mauro, M., Baglee, J.A.R., Connell, R.K., Hankinson, J., Haworth, A.R., Ingirige, B., & Proverbs, D. (2018). Assessing Climate Risks across Different Business Sectors and Industries: An Investigation of Methodological Challenges at National Scale for the UK. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 376.2121, 20170307. <https://doi.org/10.1098/rsta.2017.0307>

Sustainable Blue Economy Conference. (2018). Sustainable Blue Economy Conference Report - 26-28 November 2018 (Nairobi: Kenya Government, 2018), p. 30.

Taliento, M., Favino., & Netti, A. (2019). Impact of Environmental, Social, and Governance Information on Economic Performance: Evidence of a Corporate "Sustainability Advantage" from Europe. Sustainability, 11.6, 1738. <https://doi.org/10.3390/su11061738>

Tickler, D. (2018). Modern Slavery and the Race to Fish. Nature Communications, 9.

UN Convention on the Law Of the Sea. (2021). Overview - Convention & Related Agreements. <https://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm>

UN Decade on Restoration. (n.d.) About the UN decade. https://www.decadeonrestoration.org/about-un-decade

UN Economic Commission for Africa. (2016). Africa's Blue Economy: A Policy Handbook.

United Nations Environment Programme. (n.d.) Our work in Africa. https://www.unep.org/regions/africa/our-work-africa

United Nations. (2022, March). Intergovernmental conference on an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction. https://www.un.org/bbnj/

United Nations Environment Programme. (2017). Marine Spatial Planning of the Western Indian Ocean Blue Economy. https://wedocs.unep.org/bitstream/handle/20.500.11822/25679/annex11_MSP_BlueE conomy.pdf?sequence=1&isAllowed=y

United Nations Environment Programme (2021, April). Draft African strategy for ocean governance. Third consultative meeting on the development of an African strategy for ocean governance. UNEP/ASOG/WG.3/2. 1.

United Nations Environment Programme, Nairobi Convention, and WIOMSA. (2015). Regional State of the Coast Report, Western Indian Ocean (UNEP and WIOMSA, 2015).

UNEPFI. (2020). Rising Tide: Mapping Ocean Finance for a New Decade. UNEP Sustainable Blue Economy Finance Initiative/European Commission, p. 79. <https://www.unepfi.org/publications/rising-tide/>

UNEPFI. Turning the Tide: How to Finance a Sustainable Blue Recover - a Practical Guide for Financial Institutions (Geneva: UNEP Sustainable Blue Economy Finance Initiative/European Commission, 2020), p. 121. <https://www.unepfi.org/publications/turning-the-tide/>

World Meteorological Organization. (2020). WMO Provisional Report on the State of the Global Climate 2020.Geneva: WMO.

Wong, G., Bi, Y-H, Wang, Q-H., Chen, X.W., Zhang, Z-G., Yao, Y-G. (2019). Zoonotic Origins of Human Coronavirus. (HCoV-19 / SARS-CoV-2): Why Is This Work Important?' Zoological Research, 41.3, 213–19. <https://doi.org/10.24272/j.issn.2095-8137.2020.031>

World Bank. (2019). Climate Change and Marine Fisheries in Africa: Assessing Vulnerability and Strengthening Adaptation Capacity. Washington, DC. <https://openknowledge.worldbank.org/handle/10986/33315>

World Wildlife Fund. (2014). Principles for a Sustainable Blue Economy. Worldwide Fund for Nature Baltic Ecoregion Programme. <wwf.ocean.panda.org>
Wynberg, R. (2016). Marine Genetic Resources and Bioprospecting in the Western Indian Ocean, in José Paula and Julius Francis (Eds.) Regional State of Coast Report. WIOMSA, UNEP Nairobi Convention, pp. 407–16.

Yentcharé, P.J. (2021). Marine Genetic Resources in Areas Beyond National Jurisdictions: Strategy for a Successful Harnessing of Blue Biotechnology in Africa. African Natural Resources Centre, Africa Development Bank, p. 24.

Yoshioka, N., Hao Wu, H., Huang, M.C., & Tanaka, H. (2020). Proposing Regulatory-Driven Blue Finance Mechanism for Blue Economy Development, ADBI Working Paper 1157. Asian Development Bank Institute, p. 19. <https://www.adb.org/publications/proposing-regulatory-driven-blue-finance-mechanism-blue-economy-development>

Zalasiewicz, J., Waters, C.N., Summerhayes, C.P., Wolfe, A.P., Barnosky, A.D., Cearreta, A., Crutzen, P., Ellis, E., Fairchild, I.J., Galuszka, A., Haff, P., Hajdas, I., Head, M.J., Ivar do Sul, J.A., Jeandel, C., Leinfelder, R., McNeill, J.R., Neal, C., ……Williams, M. (2017). Anthropocene, Anthropocene, 19, 55–60. DOI:10.1016/j.ancene.2017.09.001

9. SUPPORTING MATERIAL

9.1. ANNEX 1 - NATURE'S CONTRIBUTIONS TO PEOPLE

The concept of Nature's Contributions to People was developed as a more inclusive framing than that of Ecosystems Services, to incorporate non-material and cultural dimensions more representative of multiple perspectives on nature around the world. It was developed through the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). This table is obtained from[4]

Group		Nature's Contributions to People (NCP)
Regulating	1	Habitat
	2a	Pollination
	2.b	Seed Dispersal
	3	Regulation of air quality
	4	Climate regulation
	5	Regulation of ocean acidification
	6	Regulation of freshwater quantity, location, and timing
	7	Regulation of freshwater and coastal water quality
	8	Formation, protection and decontamination of soils and sediments
	9	Regulation of hazards and extreme events (b. Coastal protection; d Landslides)
	10	Pest, disease and stress regulation
Material	11	Energy
	12	Food and feed
	13	Materials
	14	Medicinal, biochemical and genetic resources
Non-material	15	Learning, artistic, scientific and technological inspiration
	16	Physical and experiential interactions with nature
	17	Symbolic meaning, involving spiritual, religious, identity connections, social cohesion and cultural continuity
	18	Preservation, by organisms and ecosystems, of options for the future

[4]Sandra Díaz and others, 'ScienceDirectThe IPBES Conceptual Framework — Connecting Nature and People', Current Opinion in Environmental Sustainability, 14 (2015), 1–16 <https://doi.org/10.1016/j.cosust.2014.11.002>.

9.2. ANNEX 2 - KEY GUIDANCE DOCUMENTS

The following references provide key concepts relevant to a sustainable, climate-resilient blue economy, for background reading.

- Dasgupta, Partha, 'The Economics of Biodiversity: The Dasgupta Review', 2021, 606
- Fenichel, Eli P, Ben Milligan, Ina Porras, Ethan T Addicott, Ragnar Árnasson, Michael Bordt, and others, National Accounting for the Ocean and Ocean Economy (High Level Panel for Ocean Sustainability, 2020), p. 48
- Meyers, David, John Bohorquez, et al., Conservation Finance: A Framework (Conservation Finance Alliance, www.cfalliance.org, 2020) <10.13140/RG.2.2.14186.88000>
- Sumaila, U Rashid, Melissa Walsh, Kelly Hoareau, Anthony Cox, Patrízia Abdallah, Wisdom Akpalu, and others, Ocean Finance: Financing the Transition to a Sustainable Ocean Economy (High Level Panel for Ocean Sustainability, 2020), p. 38
- UNECA, Africa's Blue Economy: A Policy Handbook (UN Economic Commission for Africa, April 2016)
- UNEPFI, Rising Tide: Mapping Ocean Finance for a New Decade (Geneva: UNEP Sustainable Blue Economy Finance Initiative/European Commission, 2020), p. 79 <https://www.unepfi.org/publications/rising-tide/>
- UNEPFI, Turning the Tide: How to Finance a Sustainable Blue Recover - a Practical Guide for Financial Institutions (Geneva: UNEP Sustainable Blue Economy Finance Initiative/European Commission, 2020), p. 121 https://www.unepfi.org/publications/turning-the-tide/
- WWF, Principles for a Sustainable Blue Economy. (Worldwide Fund for Nature (WWF) Baltic Ecoregion Programme., 2014) <wwf.ocean.panda.org> [accessed 10 January 2017]

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