The Socio-Economics of the West, Central and Southern African Coastal Communities

A Synthesis of Studies Regarding Large Marine Ecosystems

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The Socioeconomics of the West, Central and Southern African Coastal Communities: A Synthesis of Studies Regarding Large Marine Ecosystems

The Benguela Current Large Marine Ecosystems (Sumaila 2015)
The Guinea Current Large Marine Ecosystems (Interwies 2011)
The Canary Current Large Marine Ecosystems (Interwies and Görlitz 2013)

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Foreword

UN Environment welcomes this publication initiated by the Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern Africa Region (Abidjan Convention).

People living along the west, central and southern African coast are directly dependent on a healthy ocean and healthy coasts for sustenance, economic progress and a quality way of life. Socially and ecologically sustainable ocean-dependent societies and dynamic, vibrant cultures are interconnected with thriving natural systems. They are also dependent on the ability to properly govern and manage human impacts on coastal and marine ecosystems.

The Large Marine Ecosystems of the west, central and southern African coasts are among the most productive in the world. Their health constitutes a vital anchor of the blue economy of the region, an approach defined in the African Union's Agenda 2063 as one that: a) emphasizes the interconnectedness across sectors, b) recognizes the critical importance of a healthy ocean and c) is underpinned by a sustainable economic framework that can deliver social equity and tangible benefit sharing. Blue Economy work has been and continues to be a key focus of UN Environment both in the region of the Abidjan Convention and globally.

The Large Marine Ecosystems of the west, central and southern African coasts have been developed as a tool enabling ecosystem-based management and to provide a collaborative approach to transboundary resource management. They gather a baseline of ecological data regarding the coverage, ecological outputs and functions of marine and coastal ecosystems. They have also allowed decision and policy-makers to know about the profound connections between people and nature in the context of these ecosystems and the values placed on the benefits inherent in and derived from the west, central and southern African coasts and ocean. More recently, trends within Large Marine Ecosystems of the west, central and southern Africa show increased environmental degradation which will have significant financial, economic and social costs if no action is taken.

This report provides an overview and synthesis of three economic valuation efforts, each with the goal of determining the "flow of value" or benefits derived from the natural ecosystems and services of the Benguela Current Large Marine Ecosystem, Guinea Current Large Marine Ecosystem, Canary Current Large Marine Ecosystem. As examples, investigators estimate that Benguela Current Large Marine Ecosystem ecosystem services (including mariculture and fisheries) provide approximately USD 2.35 billion of Total Economic Impact annually with USD 472 million of wage impact; for Guinea Current Large Marine Ecosystem the estimated impact is USD 17 billion annually derived mainly from its fisheries endowment; and for Canary Current Large Marine Ecosystem, the estimate is USD 11.7 billion, mostly derived from tourism and recreation opportunity in addition to fisheries.

Monetary valuation provides a critical albeit partial picture of the value people and societies ascribe to and derive from healthy 'blue' nature. This synthesis report makes an important contribution to raising the awareness of decision and policy makers from west, central and southern Africa, who have the influence and ability to design and implement innovative solutions that will ensure a thriving ocean supporting sustainable societies for generations to come.

It is critical that other African Regional Seas Conventions follow the path set by the Abidjan Convention to assess the economic values of their marine and coastal ecosystems which is of paramount importance for oceans sustainable economic planning, which UN Environment strongly would welcome and support.

Erik Solheim
UNEP Executive Director

Preamble

This synthesis report sources from three assessments conducted by the Large Marine Ecosystems of the Canary, Guinea and Benguela currents. The publications of these separate assessments ranges in time from 2011 to 2015. As this report aims to support sound decision making by Member States to the Abidjan Convention, it is imperative that attention be brought to new information and data that has emerged since the source reports were completed. An Addendum section was therefore added at the end of this report to: present up-to-date figures on the value of fisheries, tourism and regulating services; present updated information on the status of fish stocks and contextual information regarding marine activities and their link to the African Integrated Maritime Strategy (AIM Strategy 2050).[1] The Addendum is not a comprehensive list as this would fall outside the mandate of the current report. It does however highlight the need for awareness of latest research and data that can further support policy and decision making needs in the region.

Introduction

People living along the west, central and southern African coast are directly dependent on the health of Large Marine Ecosystems (LMEs) for sustenance, economic development and their way of life. The Benguela Current LME (BCLME) stretches along the southwestern coast (Figure 1a); the Guinea Current LME (GCLME) along central Africa (Figure 1b); and the Canary Current LME (CCLME) along north-western Africa (Figure 1c). The west, central and southern African coastal populations' well-being, economies and cultures are interlinked with their ability to properly govern and manage their own activity within these ocean and coastal ecosystems. Over the last 30 years, amid serious conflicts and extensive poverty, these coastal communities, nations and regions have been unable to effectively counteract rapid development, extensive pollution growth, habitat loss and unsustainable use of resources. They have missed opportunities to effectively manage the highly productive ocean and coastal ecosystems and to unlock the economic potential that accompanies sustainable development.[2]

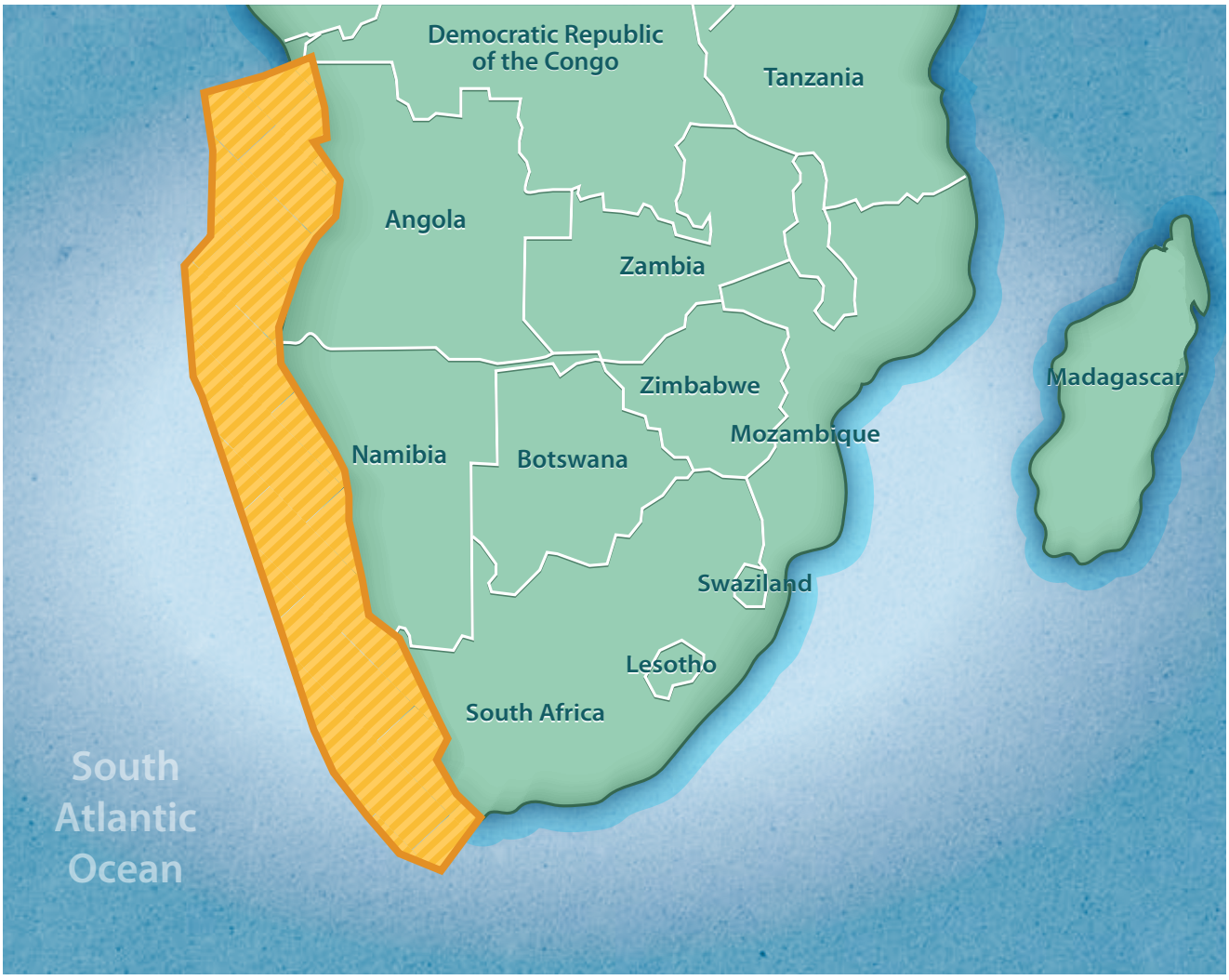


Figure 1a: The BCLME and bordering countries.

Source: International Waters Learning Exchange & Resource Network, http://iwlearn.net/iw-projects/789/maps_graphics/benguela-current/view (accessed August 1, 2016). Map data: Google Imagery, 2016 NASA, TerraMetrics.

Supported by the United Nations Environment Programme (UNEP), these west, central and southern African nations have nonetheless taken great strides in marine governance and management, beginning with the 1984 Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern Africa Region (Abidjan Convention). This umbrella legal framework was established for the protection, conservation and development of the marine area extending from Mauritania to South Africa.[3] With the emergence of the Global Environment Facility's (GEF) 1995 Operational Strategy approving the use of LMEs,[4] a partnership began and, in 2005, at the Seventh Conference of the Parties (COP 7) of the Abidjan Convention, countries within each of the Benguela, Guinea and Canary Current LMEs were organized as "autonomous nodes". Each region now benefits from a GEF-funded LME project.[5]

The "Blue Growth" theme of the most recent Abidjan Conference (COP 11) is a major milestone in west, central and southern Africa's development as it demonstrates a readiness among countries to address sustainability.[6] This readiness arrives at a pivotal moment, when west, central and southern African LME fish stock levels are declining from unsustainable harvesting; uncertainty surrounds the integrity of marine and coastal ecosystems; water quality has declined from land- and sea-based activities; and coastal and seabed habitats have deteriorated.[7] Time is of the essence.

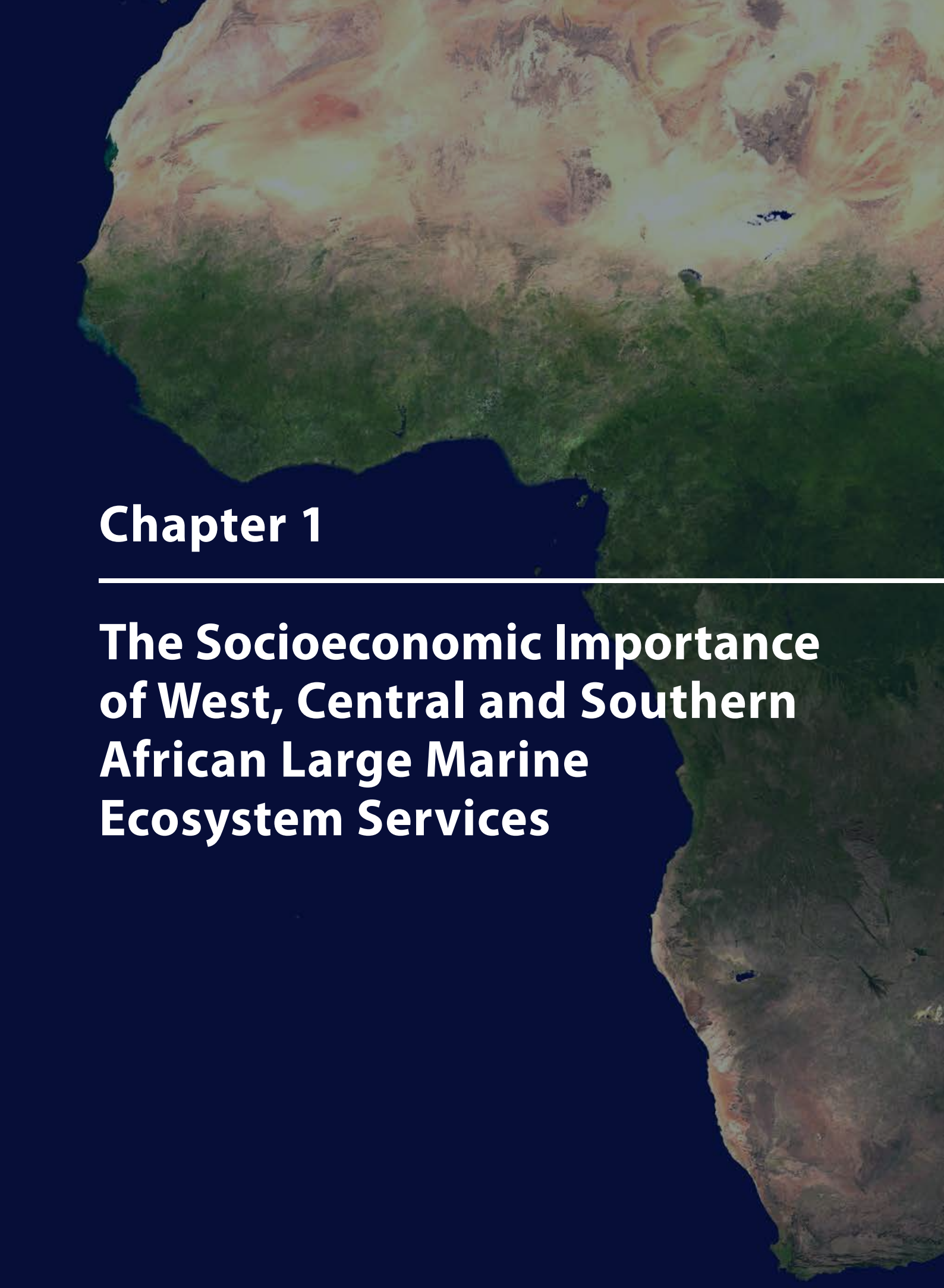
In order to shift the ever-changing relationship between humans and their environment to a sustainable status quo, governing bodies and stakeholders must understand the value that the west, central and southern African LMEs provide. In addition to establishing a baseline of ecological data regarding the coverage, ecological outputs and functions of LMEs and responding to changes thereto, policymakers must also be aware of the people dependent on and acting within these coastal and ocean ecosystems, and the value placed on their associated benefits.[8]

Figure 1b: The GCLME and bordering countries.

Source: International Waters Learning Exchange & Resource Network http://iwlearn.net/iw-projects/1188/maps_graphics/gulf-of-guinea/view (accessed August 1, 2016). Map data: Google Imagery, 2016 NASA, TerraMetrics.

Figure 1c: The CCLME and bordering countries.

Source: International Waters Learning Exchange & Resource Network, http://iwlearn.net/iw-projects/1909/maps_graphics/canary-current-large-marine-ecosystem/view (accessed August 1 2016). Map data: Google, INEGI Imagery, 2016 TerraMetrics.



Chapter 1

The Socioeconomic Importance of West, Central and Southern African Large Marine Ecosystem Services

1.1 **Sustainable Development and the Need to Value Ecosystems**

The UN's Three Pillars of Sustainable Development

Achieving sustainable development – "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"[9] – means finding the right balance between the three pillars of social equity, economic development and environmental protection.[10] While socioeconomic equity is one objective in achieving this balance, sustainable development cannot be feasible or liveable without also determining the costs and benefits derived from the enviro-economic and enviro-social dimensions.[11] As humans are completely dependent on the ecosystems that they inhabit for their survival and well-being, without healthy ecosystems, economic and social progress cannot meet the sustainable development goals (SDGs).[12]

Recognizing the importance of this three-pillar balance, world leaders at the United Nations Sustainable Development Summit 2015 adopted 17 SDGs.[13] While SDG 14 – "Conserve and sustainably use the oceans, seas and marine resources" – is specific to ocean and coastal ecosystems, these ecosystems also support many of the other SDGs. For instance, coastal populations' dependence on LMEs is directly linked to SDGs pertaining to human survival, livelihood and well-being: ending poverty (SDG 1), ending hunger and improving nutrition (SDG 2), ensuring healthy lives and promoting well-being (SDG 3), ensuring clean water and sanitation (SDG 6), promoting sustainable economic growth and employment (SDG 8), and reducing inequality within and among countries (SDG 10).[14] Fisheries, harvestable plants, and the waste treatment, tourism and recreation sectors are some examples of ocean and coastal "ecosystem services" that promote these SDGs.[15] Furthermore, coastal ecosystems consisting of coral reef, mangroves and seagrasses can provide protection from storm surges (SDG 9 "Build resilient infrastructure"), thereby protecting coastal populations (SDG 11: "Make cities and human settlements inclusive, safe, resilient and sustainable") and reducing the impacts of climate change (SDG 13: "[…] combat climate change"). The oceans also regulate climate change by absorbing and storing heat and sequestrating carbon from the atmosphere.[16] Many women are employed in the fisheries industry, particularly in the post-harvest stages, while in rural areas, women often engage in aquaculture as part of families' subsistence activities (SDG 5 "Achieve gender equality"). By jointly working to manage coastal and ocean resources, communities enhance social relationships and institutions (SDG 16: "Promote peaceful and inclusive societies for sustainable development").[17]

Ecosystem Services are a "Flow of Value"

Sustainable development requires that we maintain and enhance the four types of "capital" upon which people depend: natural, human, economic and social capital. Efforts to measure only one or two of the four capital stocks tell only part of the story, since they are interlinked and constantly changing. These different forms of capital generate flows of value, with ecosystem goods and services representing the flow of value from natural capital to the other capital stocks (Figure 2). How these flows are reinvested is the key to meeting the SDGs and growing wealth sustainably.[18]

A Synthesis: Three Economic Valuations of West, Central and Southern African Ecosystem Services

The goal of this report is to provide an overview and synthesis of three economic valuations, each performed for the purpose of determining the "flow of value" – or "ecosystem service" benefits – that result from the three west, central and southern African LMEs. While "marine" implies "ocean," ecosystem services arise from both ocean ecosystems and coastal ecosystems that comprise the west, central and southern African LMEs. This report will therefore cover both the ocean and coastal ecosystem services examined in the three valuations.

The first study, Sumaila (2015),[19] examines ecosystem services originating from the Benguela Current Large Marine Ecosystem (BCLME) (Figure 1a). This southernmost west African LME is a changing and complex system with a mild climate that plays an "important role in global climate and ocean processes."[20] The significantly generative BCLME[21] encompasses the exclusive economic zones (EEZs) of Angola, Namibia and part of South Africa.[22] The second study, Interwies (2011),[23] assesses the highly productive Guinea Current Large Marine Ecosystem (GCLME) (Figure 1b). The GCLME extends from a defined northern border (with seasonal fluctuations) to a less clear southern border formed by the South Equatorial current.[24] It encompasses 16 countries from Guinea-Bissau in the northwest coast of Africa to Angola in the southwest.[25] Finally, the third study, Interwies and Görlitz (2013),[26] examines those goods and services emanating from the Canary Current Large Marine Ecosystem (CCLME) (Figure 1c), a cold water upwelling off the coast of north-west Africa. The CCLME ranks third in the world for primary productivity after the Humboldt (South American west coast) and the BCLME, and has the highest fisheries production of any African LME.[27] The CCLME is bordered by Morocco, Mauritania, Senegal, Guinea-Bissau, Guinea, the Canary Islands (Spain), The Gambia, Cape Verde, and to a lesser extent, Sierra Leone.[28,29]

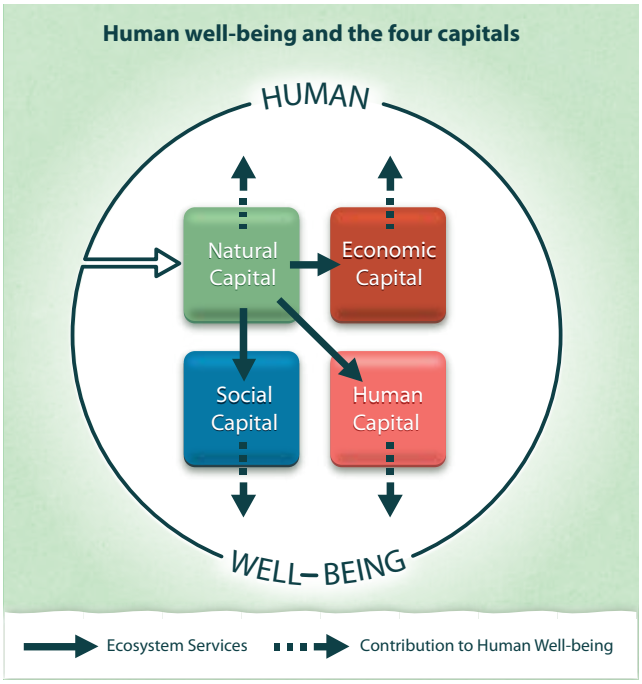


Figure 2: The Flow of Capital.

Source: Pendleton, L. and A. Kaup. 2015. The Future Management of Marine and Coastal Ecosystem Services for People. In: The Ocean and Us. Neumann, C., T. Bryan, L. Pendleton, A. Kaup, J. Glavan (eds). GRID-Arendal, Arendal, Norway. p. 46.

1.2 **The Establishment of Large Marine Ecosystems as Management Areas**

An Ecosystem-Based Management Approach

The LME concept was introduced in the mid-1980s as an alternative to the pre-existing sectoral approach to marine conservation.[30] As opposed to the management of individual resources and country-delineated boundaries, ecosystem-based management is "driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem structure and function."[31] Each LME is defined by ecological criteria (bathymetry, hydrography, productivity, and trophic relationships), and encompasses ocean space of at least 200,000 km^2.[32] The coastal oceans in which the 66 LMEs are located produce 80 per cent of the world's annual marine fisheries catch.[33] These areas are at risk from unsustainable use that has led to coastal ocean pollution, nutrient over-enrichment, habitat degradation (of sea grasses, corals and mangroves for example), overfishing, biodiversity loss, and climate change effects.[34]

In 1995, the GEF approved the use of the LME as a unit for ecosystem-based management of international coastal oceans.[35] The ecosystem-based process consists of a five-module approach focused on productivity, fish and fisheries, pollution and ecosystem health, socioeconomics and governance (Figure 3).[36]

Transboundary Diagnostic Analysis and Strategic Action Programmes

The 1995 GEF Operational Strategy developed two key processes for countries to work together in order to manage the LME transboundary systems. First, countries and partners jointly compile a Transboundary Diagnostic Analysis (TDA) consisting of data and factual information on the first four indicators in the five-module approach: productivity, pollution and ecosystem health, fish and fisheries and socioeconomics. This united effort fills information gaps in joint understanding of how the LME works. The second process, the creation of a Strategic Action Programme (SAP),

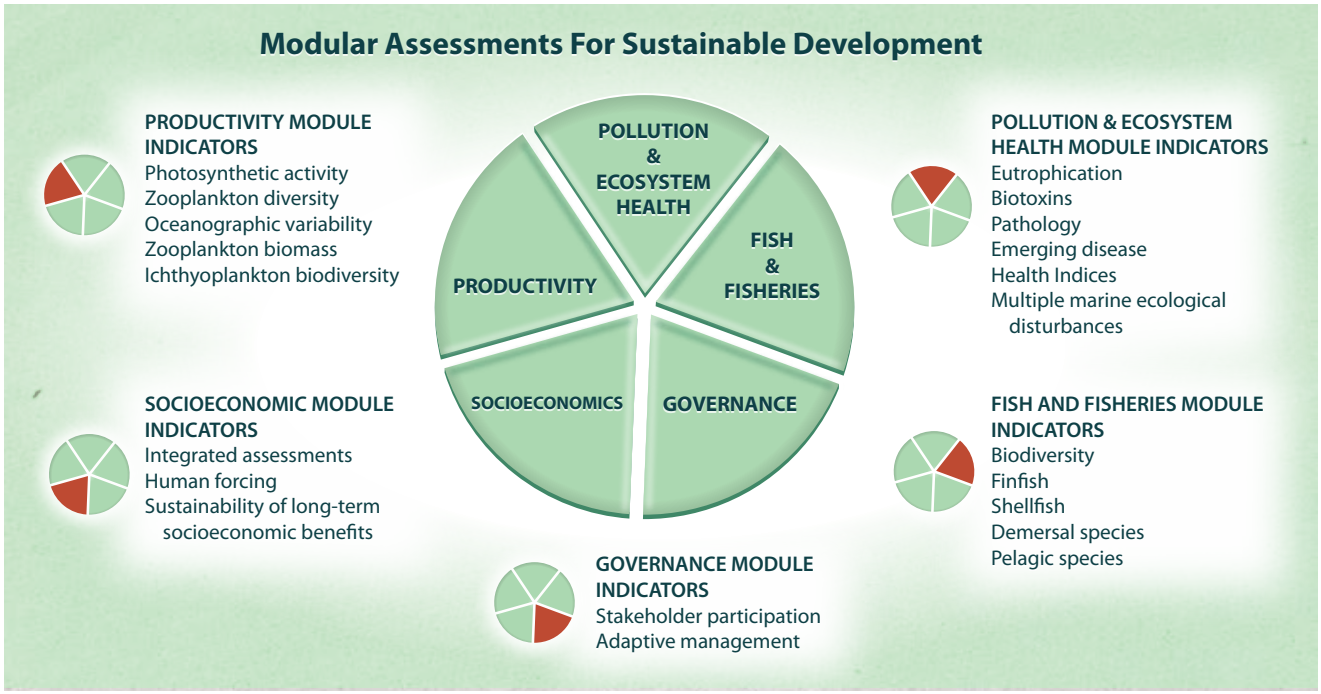


Figure 3: The Five-Module Approach to Ecosystem-Based Management.

Source: Sherman and Hempel, p. 8.

incorporates the final indicator – governance. The purpose of the SAP is to design management regimes that can be adapted in accordance with TDA updates.[37]

Advancements in Management Processes of West, Central and Southern African LMEs

The three west, central and southern African LME management regimes are at different stages in working towards their SDGs. The BCLME's regional management was the first LME in the world to have a fully ratified convention, the Benguela Current Convention (BCC). In 1999, the BCC developed its first TDA and SAP and in 2013, it again carried out the TDA process, creating a supplemental implementation plan and updating relevant documents for the period 2015 to 2019.[38]

In 2004, GEF funding expanded the GCLME programme to include all 16 countries and in 2012, the countries decided to establish a permanent Guinea Current Commission (GCC) by a protocol to the Abidjan Convention.[39] The GCLME countries are committed to implementing their agreed SAP and associated National Action Plans (NAPs).[40]

Meanwhile, the CCLME has completed a TDA, but has yet to finalize a SAP, create a legal framework for the CCLME or establish a formal commission.[41]

1.3 **Reasons for Economic Valuations and the Valuation Process**

People's Well-being and Ecosystem Service Trade-off Decisions

Economic valuations of LME ecosystem services are integral to the TDA process and the socioeconomic indicator of the five-module approach. While scientists must determine the magnitude and priority of issues such as water quality, biodiversity, fisheries and habitat degradation,[42] ecological data alone is not enough. Governments and stakeholders must also be aware of the many socioeconomic benefits derived from marine ecosystems in order to address the competing interests that can lead to the exploitation of fisheries and other marine resources.[43] Policymakers must acquire data about the people who depend on these ecosystems. Where do these people live and what goods and services do they derive from marine and coastal ecosystems? What proportion of their well-being depends on these ecosystems?[44]

Economic valuations help to delineate the relationship between human well-being and ecosystem services. They can aid in quantifying trade-offs between ecosystem services (one service could limit or damage another), between costly conservation efforts, or between competing interests of LME countries. Ecosystem service values can be weighed against the worthiness of extraction of non-renewable resources such as crude oil, sand, gravel or other mineral resources. Although these inert substances are not true "ecosystem services" as they do not derive value from the existence of an ecosystem and its living components, they do have value and share the same origin area as ecosystem services. Knowing ecosystem service values helps to assess outcomes when faced with abrupt or non-linear changes in ecosystems or when completing the probabilistic analysis of various future environmental scenarios.[45]

The Ecosystem Valuation Process

Economic valuations consist of a two-step process. Firstly, the ecosystem services for review must be identified. The Millennium Ecosystem Assessment (MA) provides a scientific consensus regarding the four categories of ecosystem services: "provisioning services" such as food, water, timber, and fibre; "regulating services" that affect climate, floods, disease, waste, and water quality; "cultural services" that provide recreational, aesthetic, educational and spiritual benefits; and "supporting services"[46] such as photosynthesis, soil formation or primary production, e.g. fish nurseries.[47]

Second, the value of the ecosystem is appraised, if possible, in monetary terms.[48] From a utilitarian perspective, ecosystem services may have "use" and/or "non-use" values. Use values can be "direct use" values such as fish or firewood; "indirect use" values such as improved water quality or nutrient cycling;

or "option" values, which are values preserved for possible future use either by an individual ("option" value) or by others or heirs ("bequest" value).[49] Non-use values are divided into

three categories: "altruistic" value comes from knowing that people can enjoy certain ecosystem services; "bequest" value derives from knowing that certain ecosystem services will be passed on to future generations; and "existence" value is the satisfaction in knowing that the ecosystem service will continue to exist regardless of future use.[50,51]

1.4 **Selection of Ecosystem Services for Review**

Stakeholders and decision makers choose to review and value certain ecosystem services in order to manage and/or reverse the deterioration of ecosystem functions that supply critical ecosystem goods and services to populations and national economies.[52] The desired ecosystem service valuations, however, are often limited due to a lack of available data or the cost and time involved in data collection. The ecosystem services reviewed in the west, central and southern African LME studies were selected for their socioeconomic importance, the critical state of the relevant ecosystems, and the availability of the corresponding data.

The BCLME Ecosystem Services

A large portion of the three BCLME countries' populations, totalling approximately 81 million in 2014,[53] live in urban areas, many of which are located along the coast. LMEs contribute to a significant proportion of gross domestic product (GDP) in these countries: for example, in Angola, the fisheries sector is second to oil and gas production that comprises 90 per cent of GDP. Meanwhile, in Namibia, fishing-sector revenue accounts for 9 per cent of GDP.[54] Although adding only 1 per cent to South Africa's economy, fisheries have regional significance to the Western Cape, which is an industrial fishing centre. Therefore, in all three BCLME countries, fisheries have greatly impacted the livelihoods of coastal communities.[55] Almost the entire BCLME coastline is exposed to open ocean, and four estuaries and five coastal lagoons are considered to be of transboundary significance. A decline or change in fish stocks and pollution from agricultural, industry, mining, coastal development, inadequate waste management and storm run-off pose the greatest threats to the BCLME.[56]

Based on the socioeconomic importance of fisheries and the suspected sharing of stock due to fish populations that migrate across the Exclusive Economic Zones (EEZs) of the three adjacent countries,[57] Sumaila (2015) evaluates the values of the BCLME ocean ecosystem services, specifically fisheries, mariculture and marine recreational fisheries (Figure 4).[58] The purpose of the BCLME review is to "build further political will to undertake threat abatement activities while leveraging finances proportionate to management and governance needs."[59]

The GCLME Ecosystem Services

Approximately 47 per cent of the GCLME countries' people live within 200 km of the coast,[60] and the estimated total population for the 16 countries is 398 million (2014).[61] An accelerated growth of coastal populations has led to crowded conditions where the poor depend on subsistence activities such as "fishing, farming, sand and salt mining and production of charcoal."[62] Interwies (2011) lists the following major problems in the GCLME region, which were identified by the TDA:

- a decline in fish stocks and unsustainable harvesting of living resources
- uncertainty regarding ecosystem status, integrity and yields in a highly variable environment, including effects of global climate change
- deterioration of water quality from land- and sea-based activities, eutrophication and harmful algal blooms
- habitat destruction and alteration including, inter alia, modification of seabeds and coastal zones, degradation of coasts and capes, and coastline erosion.[63]

Interwies (2011) examines both ocean and coastal ecosystem services that include fisheries, timber and non-timber products, coastal protection, climate regulation, drinking water, fish nurseries, tourism, other cultural services, and biodiversity (Figure 4). These services were chosen based on the problems identified by the TDA, their socioeconomic importance, and the available data from which to derive estimated economic impacts.

The CCLME Ecosystem Services

The estimated population for the CCLME countries is 69 million (2014).[64] Most cities and industrial infrastructure are located in coastal areas and approximately 70 per cent of the people that live within the CCLME countries directly rely on the ocean and coastal ecosystems for their livelihood.[65] Agriculture and fisheries contribute over 30 per cent of GDP in the region – more than the industrial sector – with coastal populations depending on fisheries, agriculture and tourism activities for their livelihoods and sustenance, and also relying on firewood from wetland ecosystems to heat their homes.[66] Pollution of coastal waters could therefore cause major public health risks in an area so heavily dependent on the ocean.[67] According to Interwies and Görlitz (2013), the CCLME TDA identified the following problems:

- declining fisheries including small pelagic species, demersal finfish, sharks, rays, marine turtles, cetaceans and an uncertain status of tuna resources
- habitat modification such as destruction of mangroves, degradation of seabed habitat, seamounts, coastal wetlands, coral reefs and estuaries
- declining water quality such as changing salinity upstream of river mouths, hydrocarbon pollution, eutrophication of coastal waters, invasive non-native species, sediment mobilization in water columns and toxicity from pesticides.[68]

The CCLME valuation closely follows that of the GCLME study. It examines both ocean and coastal ecosystem services such as fisheries, biodiversity, timber and non-timber products, coastal protection, climate regulation, fish nurseries, other cultural services, biodiversity and "possibilities for tourism and recreation" (Figure 4).

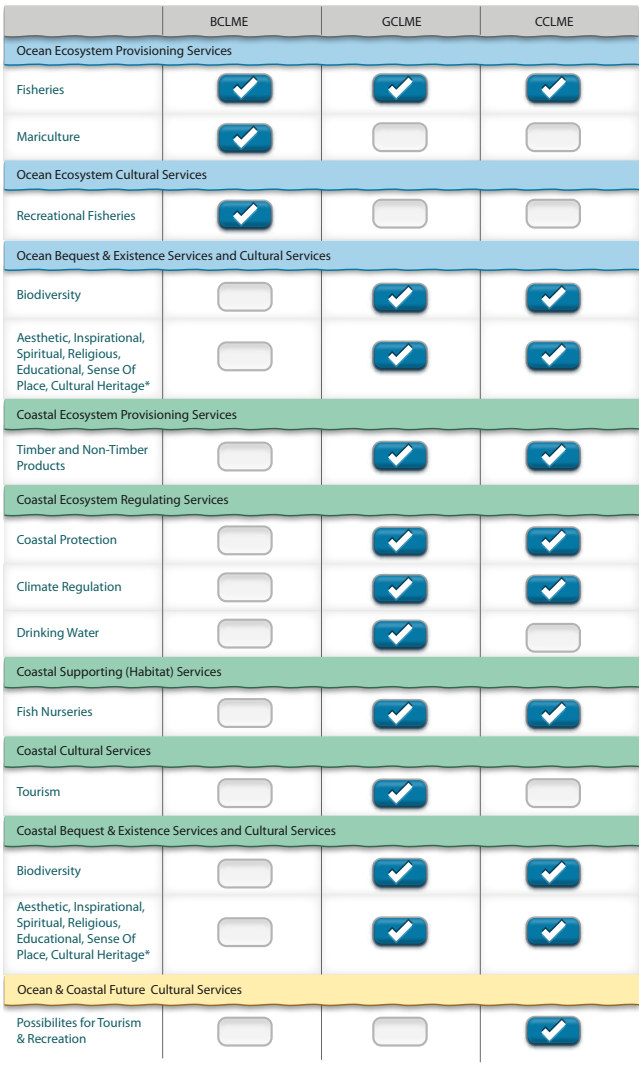


Figure 4: Ecosystem Services Examined in the West, Central and Southern African LME Studies

Interwies (2011) and Interwies and Görlitz (2013) consider the listed cultural services (aesthetic, spiritual, educational etc.) and "possibilities for tourism and recreation" as "non-use" values,[69] but The Economics of Ecosystems and Biodiversity (TEEB) Ecological and Economic Foundations considers all cultural services (including tourism) as "direct use" values and "possibilities for tourism and recreation" as a future direct use value ("option value"). "Non-use value" is the satisfaction in knowing that ecosystem services, including cultural services, exist or can be passed on to future generations.[70]
Sources: Sumaila (2015), Interwies (2011), Interwies and Görlitz (2013).

1.5 **Determining Applicable Economic Valuations for LME Ecosystem Services**

Direct Output Impact

The Direct Output Impact (DOI) is used to estimate the "economic impact" of goods and services from various LME marine sectors. To find the DOI, the quantity of an ecosystem good or service is multiplied by its market price.[71,72] This economic impact measurement can be useful in determining the societal importance of an ecosystem service. It does not, however, reflect the "value"[73] of the good or service because the costs of production inputs, including environmental degradation or depletion of natural resource stocks, are not accounted for.[74]

Total Economic Value

Total Economic Value (TEV) is typically the preferred valuation method as it measures the "value" of ecosystem services, or the net environmental benefits. Additionally, TEV includes non-use values. It is an estimation of the "sum of consumer surpluses (what consumers are willing to pay over and above the market price for goods or services) and producer surpluses (what firms, such as trawling companies, earn from the sale of goods and services over and above their cost of production)."[75]

The standard approach to TEV valuation employs direct and indirect observed behaviour methods. Direct observation methods are usually applicable "where the ecosystem services are privately owned and traded in functioning markets."[76] Indirect observation methods use actual observed behaviour "in a surrogate market, which is hypothesized to have a direct relationship with the ecosystem service value."[77] These indirect methods include:

- hedonic pricing methods: statistical techniques are used to divide a price paid for a service into prices for each of its attributes, including environmental attributes, e.g. aesthetic views or clean air
- travel cost methods: a site's demand function is derived from travel costs that people incur to visit that destination
- replacement cost methods: an estimated value is assumed from the cost of a service that has been substituted for the service provided by an ecosystem, e.g. water filtration. (Replacement cost methods have been criticized for over- and underestimating value, as costs do not reflect the true benefit or welfare of an ecosystem service).[78]

When observed behaviour methods are not available or workable, a second TEV valuation approach based on hypothetical behaviour is often conducted. People are asked either directly how much they would be willing to pay for specified benefits (contingent valuation), or are asked to rank, by their willingness-to-pay for or willingness-to-accept, different hypothetical bundles of goods.[79]

The Benefit Transfer Method

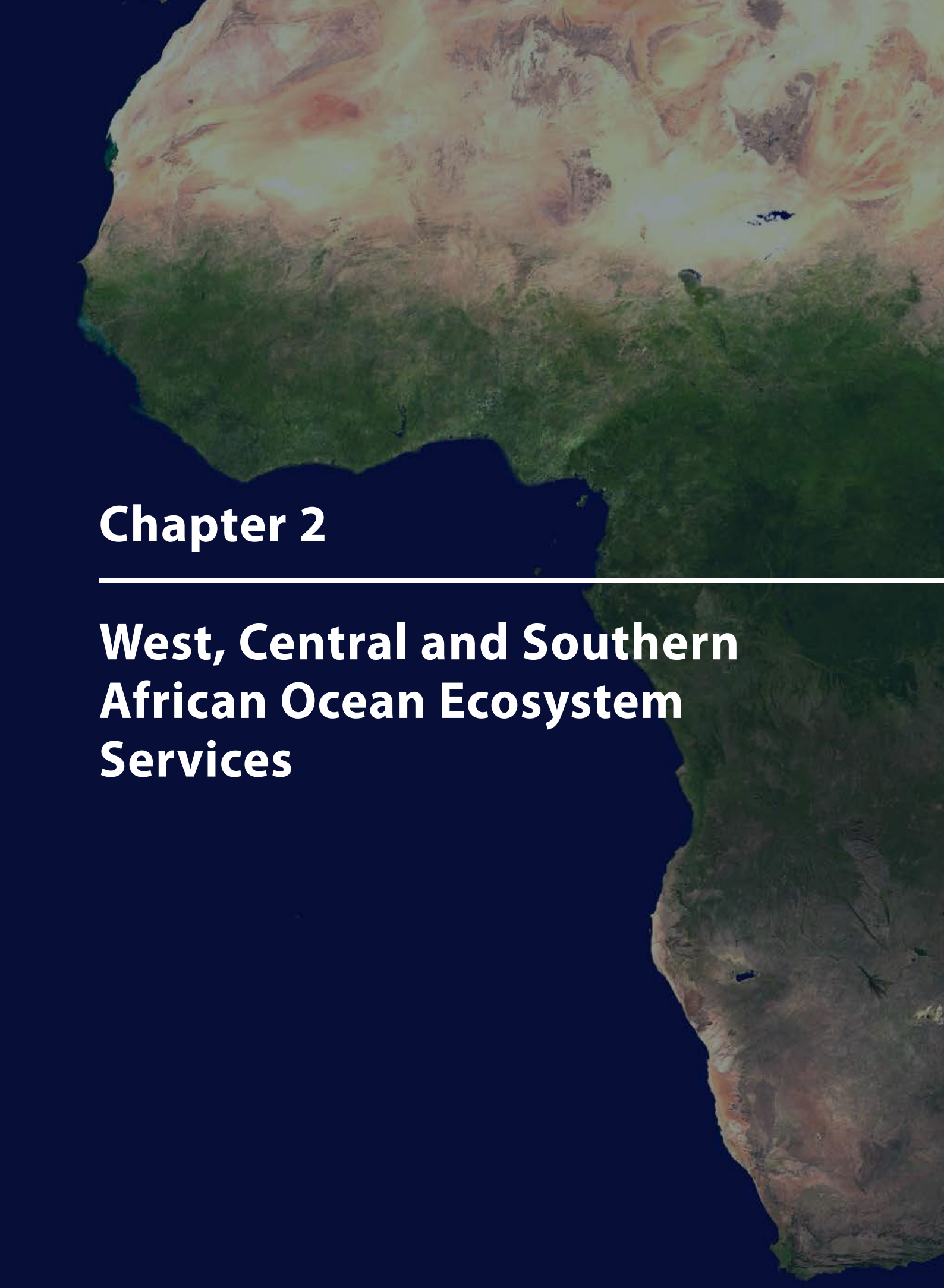
When neither the observed behaviour nor hypothetical methods are available, a final approach known as "benefit transfer" may be used. Due to lack of data regarding a given ecosystem service, estimates from a different site or context are used. For the valuation to be at all effective, the site and populations affected by the service being valued must be almost identical to the site and populations affected where the actual estimates were made. For example, data regarding the economic benefits of west, central and southern African mangroves are unavailable so the west, central and southern African studies "transfer" figures from valuations of south Asian mangrove regions.[80] However, since it has often been used incorrectly, benefit transfer is a controversial method.[81]

Valuation Methods Used in the West, Central and Southern African LME Studies

Due to lack of data, the three economic valuations considered in this report largely provide DOI estimates as opposed to estimated TEVs. Furthermore, when values, as opposed to economic impacts, are approximated, they are generally derived from the benefit transfer approach and/or the replacement cost method.

The economic figures are reported as presented in the LME studies, without any adjustments for inflation or exchange rate fluctuations. Within this synthesis, all monetary amounts will be listed in U.S. dollars and all values, unless otherwise stated, are annual estimates.

These initial studies are not intended to serve as a basis for a comprehensive management plan, but rather to illustrate a "broad overview" that can "provide local resource managers with indicators about the economic impact of different economic sectors."[82] Regional studies would provide the detail necessary for more thorough decision-making.[83] These larger views are intended as "rough estimates", given that the "urgency of initiating a more sustainable management practice in LME conservation" outweighs the uncertainty of the results.[84]



Chapter 2

West, Central and Southern African Ocean Ecosystem Services

2.1 **The Economic Impact of the BCLME**

BCLME Fisheries

For the people of Angola, Namibia and South Africa, the BCLME fisheries supply nourishment, employment, enterprise, revenue and a way of life. Angolans rely almost solely on fish as their source of protein, directly consuming 11.1 kg per person per annum, while South Africa's fishing industry supplies food for the whole South African subregion. Angola's revenues from fish product exports amount to millions of U.S. dollars, and in all three countries, most fishing companies are locally owned or are joint ventures with foreign companies. In Angola, artisanal fishing and informal fish trading, which involve thousands, mostly women, are a part of local culture. Similarly, local employment in fishing-sector jobs has been growing in Namibia since its independence in 1990. Populations, specifically in major fishing ports such as Walvis Bay of Namibia (where most of the country's processing plants are located) and the Western Cape of South Africa, have created a society based on the fishing culture.[85]

The total BCLME fisheries catch (2006) is 966,000 tons, giving rise to a DOI of US$ 517 million annually (see appendix A).[86] The DOI is the product of landed quantities of fish and ex-vessel prices or "the prices that fishers receive when they sell their catch" and does not include costs.[87] The BCLME fishing sector employs approximately 75,000 people per year (Figure 6).[88]

Of the three BCLME countries, Namibia brings in the largest catch, with a DOI of US$ 303 million – roughly three times that of Angola or South Africa (Figure 5). Despite Namibia's huge economic gains, the fishing sector employs over twice as many people in both Angola and South Africa as it employs in Namibia (Figure 6).[89]

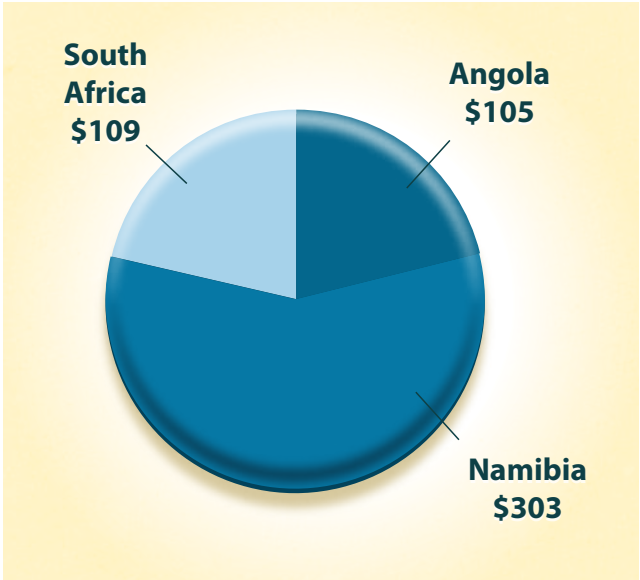


Figure 5: Direct Output Impact from the BCLME Fisheries in US$ million (2006).

Source: Sumaila (2015).

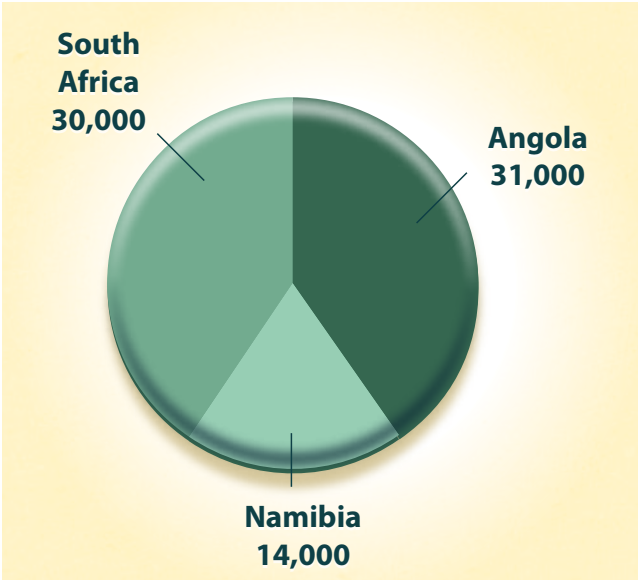


Figure 6: Number of People Employed by the BCLME Fisheries (2006).

Source: Sumaila (2015).

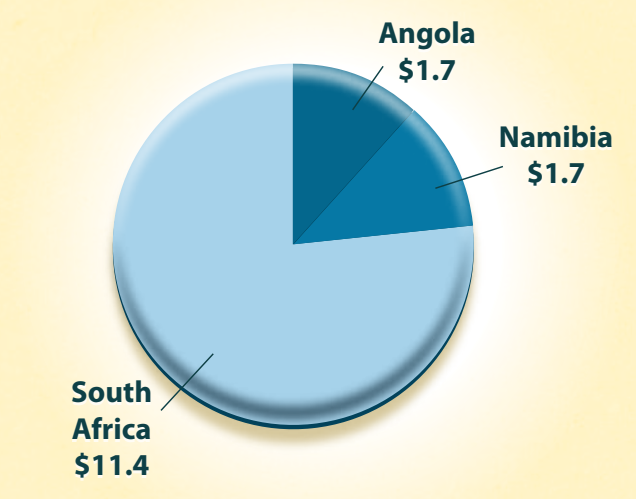


Figure 7: Direct Output Impact from BCLME Mariculture in US$ millions.

Source: Sumaila (2015).

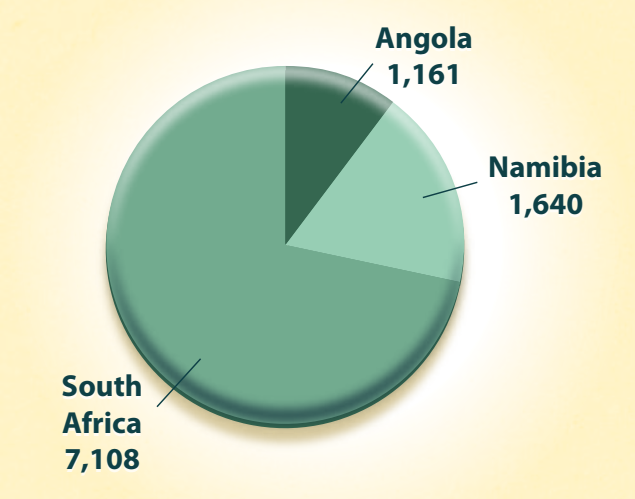


Figure 8: Number of People Employed in BCLME Mariculture.

Source: Sumaila (2015).

BCLME Mariculture

The total annual BCLME mariculture harvest for all three countries is 4,926 tons[90] with, based on ex-farm prices, an estimated DOI of US$ 14.8 million (see appendix A). BCLME mariculture employs an estimated 9,909 people (year not given).[91] South Africa's annual 3,806 ton harvest is over six times that of either Angola or Namibia and therefore has a much larger economic impact,[92] maintaining an estimated US$ 11.4 million DOI – almost seven times that of either Angola or Namibia's $1.7 million DOI (Figure 7). In South Africa, mariculture employs 7,108 people; compared with 1,161 for Angola or 1,640 for Namibia (Figure 8).[93]

BCLME Recreational Fisheries

Sumaila (2015) considers recreational fishing,[94] whale watching and diving to be marine recreational activities (MRAs). These ecosystem services directly rely on BCLME marine life populations.[95] For the three BCLME countries, total expenditure by MRA participants is estimated at US$ 70.4 million (2003). This figure serves as a proxy for the DOI (the product of price and quantity) (see appendix A).[96]

As with mariculture, South Africa receives the largest benefit from the recreational fisheries sector.[97] While the number of annual MRA participants (2003) for Angola and Namibia are estimated at 30,000 and 20,000 respectively, South Africa has an estimated total of 398,000 participants, producing a DOI of US$ 52.9 million — almost six times that of Angola or Namibia (Figure 9). The number of jobs generated in relation to the number of participants is relatively high in Angola (316 jobs) and Namibia (281 jobs) compared with South Africa (667 jobs) (Figure 10).

Use of Multipliers

Sumaila (2015) extends the BCLME analysis by estimating the "multiplier effects" associated with ocean ecosystem

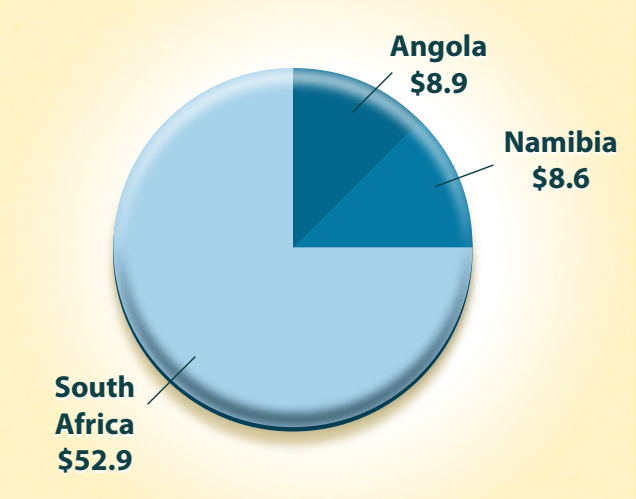


Figure 9: Direct Output Impact from BCLME Recreational Fisheries in US$ millions (2003).

Source: Sumaila (2015).

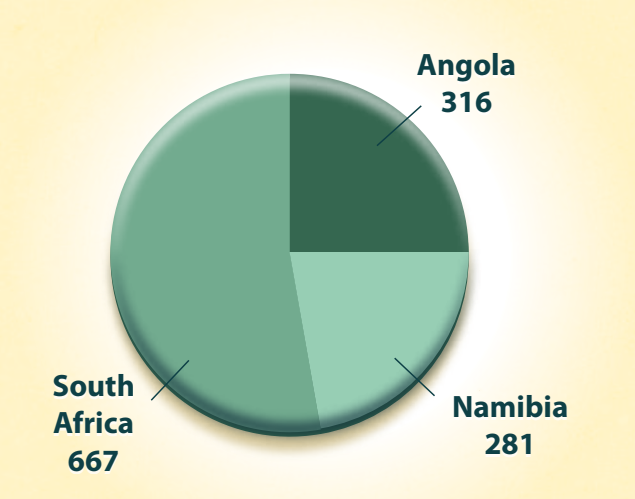


Figure 10: Number of People Employed in BCLME Recreational Fisheries (2003).

Source: Sumaila (2015).

services.[98] The "Total Economic Impact" (TEI) is calculated by multiplying the DOI and an "input-output multiplier" to reflect the additional benefits that come from secondary economic activities such as boat building, production of tin for canning, international transport, and management services for retail distribution.[99] Similarly, the "wage impact" is the product of the DOI and a "wage impact multiplier".[100] The estimated TEI of US$ 2.35 billion and wage impact of US$ 472 million demonstrate a much larger economic impact that extends beyond the initial DOI of US$ 602 million and the 75,000 people employed in BCLME fisheries, mariculture and recreational fisheries (Figure 11) (see also appendix A).[101]

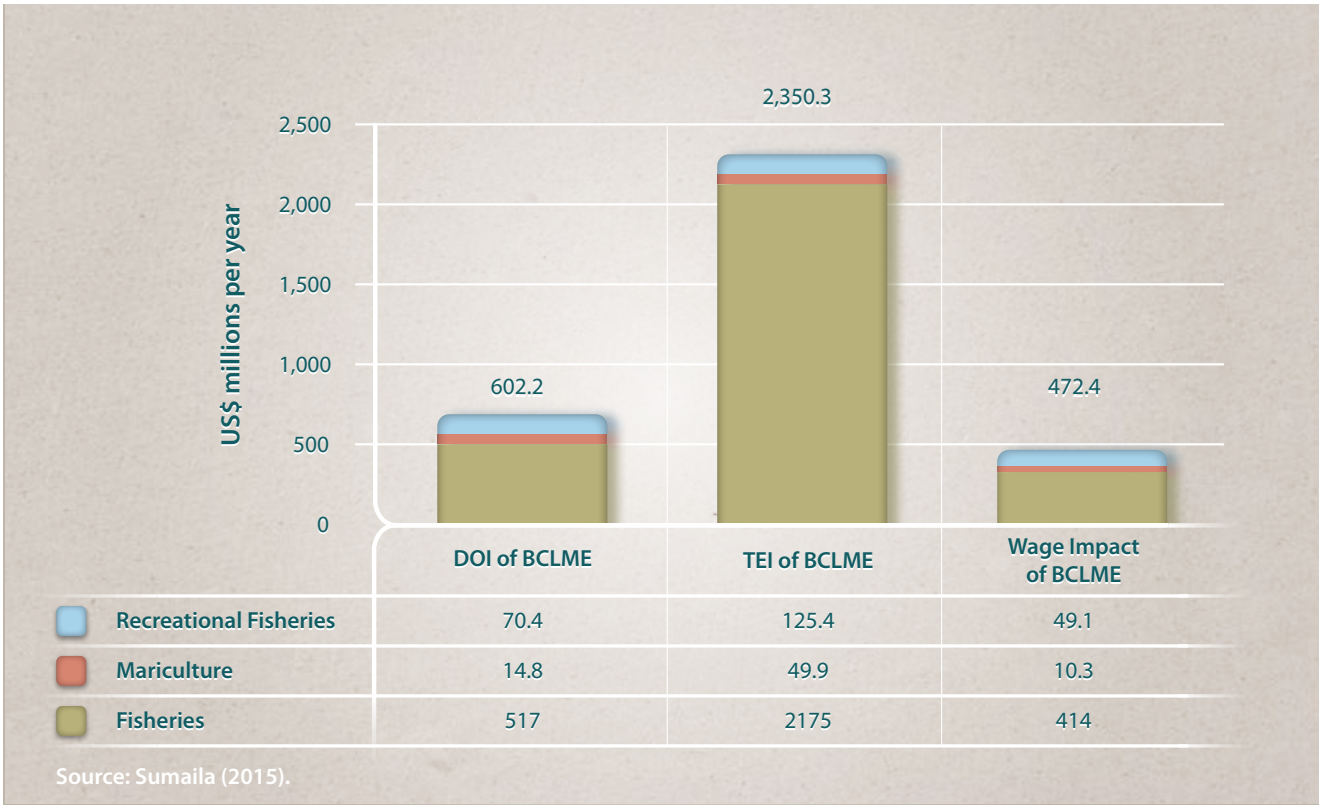


Figure 11: The Primary and Secondary Economic Impact of the BCLME (US$ millions per year).

Source: Sumaila (2015).

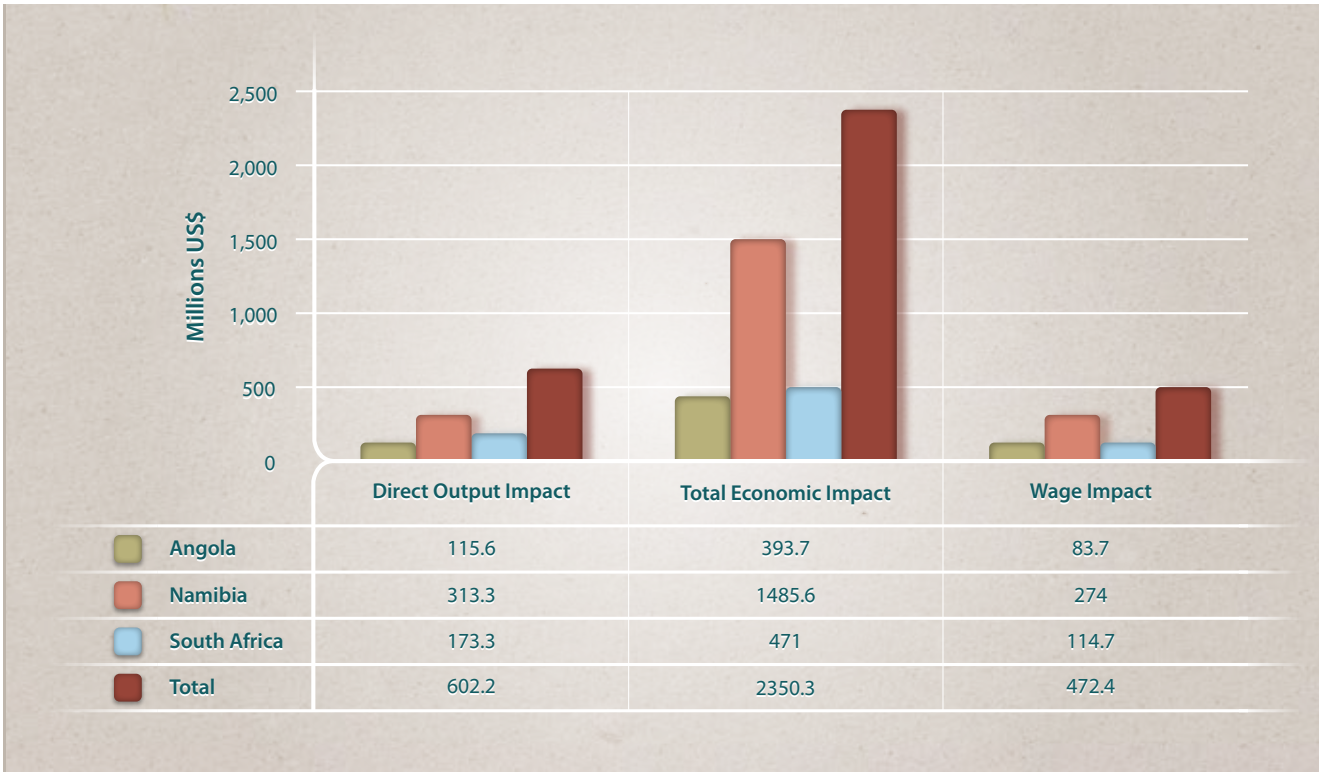


Figure 12: Economic Impact of the BCLME (US$ millions per year).

Source: Sumaila (2015).

The Combined Value of the Ocean Ecosystem Services to the BCLME Countries

The combined DOI of the BCLME ocean ecosystems is US$ 602.2 million per year. Although South Africa gains the most from the mariculture and recreational fisheries sectors, Namibia, with an estimated DOI of US$ 313.3 million, experiences the greatest economic impact overall on account of the fisheries sector (Figure 12). South Africa and Angola, however, lead in terms of people employed by the BCLME (Figure 13).[102]

The data used in Sumaila (2015) is imperfect and comes from previous studies. The benefit transfer approach is applied with regards to the economic multipliers that are based on input-output models of differently structured economies.[103] Participation, expenditure and employment data for the MRA estimates come from a 2010 meta-analysis that uses a large degree of economic modelling and relies heavily on the benefit transfer approach.[104] Sumaila (2015) presents a rough, but telling, picture of how the BCLME countries share marine ecosystem services.

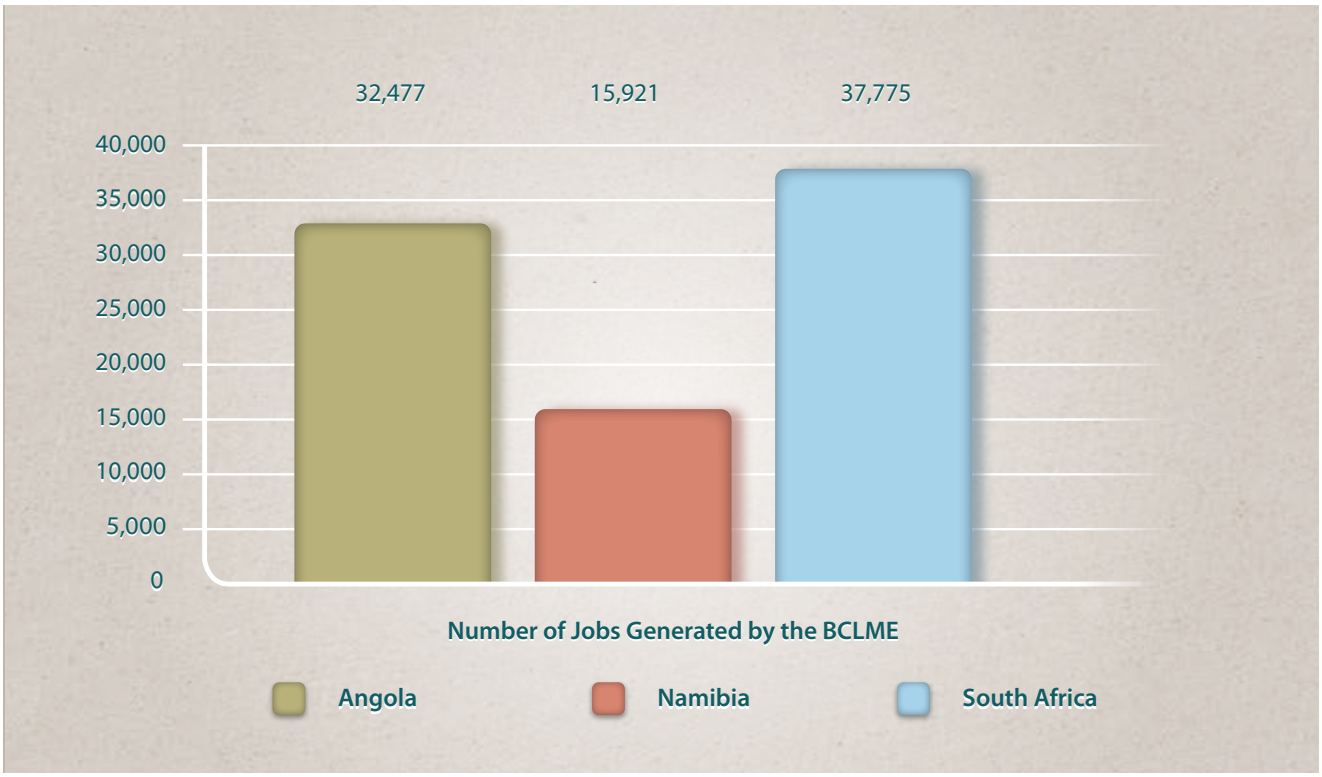


Figure 13: Number of Jobs Generated by the BCLME.

Source: Sumaila (2015).

2.2 **The Economic Impact of Sustainable GCLME and CCLME Fisheries**

Many people living in coastal areas of the GCLME and CCLME regions depend directly upon ecosystems for their survival. Industrial development is weak, population growth is high, and literacy rates are low.[105] Fisheries make up a major economic sector for the 16 GCLME countries, and a large portion of the population that is poor depends mainly on artisanal fishing and agriculture for subsistence.[106] The majority of the CCLME countries are among the poorest nations in Africa, and "an estimated 70 per cent of the population is directly dependent on international waters for their livelihoods."[107] Given this reliance on fishing, the declining fish stocks as identified in the CCLME preliminary TDA and the GCLME TDA will have a great effect on the socioeconomics of these regions.

Interwies (2011) and Interwies and Görlitz (2013) apply several adjustments to the GCLME DOI estimates for fisheries that are obtained from BDCP (2007) figures,[108] and the CCLME DOI estimates that are derived from the share of fisheries as part of GDP. First, an additional roughly estimated percentage is added to the DOIs in order to account for illegal, unreported and unregulated (IUU) fishing: 30 per cent[109] to the GCLME DOI and 25 per cent[110] to the CCLME DOI. Secondly, based on an assumption that the current fishing practices in the respective LMEs are unsustainable or "exceed the reproduction rate of fish stock",[111] the GCLME and CCLME studies reduce the DOI estimates by 20 per cent. As exact data regarding the Maximum Sustainable Yield (MSY) for the regions is unavailable,[112] a global estimation of a 20 per cent reduction is applied in order to reflect economic impact values for sustainable levels of the GCLME and CCLME fisheries.[113] Finally, both studies recognize that the economic impact of fisheries can be partially attributed to nurseries. Since fish nurseries are largely found in mangroves and seagrass, their economic impact is accounted for as a coastal ecosystem service within the two studies (see section 3.3). In order to avoid double-counting the DOI of fish nurseries both individually and as part of the DOI of fisheries, the GCLME and CCLME studies subtract an estimated 10 per cent from the respective fisheries DOI.[114]

GCLME Fisheries

According to data from 2003, the total DOI of fisheries for the GCLME countries, including a 30 per cent addition for illegal, unreported and unregulated (IUU) fishing, is estimated at $18.795 billion[115] per annum or US$ 74.3/ha/a.[116] The DOI is the summed products of fish landings for each of the GCLME countries and market price. The DOI is reduced by 20 per cent in order to reflect a "sustainable" DOI of US$ 15.1 billion (US$ 59.7/ha). A further reduction of 10 per cent to US$ 13.6 billion (US$ 53.7/ha) prevents double-counting of fish nurseries, which are considered a "coastal" ecosystem service for purposes of the GCLME review.[117]

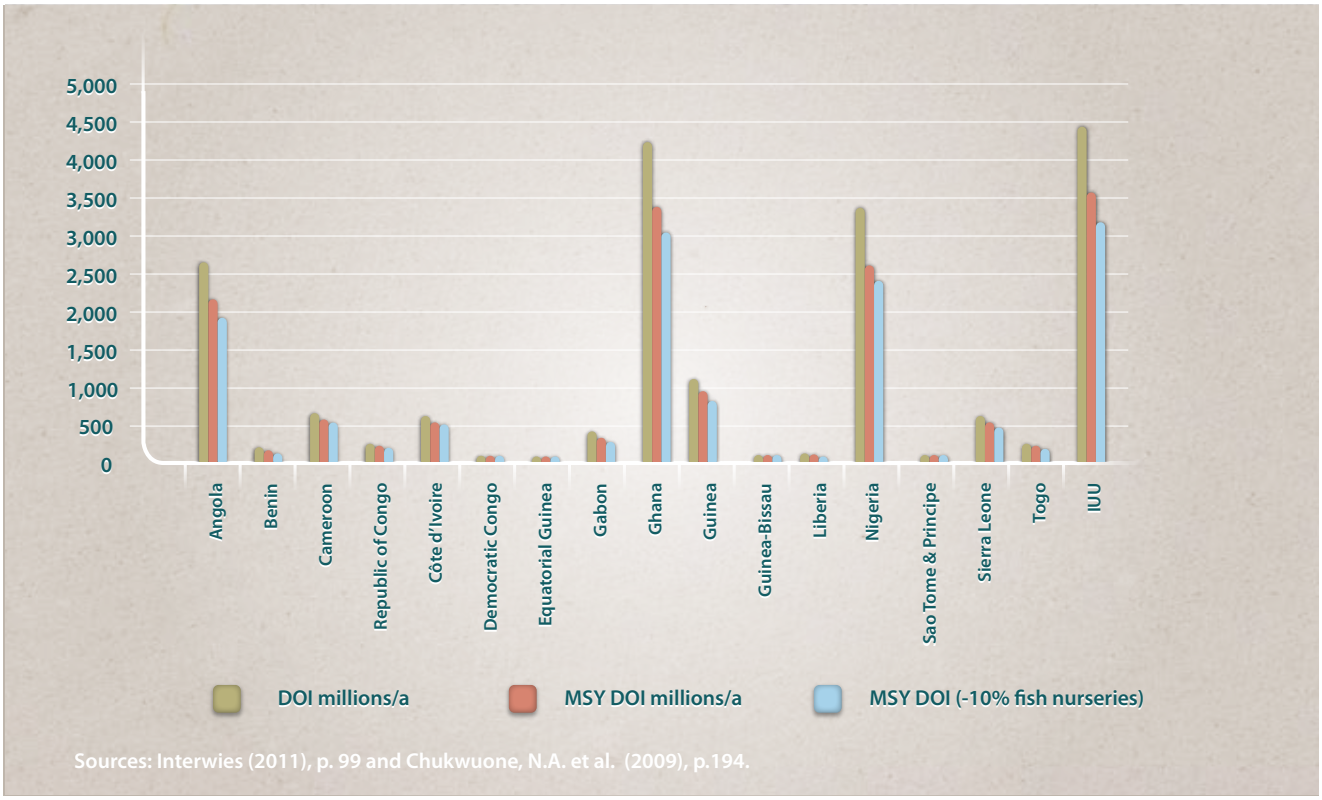


Figure 14: Direct Output Impact (DOI), Maximum Sustainable Yield (MSY) DOI, and MSY DOI (excluding fish nurseries) for GCLME countries (US$ millions/ annum). Based on 2003 figures.

Source: Interwies (2011), p. 99 and Chukwuone, N.A. et al. (2009), p. 194.

Figure 14 shows the DOI and sustainable (or MSY) DOI for each GCLME country. IUU fishing, with a MSY DOI (minus 10% for fish nurseries) of US$ 3.2 billion, results in more revenue than that of any GCLME country, including Ghana, Nigeria and Angola, which have sustainable DOI values of US$ 3.0 billion, US$ 2.4 billion and 1.9 billion respectively (see also appendix B).[118]

CCLME Fisheries

The total DOI (2007) for the CCLME countries, which includes a 25 per cent addition for IUU fishing, is estimated at US$ 4.04 billion annually (US$ 35.9/ha/a). The DOI for each country is calculated by taking the percentage of fisheries income as part of the national GDP (averaged from years 2007–2011).[119] After subtracting 20 per cent from the DOI, the MSY DOI comes to US$ 3.2 billion (US$ 28.8/ha). Taking off another 10 per cent in order to avoid double-counting for fish nurseries, the MSY DOI comes to US$ 2.9 billion (US$ 25.9/ha) (see also appendix C).[120]

Figure 15 shows the estimated DOI for each CCLME country and for the IUU catch. Morocco receives the most revenue with a DOI of US$ 2.4 billion, and IUU landings have the second greatest impact, at US$ 808.2 million.[121]

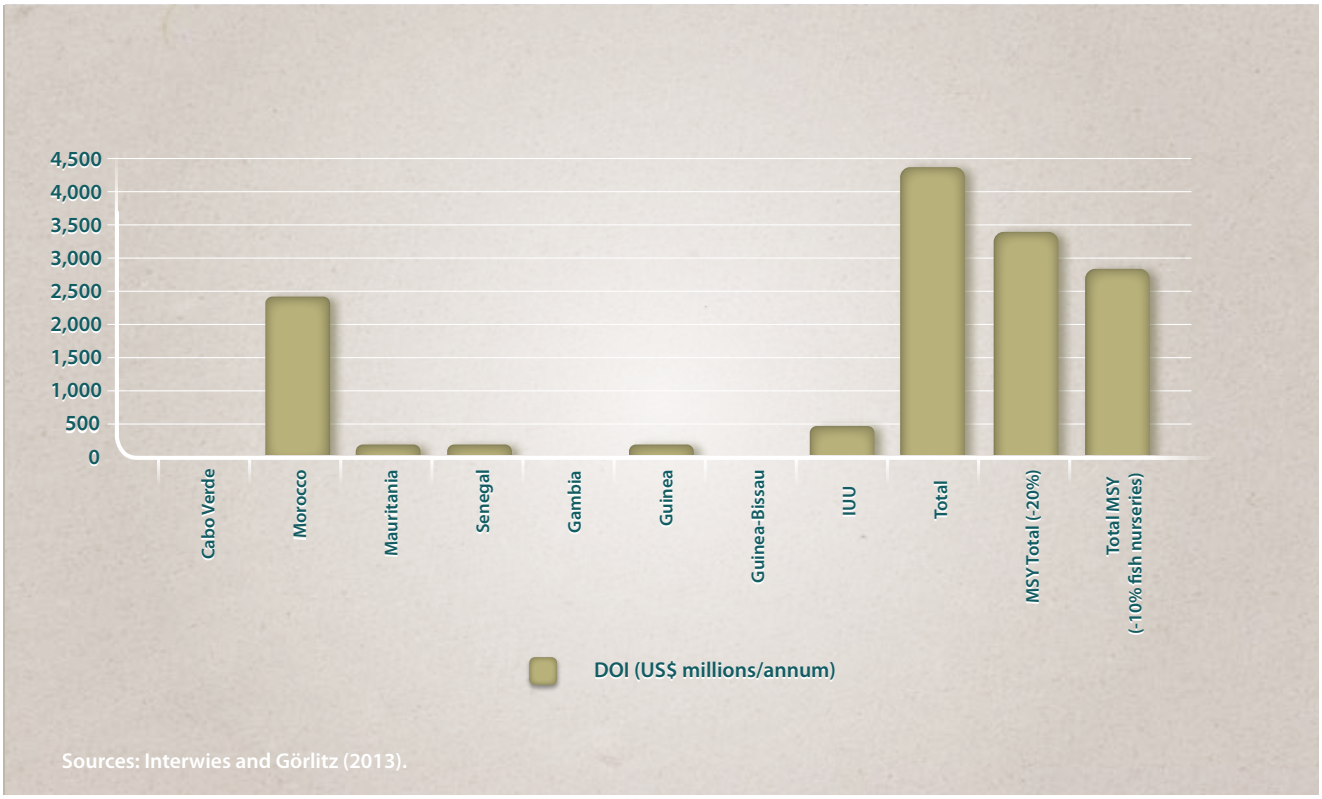


Figure 15: Direct Output Impact (DOI) for CCLME countries (US$ millions/year). Based on share of fisheries in GDP (%; average 2007–2011).

Source: Interwies and Görlitz (2013).

The GCLME and CCLME DOI estimates - after adding estimated IUU catch impacts, subtracting 20 per cent for MSY levels, and subtracting 10 per cent to avoid double-counting the economic impact of fish nurseries - are US$ 13.6 billion and US$ 2.9 billion respectively (Figure 16).

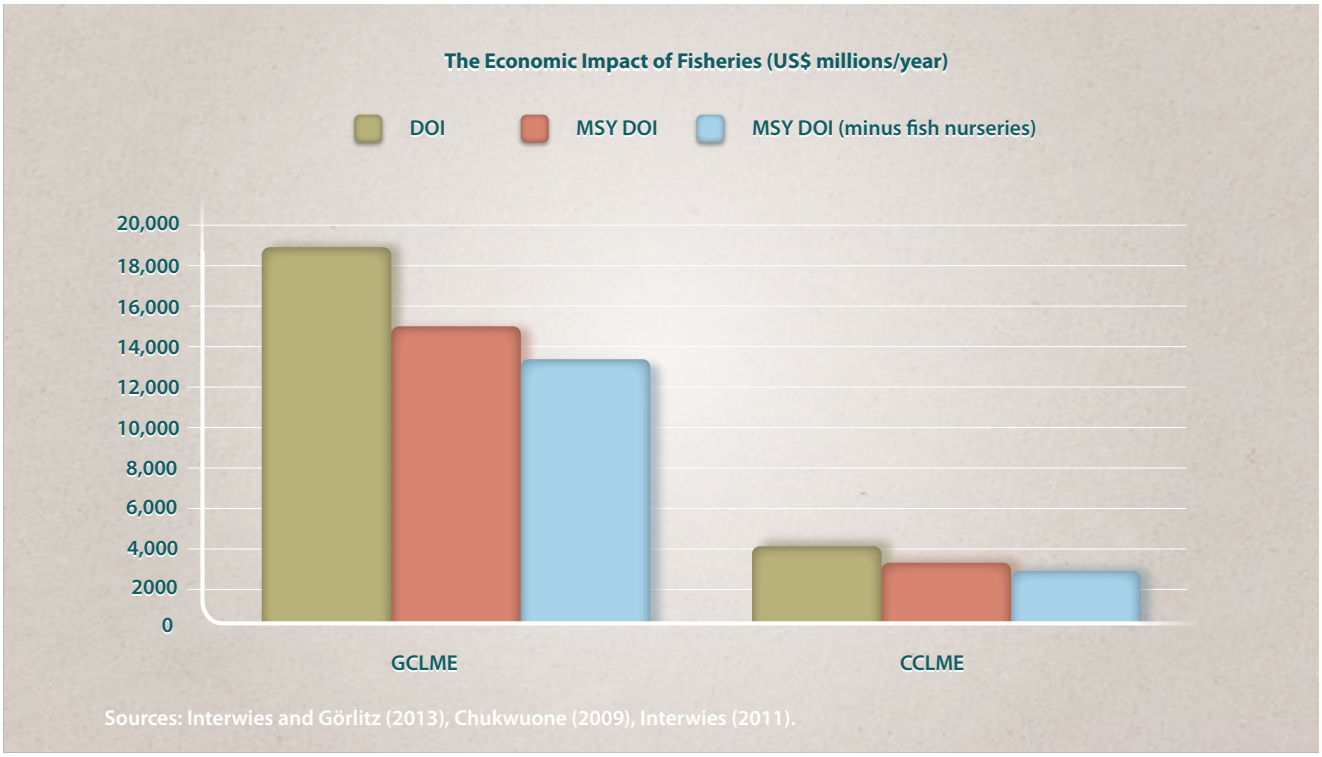


Figure 16: Direct Output Impact (DOI) measures adjusted to sustainable levels (excluding fish nurseries) for GCLME and CCLME countries.

Source: Interwies and Görlitz (2013), Chukwuone (2009), Interwies (2011).

2.3 **Comparison of the West, Central and Southern African LME Fisheries**

The DOI for all three LMEs, before adjusting for MSY or subtracting 10 per cent for fish nurseries, totals an estimated US$ 23.35 billion (see appendix D).[122] The GCLME fisheries, with an estimated US$ 18.8 billion DOI, provides the bulk of the total DOI, followed by the CCLME fisheries with US$ 4.1 billion and then the BCLME fisheries with US$ 517 million (Figure 17; all figures include IUU catch). The GCLME ocean region is 2.2 times the size of the CCLME which would perhaps explain the larger DOI, but the GCLME's estimated per hectare DOI of US$ 74.3 is still twice that of the CCLME per hectare impact of US$ 35.9.[123] The GCLME DOI figure is about 31 times that of the BCLME even though the GCLME catch of approximately 1.59 million tons (2003) is only about 1.6 times that of the BCLME catch of 0.96 million tons (2006).[124] Furthermore, the DOI estimates for Angola's fisheries comes to $105 million in the BCLME study versus over $2.5 billion (not adjusted for MSY levels or double-counting of fish nurseries) in the GCLME study. These massive differences elucidate a disparity in valuation methodologies.

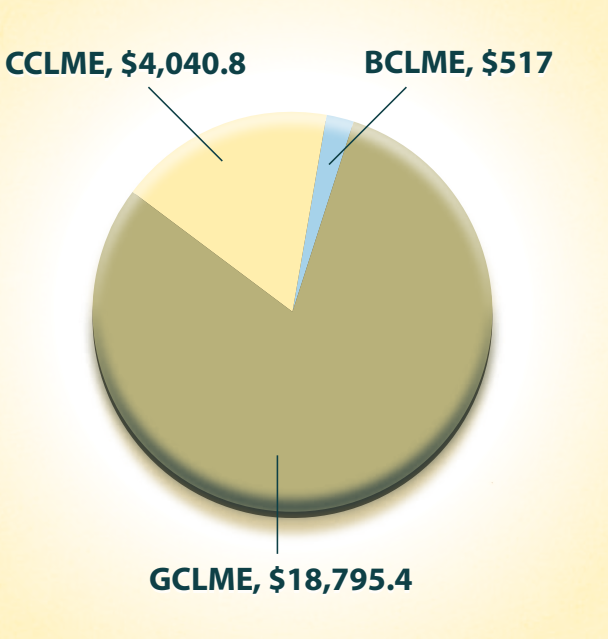


Figure 17: The Direct Output Impact (DOI) from each of the west, central and southern African LME fisheries in US$ million per year. Not adjusted to Maximum Sustainable Yield (MSY) levels. The value of fish nurseries has not been subtracted from the total. The DOI is chosen as a measure for comparison in Figure 17 because the BCLME study does not examine MSY levels nor deduct for the impact of fish nurseries (a coastal ecosystem review is not part of the study). The GCLME and CCLME values include the IUU catch values.

Source: Sumaila (2015), Interwies and Görlitz (2013), Interwies (2011)), Chukwuone et al. (2009).

2.4 **Biodiversity and Cultural Services from the West, Central and Southern African Ocean Ecosystems**

"It is scientifically undoubted that biodiversity has an immense value for human mankind,"[125] but this "intrinsic" value is difficult to measure with any degree of certainty. Most studies focus on the "use value" of biodiversity,[126] which sometimes includes the many fish species and marine mammals that are essential to the fisheries and/or the tourist sector.[127] The economic impacts of fisheries and tourism are examined in the GCLME and CCLME studies (see section 3.4), but a significant share of biodiversity value relates to the satisfaction in knowing that these species exist ("existence" value) or will exist for future generations ("bequest" value). Even if, for now, these "non-use" values cannot be specifically identified, they must be considered in policy and management decisions regarding the LMEs.[128]

In addition to biodiversity, cultural services from ocean ecosystems are also often difficult to measure. These values are "highly related to the specific context of region and/or situation,"[129] and "cultural preference will greatly vary in terms of what has value and what not."[130] Interwies (2011) and Interwies and Görlitz (2013) categorize cultural services – specifically aesthetic, inspirational, spiritual, religious, educational, sense of place, and cultural heritage – as "non-use" benefits, as opposed to the TEEB's "non-consumptive direct use values." Aside from this inconsistent terminology, TEEB does consider that cultural services and non-use values are "co-produced by ecosystems"[131] as they both "involve the production of experiences that occur in the valuer's mind."[132]

The GCLME study attempts to derive rough estimates for the non-use value of biodiversity and for cultural services (other than tourism) from the 2008 Cost of Policy Inaction (COPI) report.[133] The COPI report is an initial global examination of the welfare loss incurred by further biodiversity destruction of terrestrial ecosystems.[134] Interwies (2011) estimates US$ 202.2 million as the overall "non-use" value of GCLME biodiversity and cultural services that is attributable to ocean ecosystems. This figure is minimal compared to the estimated US$ 13.6 billion DOI from GCLME fisheries (Figure 18).[135] Based on "COPI results as measures of non-use values,"[136] Interwies (2011) approximates that US$0.40/ha (non-use value) is derived from GCLME ocean biodiversity and, equally, US$0.40/ha from cultural services (excluding tourism).[137] These rough figures suggest that more data and further study is required regarding the biodiversity and cultural value of GCLME ocean ecosystems.

Interwies and Görlitz (2013) estimate the value of "biodiversity/cultural" services to the CCLME ocean ecosystem at US$ 23/ha. This figure is taken from a meta-analysis[138] that includes 19 examinations of the ecosystem service "biodiversity", with an enormous range of values as indicated by the average value of US$ 26,500/ha and median value of US$ 23/ha. Multiplying US$ 23/ha by the area of the CCLME ocean ecosystem results in an estimated US$ 2.6 billion attributable to ocean "biodiversity/cultural" services – almost equal to the CCLME fisheries DOI of US$ 2.6 billion (Figure 19).[139]

It is clear from the disparity between the US$ 202.2 million GCLME and US$ 2.6 billion CCLME ocean biodiversity/cultural estimates that the valuation methodology for these ecosystem services varies dramatically. Furthermore, both the COPI report and Brander (2006) only cover the values of terrestrial biodiversity; a very limited number of studies specifically examines the value of marine biodiversity.[140] The GCLME and CCLME studies assume that ocean and terrestrial biodiversity is of equal density, despite the density of species being much lower in ocean ecosystems.[141] Finally, the "non-use" terminology used in Interwies (2011) and Interwies and Görlitz (2013) provides confusion, as cultural services are considered "use" values within international frameworks (see section 4.2).

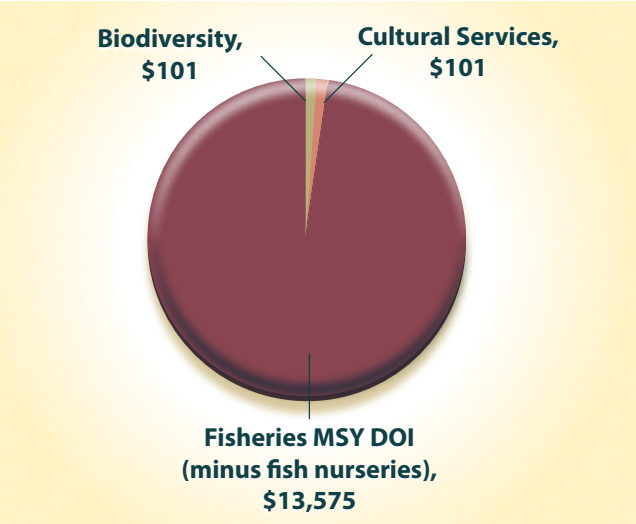


Figure 18: Biodiversity and Cultural Services Values from the GCLME Ocean Ecosystems (US$ millions/year).

Source: Interwies and Görlitz (2013).

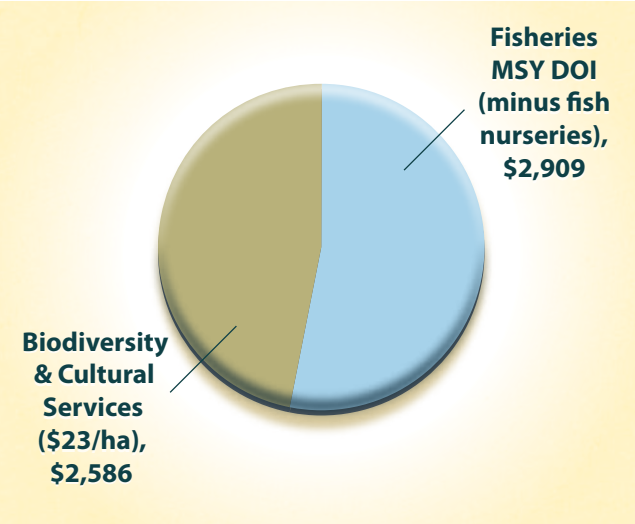
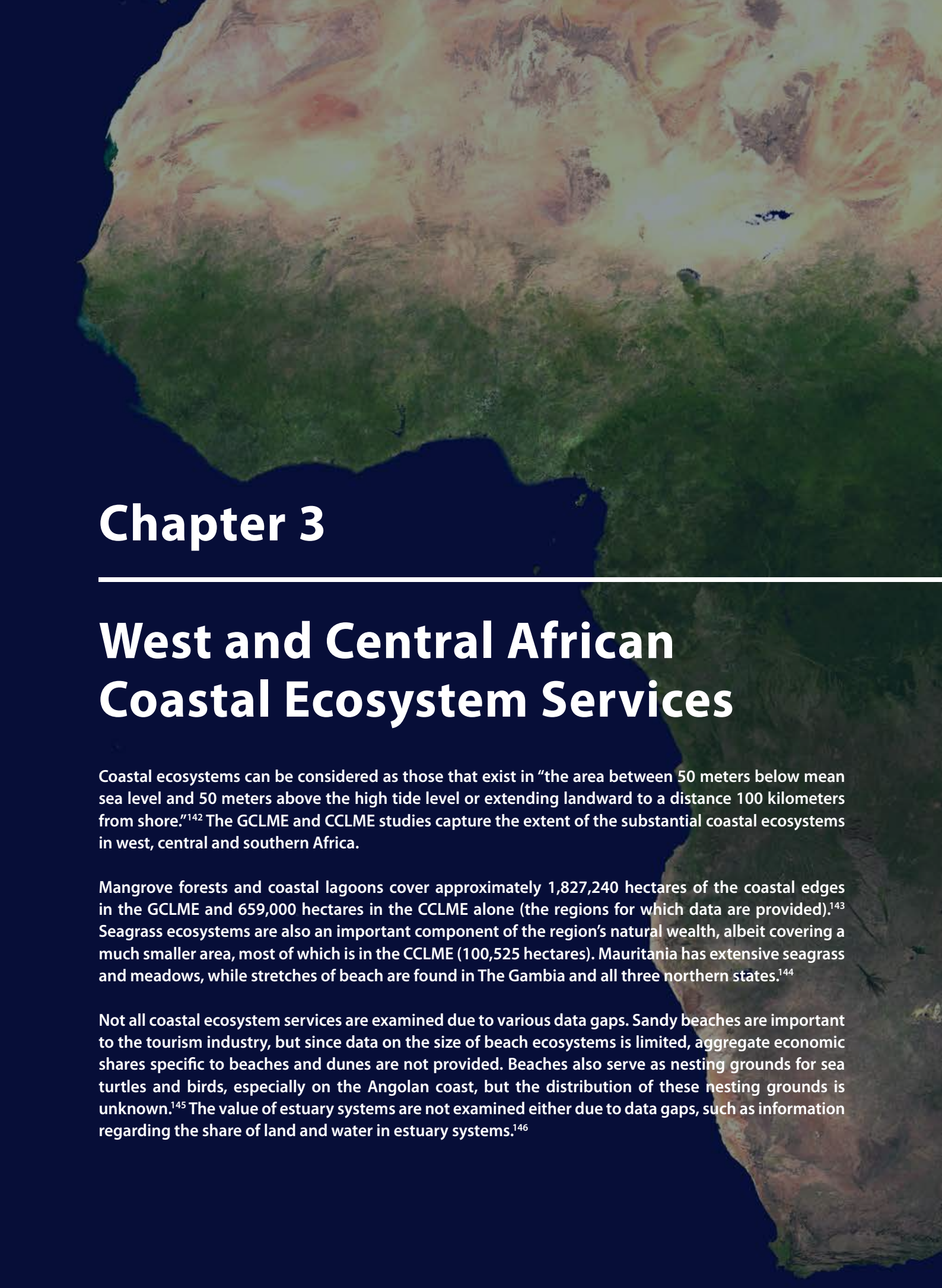


Figure 19: Biodiversity/Cultural Service Value from the CCLME Ocean Ecosystems (US$ millions/year).

Source: Interwies and Görlitz (2013).



Chapter 3

West and Central African Coastal Ecosystem Services

Coastal ecosystems can be considered as those that exist in "the area between 50 meters below mean sea level and 50 meters above the high tide level or extending landward to a distance 100 kilometers from shore."[142] The GCLME and CCLME studies capture the extent of the substantial coastal ecosystems in west, central and southern Africa.

Mangrove forests and coastal lagoons cover approximately 1,827,240 hectares of the coastal edges in the GCLME and 659,000 hectares in the CCLME alone (the regions for which data are provided).[143] Seagrass ecosystems are also an important component of the region's natural wealth, albeit covering a much smaller area, most of which is in the CCLME (100,525 hectares). Mauritania has extensive seagrass and meadows, while stretches of beach are found in The Gambia and all three northern states.[144]

Not all coastal ecosystem services are examined due to various data gaps. Sandy beaches are important to the tourism industry, but since data on the size of beach ecosystems is limited, aggregate economic shares specific to beaches and dunes are not provided. Beaches also serve as nesting grounds for sea turtles and birds, especially on the Angolan coast, but the distribution of these nesting grounds is unknown.[145] The value of estuary systems are not examined either due to data gaps, such as information regarding the share of land and water in estuary systems.[146]

3.1 **Provisioning Ecosystem Services**

Timber and Non-Timber Products

Natural resources play a significant role in the livelihoods of many, especially poor, households along the west, central and southern African coast.[147] For example, mangrove forests supply abundant provisioning ecosystem services, including fuelwood, medicinal herbs and raw material for house construction and manufactured traded goods.[148] Mangrove timber from the GCLME and CCLME coasts provides an estimated US$ 26.4 million per year, of which US$ 18.5 million (US$ 10.1/ha/a) comes from the GCLME and US$ 7.9 million (US$ 12/ha/a) from the CCLME.[149] Non-timber products from these regions are estimated to provide US$ 143.2 million, with US$ 98.7 million (US$ 54/ha/a) from the GCLME and US$ 44.5 million (US$ 67.5/ha/a) from the CCLME.[150]

These "direct use" values (where both market price and harvesting costs are incorporated in the value) are derived from application of the benefit transfer method. Figures are "transferred" from an economic valuation of timber products in the Mekong Delta of Vietnam[151] and from a valuation of non-timber products in a Sri Lanka wetland region.[152] The South Asian ecosystem resembles the GCLME and CCLME mangrove ecosystems, so these values are not modified except to adjust for West African price levels (using 2009 GDP per capita ratios).

3.2 **Regulating Ecosystem Services Provided by Mangroves**[153]

Sewage Treatment and Drinking Water

Mangroves serve as biological purification plants by filtering water and decomposing organic materials to provide the important regulating services of sewage treatment and maintenance of clean drinking water.[154] The value of sewage treatment plants is estimated at US$ 63.2 million for the west and central African coastal region, with US$ 42.9 million (US$ 23.5/ha) attributed to the GCLME and US$ 20.3 million (US$ 30.8/ha) to the CCLME.[155] Maintaining clean drinking water provides an additional value of approximately US$ 9.5 million (US$ 5.2/ha) to the GCLME countries.[156] Employing the benefit transfer method, these values are derived from foreign wetland replacement cost valuations that use costs of treatment plants to estimate mangrove ecological purification services.[157,158]

Coastal Protection

The value of storm protection and the prevention of land erosion that mangrove ecosystems provide can be difficult to estimate.[159] Taken together, the studies approximate the value of coastal protection to be US$ 1.7 billion, with US$ 851.3 million (US$ 465.9/ha) attributed to the GCLME and US$ 883.6 million (US$ 1,340.6/ha) to the CCLME.[160] Seven replacement cost values, including two from "planned or existing" coastal repair projects within the GCLME region, are averaged to attain a figure for GCLME coastal protection.[161] Values greater than US$ 1,000/ha are adjusted to the highest result below US$ 1,000/ha in order to account for the possible overestimation.[162] For the CCLME region repair project data is unavailable so, to find the value of CCLME coastal protection, six "transferred" values (five of which are used in the GCLME coastal protection calculation) are averaged.[163] As none of these averaged figures are adjusted downward to counteract potential overestimation, the CCLME per hectare estimate is much higher than the GCLME figure.[164]

Carbon Sequestration

Mangroves absorb CO_2 and store it in their biomass. Additionally, mangroves can store carbon in their associated soils, including carbon from trapped leaf litter and other detritus. Mangroves thus act as "carbon sinks", thereby performing another crucial regulatory function. The estimated combined value of annual carbon sequestration from west and central African coastal mangroves exceeds US$373 million, of which US$ 152.6 million (US$ 83.5/ha) is attributed to the GCLME and US$ 221.1 million (US$ 335.5/ha) to the CCLME.[165]

The GCLME estimated value for carbon sequestration is the average of two values "transferred" from other studies and adjusted for the momentary price of carbon.[166] The CCLME estimate is calculated from a carbon accumulation measurement (annually per hectare) transferred from another mangrove valuation. The carbon sequestration value is the product of the quantity of carbon accumulated per hectare and an international per-unit estimate of the social cost of carbon, or the cost of the harm that would be caused by carbon if it were released into the atmosphere.[167] The fact that the per hectare GCLME estimate for carbon sequestration is much lower than that for the CCLME is likely due to the fact that Interwies (2011) uses a much lower carbon rate value of about US$ 22.4/tCo_2e compared to the rate of US$ 80/tCo_2e used for the CCLME estimate.[168]

3.3 **The Habitat Service Provided by Mangrove and Seagrass Fish Nurseries**

Mangroves and seagrass beds and meadows serve as fish nurseries and breeding grounds for surrounding ecosystems and societies, thereby fulfilling an important habitat service (or "supporting service").[169] For the west and central African region, the economic impact of mangrove and seagrass fish nurseries is estimated at US$ 1.8 billion. The impact from GCLME mangroves comprises approximately US$ 1.5 billion (US$ 828/ha) of the total,[170] CCLME mangrove fish nurseries contribute approximately US$ 280.5 million (US$ 425.6/ha) and CCLME seagrass beds and meadows about US$ 42.8 million (US$ 425.6/ha). These figures are based the assumption that fish nursery services account for 10 per cent of the entire MSY DOI of ocean fisheries.[171] This 10 per cent is subtracted from both the GCLME and the CCLME MSY DOI totals in order to avoid double-counting the impact of fish nurseries.[172]

3.4 **A Cultural Service: Tourism**

Mangroves, lagoons and sandy beaches are among the coastal ecosystems that are vital to the west, central and southern African tourism industries and their related national income and employment. For example, tourism accounts for approximately 900,000 jobs in the CCLME countries, of which 300,000 are in Morocco.[173] Nevertheless, this industry is vulnerable to pollution, with areas such as Dakar, Senegal, being badly affected. Further damage to marine and coastal ecosystems could considerably affect other economies where tourism is a main source of foreign exchange, such as in Cape Verde and The Gambia.[174]

Both the ocean and coastal ecosystems are integral to tourism services, but lack of specific tourism data makes it difficult to quantify the extent of each ecosystem's role in the GCLME or CCLME tourism industry. Interwies (2011) categorizes tourism as a coastal ecosystem service[175] and approximates 70 per cent of national tourism incomes, totalling US$ 720.8 million per year, to be attributable to the entire coast of the GCLME (see appendix E).[176] Interwies and Görlitz (2013) considers "opportunities for tourism and recreation",[177] totalling US$ 4.684 billion per year, as an "overall" value provided by CCLME coastal and ocean ecosystems.[178] Interwies and Görlitz (2013) assumes that 100 per cent of CCLME tourism income results from coastal/ocean (as opposed to inland) tourism due to the fact that the ratio of coastal/ocean to inland tourism is unavailable (see appendix F).[179]

The economic impact of tourism varies greatly among the west and cental African countries. In the GCLME region, Ghana has the largest estimated tourism income, at $326.2 million (Figure 20).[180] Overall, the CCLME has a much larger economic impact from tourism than the GCLME, mainly due to the booming Moroccan tourism industry (US$ 3.3 billion) (Figure 21).[181]

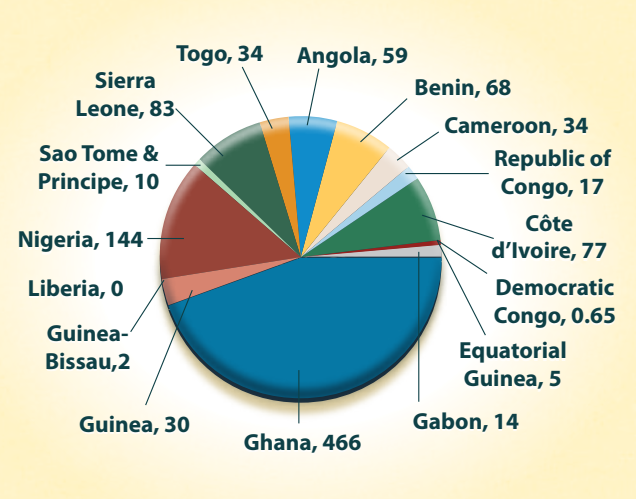


Figure 20: Share of GCLME Total Coastal Tourism Income in US$ millions/year (based on 2009 country GDPs).

Source: Interwies (2011).

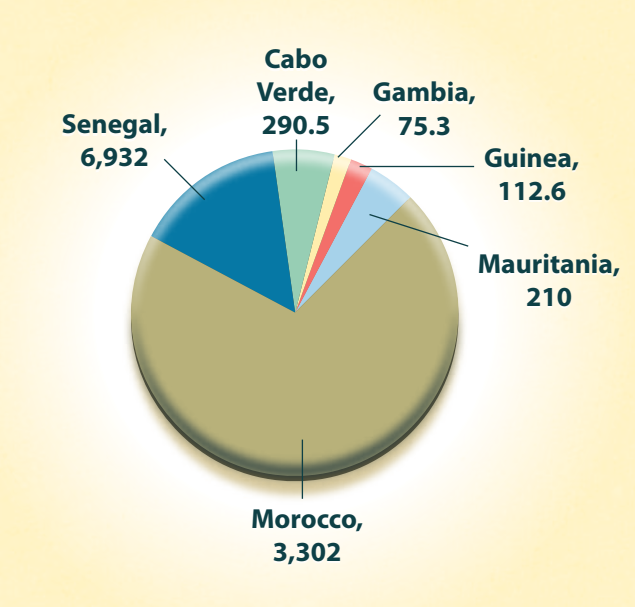


Figure 21: Share of CCLME Total Coastal/Ocean Tourism Income in US$ millions/ year (based on various years); No portion of GDP was attributed to tourism in Guinea-Bissau.

Source: Interwies and Görlitz (2013).[182]

3.5 **Biodiversity and Cultural Services from West and Central African coastal Ecosystems**

The GCLME and CCLME coastal ecosystems, including mangroves, shallow lagoons and seagrass beds and meadows, are biodiversity hotspots, hosting an array of life forms and activity that benefit people.[183] Social interactions and leisure activities, as well as spiritual and religious customs, are rooted in coastal people's connection to the ocean.[184] Taken together, such biodiversity and cultural services from west and central African coastal ecosystems provide at least US$ 55 million to the GCLME and CCLME regions.[185] GCLME coastal biodiversity and cultural services (excluding tourism) provide an estimated impact of US$ 37.6 million, a fraction of the total estimated US$ 27.2 billion impact (excludes tourism)[186] attributed to GCLME coastal ecosystem services.[187] For the CCLME, an estimated US$ 17.5 million biodiversity/cultural value from mangrove and seagrass ecosystems is an even smaller portion of the CCLME coastal ecosystem economic impact figure of US$ 1.5 billion (excludes "opportunities for tourism").[188]

Identical to the methodology used to calculate the economic impact associated with ocean biodiversity and cultural services, the estimated economic impacts of their GCLME coastal counterparts is based on figures from the COPI report (see section 2.4). Interwies (2011) equally assigns a derived value of US$ 10.3/ha to the economic impact of both biodiversity and cultural services from coastal ecosystems.[189]

The median value of US$ 23/ha from the Brander meta-analysis (2006) used to calculate CCLME biodiversity/cultural ocean ecosystem services is also applied to CCLME mangroves, seagrass beds and meadows, and beaches and dunes (although the beaches and dunes value is omitted from the total due to lack of data on the size of these ecosystems) (see section 2.4).[190] The US$ 23/ha value is multiplied by the area of CCLME mangrove coverage and also by the area of CCLME seagrass coverage to obtain separate biodiversity/cultural values of US$ 15.2 million for mangroves and US$ 2.3 million for seagrass beds and meadows.[191]

3.6 **Understanding the Relative Shares of Coastal Ecosystem Services**

According to the GCLME and CCLME studies, coastal ecosystems from these regions provide an estimated economic impact of US$ 4.2 billion, excluding the approximations of the coastal tourism impact of US$ 720.8 million for the GCLME and the "coastal and ocean opportunities for tourism" impact of US$ 4.68 billion for the CCLME.[192] Fish nurseries, with an estimated impact of US$ 1.8 billion, and coastal protection, with an estimated value of US$ 1.7 billion, are the most significant coastal ecosystem services for west and central African coastal populations (Figure 22 and appendix G).[193]

The GCLME use values of timber and non-timber products, sewage treatment, drinking water, coastal protection and carbon sequestration, combined with the economic impacts of fish nurseries, biodiversity and cultural services, total US$ 2.7 billion.[194] The CCLME use values of timber and non-timber products, sewage treatment, coastal protection and carbon sequestration, combined with the economic impacts of mangrove and seagrass fish nurseries, biodiversity and cultural services, total US$ 1.5 billion.[195]

When examined separately, for each of the GCLME and CCLME, coastal protection, fish nurseries and carbon sequestration have the greatest monetary impact (excluding tourism) (Figure 23 and 24 and appendix G).[196] Interwies (2011) approximates the value of mangroves for 50 years, concluding that [no quotation] one hectare of destroyed GCLME mangroves accounts for at least US$ 32,000 (4 per cent discount rate) considering the estimated TEV of mangroves for the next 50 years.[197] Likewise, for the CCLME, the destruction of one hectare of mangroves costs roughly US$ 2,235/ha per year.[198]

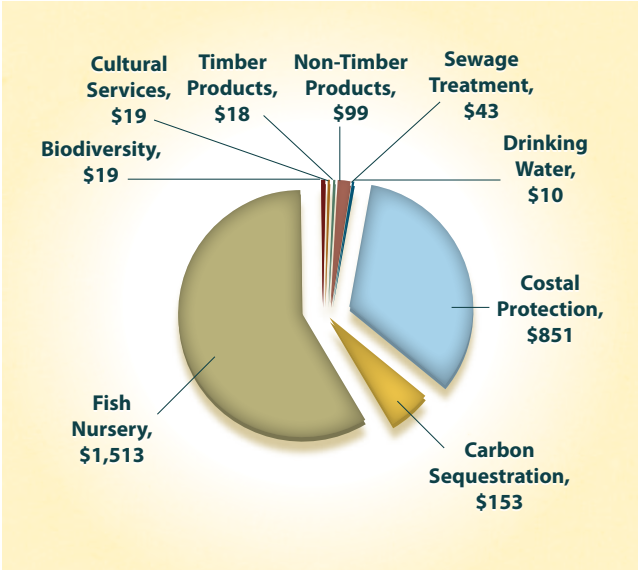


Figure 23: Economic Shares of the GCLME Coastal Ecosystems (US$ millions per year).

Source: Interwies (2011).

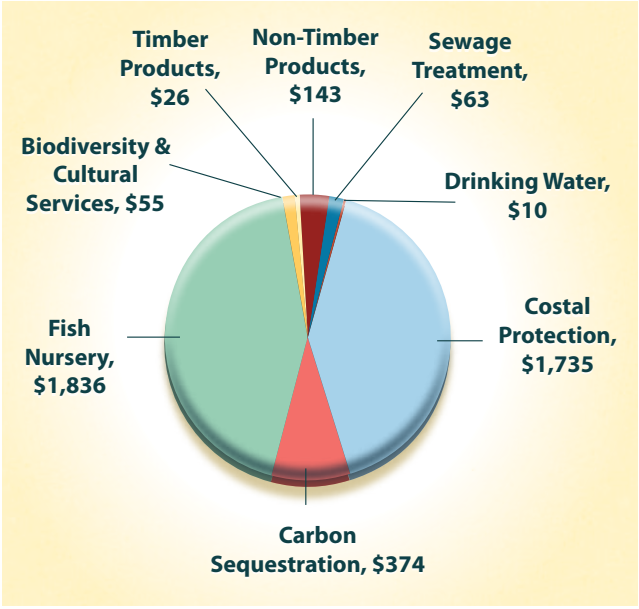


Figure 22: Economic Shares of the GCLME and CCLME Coastal Ecosystems (US$ millions per year).

Source: Interwies (2011) and Interwies and Görlitz (2013).

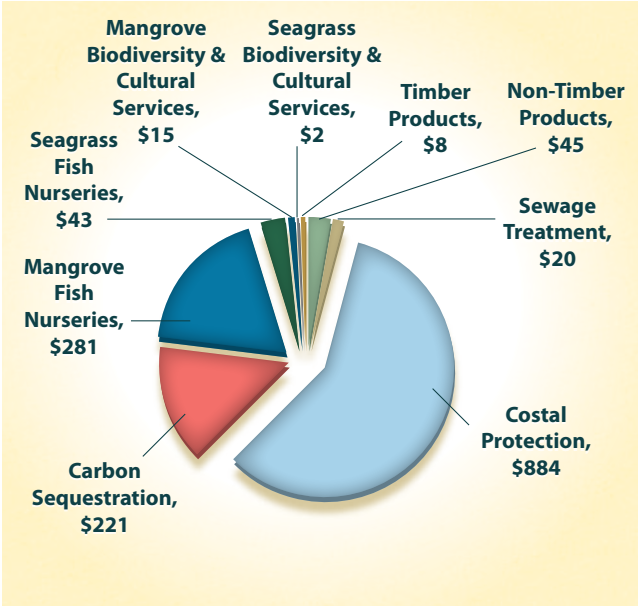
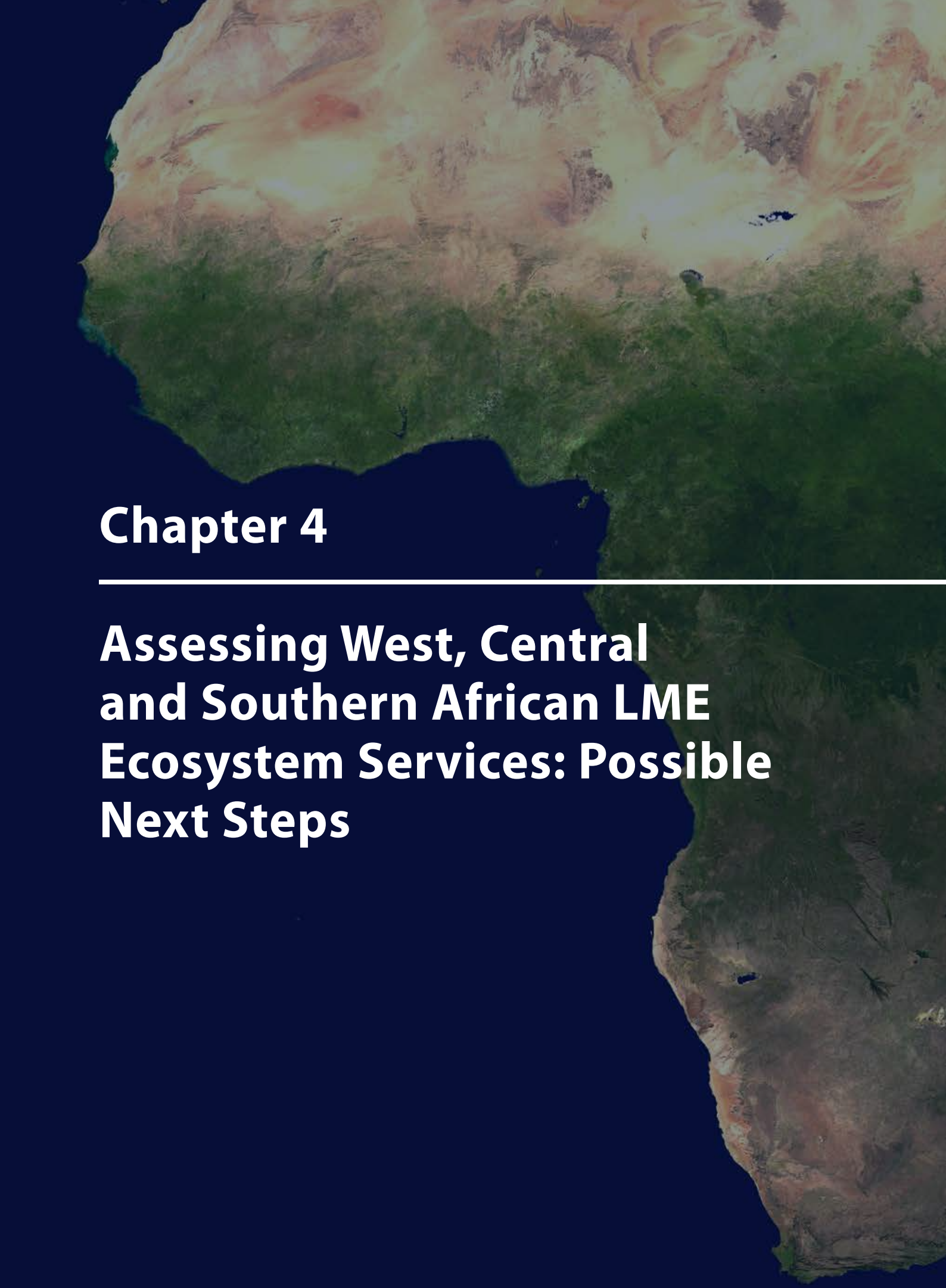


Figure 24: Economic Shares of the CCLME Coastal Ecosystems (US$ millions per year).

Source: Interwies and Görlitz (2013).



Chapter 4

Assessing West, Central and Southern African LME Ecosystem Services: Possible Next Steps

4.1 **Summary of the Economic Impact from the West, Central and Southern African LMEs**

The services provided by coastal and ocean ecosystems are critical to the west, central and southern African economies. While some of the estimated values summarized here might seem quite large – such as the GCLME fisheries DOI or the CCLME "opportunities for tourism and recreation" – these studies are only a first attempt to estimate the economic value and contribution of the west, central and southern African ocean and coastal ecosystems. This is a challenging undertaking which must still overcome big hurdles in terms of data collection and analysis.

Although BLCME coastal ecosystem services are not examined, the ocean ecosystem services reviewed (including fisheries, mariculture and recreational fisheries) have a significant economic effect on the three BCLME countries. The estimated DOI of these ecosystem services totals US$ 602 million (Figure 25) and, after multipliers are applied, these services provide an estimated TEI of US$ 2.35 billion and wage impact of US$ 472 million (Figure 12).[199] For Angola and South Africa, each country's calculated TEI estimate from fisheries, mariculture and recreational fisheries is approximately 1.1 per cent and 0.2 per cent of their respective US$ 35 billion (2006 dollars) and US$ 227 billion GDPs (2006 dollars). Meanwhile, Namibia's estimated TEI from ocean ecosystems plays a larger part, constituting approximately 22 per cent of its relatively small US$ 6.7 billion GDP (2006 dollars).[200]

The estimated 86,200 jobs (various years) supported by BCLME fisheries, mariculture and recreational fishing sectors are also of great socioeconomic importance to these countries, specifically South Africa, which benefits from the most jobs generated (Figure 13) and the largest estimated wage impact (Figure 12).[201] This is particularly advantageous for South Africa as it suffers from a lower national employment ratio (39 per cent in 2014) than both Angola (65 per cent in 2014) and Namibia (48 per cent in 2014).[202]

Likewise, the GCLME and CCLME services have a tremendous economic impact of roughly $28.9 billion (Figure 25).[203] The GCLME's estimated US$ 17.2 billion impact is 5 per cent of the GCLME countries' summed GDPs (US$ 346 billion in 2009), while the CCLME's estimated US$ 11.7 billion is 11 per cent of the CCLME countries' summed GDPs (US$ 106 billion in 2009).[204,205] The greatest share of this impact appears to be from the GCLME's fisheries sector and the CCLME's "opportunities for tourism and recreation" (Figure 25).[206]

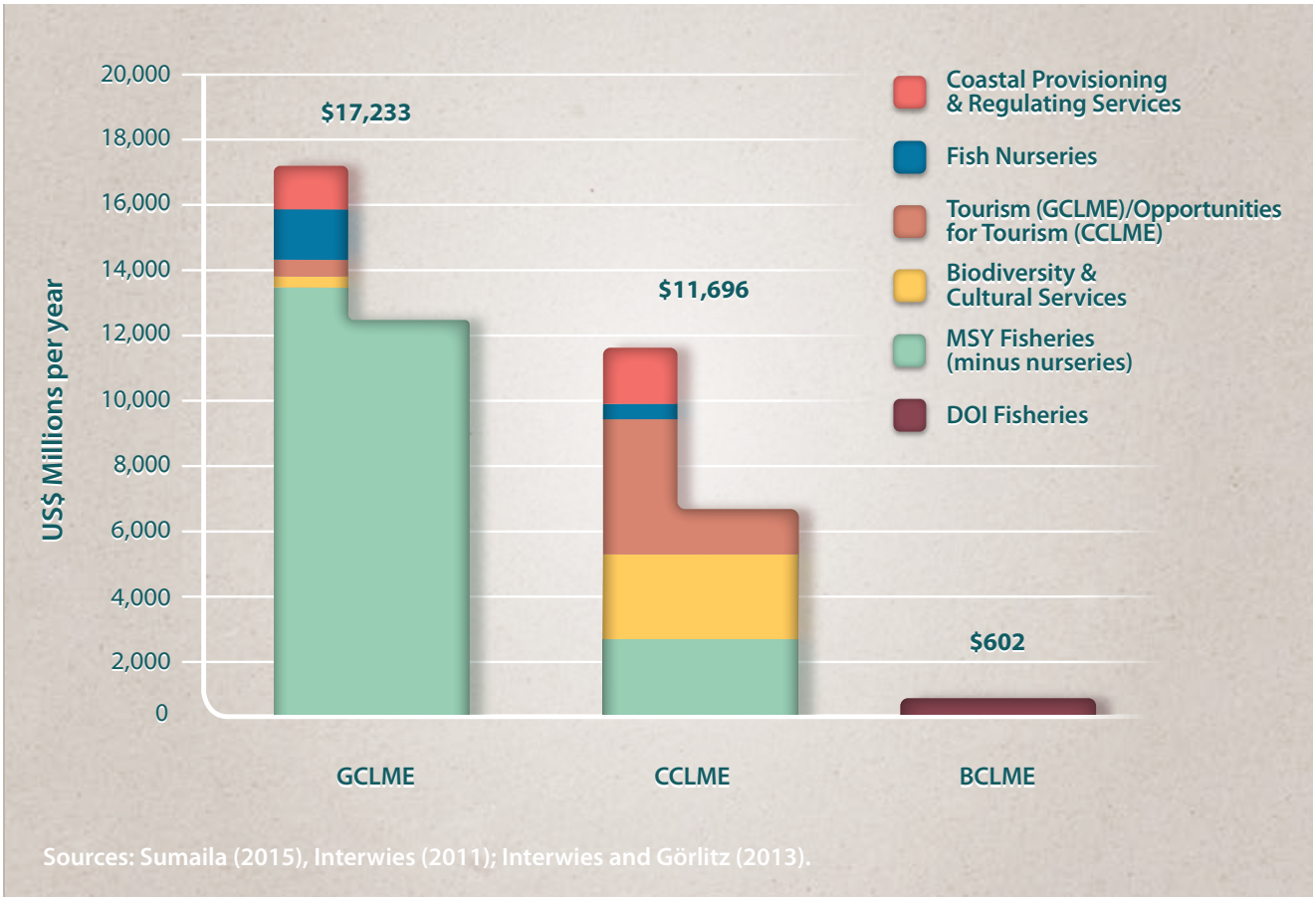


Figure 25: Economic Impact from the BCLME, GCLME and CCLME Coastal and Ocean Ecosystems.

Source: Sumaila (2015), Interwies (2011) and Interwies and Görlitz (2013).

4.2 **Possible Next Steps in Analysis and Data Collection**

Consistent Selection of Ecosystem Services for Review and Consistent Methodology

The ecosystem services chosen for review are different for each west, central and southern African LME study. For example, the BCLME valuation only covers ocean ecosystem services, whereas the GCLME and CCLME studies cover both ocean and coastal ecosystem services. Furthermore, the BCLME study includes mariculture and MRAs in its assessment of ocean ecosystem services, but only fisheries are examined in the GCLME and CCLME studies. The inconsistent selection of ecosystem services across studies makes it difficult to compare or aggregate values.

Methodologies and indicators are also inconsistent across the three studies, thereby complicating potential comparisons and summations. While the BCLME study provides a DOI and uses multipliers to find a TEI and wage impact, the GCLME and CCLME studies do not apply any multipliers to DOI figures, but instead take into account sustainable yield, IUU quantities and double-counting of fish nurseries. This variety of factors and influences makes it difficult to compare impacts and values across regions. Additionally, although the GCLME and CCLME both provide values for biodiversity and cultural services, the methods employed are vastly different. For example, in the GCLME study, a US$0.40 per hectare value for ocean biodiversity and for ocean cultural services is derived from the COPI report (see section 2.4). In contrast, the CCLME study provides a US$ 23 per hectare value for "biodiversity/ cultural" ocean ecosystem services based on a median value taken from a meta-analysis (see section 2.4). The large disparity in outcomes reveals a need for consistent methodology.

Tourism is also handled differently in each of the GCLME and CCLME studies, being considered a coastal ecosystem service for the GCLME, but a coastal and ocean ecosystem service for the CCLME. Furthermore, uncertainty regarding the share of coastal tourism as part of total national tourism is addressed dissimilarly within each study: 70 per cent of national tourism income is considered "coastal" tourism for the GCLME, while 100 per cent of national tourism revenue is credited to "coastal and ocean" tourism for the CCLME (see section 3.4). These varied approaches make it difficult to compare the economic impacts and values of ecosystem services across LMEs.

Consistent Terminology: "Cultural Services" and "Possibilities of Tourism and Recreation"

The Economics of Ecosystems and Biodiversity (TEEB) Ecological and Economic Foundations categorize cultural services, such as recreation and tourism, spiritual and cultural well-being and research and education, as non-consumptive direct use values under the Total Economic Value approach.[207] Cultural services are linked to existence and bequest values if people derive satisfaction in knowing that ecosystems supporting cultural services continue to exist or that these ecosystems will be able to provide cultural services to future generations; however, cultural services that are independent of existence or bequest implications are considered "use values."[208] Despite the TEEB categorization, Interwies (2011) and Interwies and Görlitz (2013) consider spiritual and religious, aesthetic, inspirational, educational, sense of place and cultural heritage values as "non-use values."[209] In differing from the internationally recognized standards established by TEEB, this classification makes it difficult to compare the west, central and southern African LME results with those from other parts of the world. For ease of comparison, future analysis of these regions should follow international frameworks.

TEEB categorizes tourism, within the TEV structure, as a cultural service that provides direct use value.[210] In line with TEEB standards, Interwies (2011) treats GCLME tourism as a coastal ecosystem direct use value and derives a value for this service based on the share of national tourism income as part of GDP.[211] Interwies and Görlitz (2013) also examine tourism income as part of GDP, but due to uncertainty regarding the value of tourism, they include "possibilities for tourism and recreation" as a non-use value.[212] Within the TEV framework, a future direct use of known and unknown benefits is considered an "option value."[213] TEEB acknowledges that "option value" can be understood as "a way of framing TEV under conditions of uncertainty,"[214] but places option value under "use" value, also noting that the inclusion of "option value" within the TEV framework has been contested.[215] As it is uncertainty, rather than "satisfaction of knowing" (i.e., bequest, altruistic or existence value), that prompts the "possibilities of tourism" denomination, it is better classified as a "future direct use value" or "option value" as opposed to a non-use value. For ease of comparison, future west, central and southern African studies should use the established nomenclature in terms of cultural services and tourism.

Incorporating Costs into the West, Central and Southern African Ecosystems Assessment

The west, central and southern African LME studies include many estimates of gross economic impact that are not measures of net economic value. As discussed in section 1.5, the DOI incorporates neither the costs of production inputs, nor the associated costs of environmental degradation or depletion of natural resource stock.[216] The studies only present the economic impact of the BCLME, GCLME and CCLME fisheries and the BCLME mariculture and recreational fisheries. Additionally, the economic impact of GCLME

and CCLME fish nurseries and GCLME biodiversity and cultural services are calculated as a percentage of the estimated fisheries DOI. These figures do not represent the net economic value as costs are not factored into these ecosystem service assessments. Future examinations could improve these estimates by providing more information on the costs of accessing and enjoying these services.

Given the lack of data regarding the national tourism industries of west, central and southern Africa, tourism income as part of GDP is used to illustrate the tourism sector's importance for the CCLME and GCLME economies. GDP is not the best measure of ecosystem services as it does not take into account the depletion or degradation of natural capital and "lumps together costs with benefits, so that activities that enhance welfare have equal weight as expenditures that represent the externalized costs of growth."[217] For example, boat and equipment costs necessary for scuba tourism are indistinguishable from costs associated with remedying ecosystem damage caused by scuba tourism. Improved data collection that allows for alternative valuation methods could result in better net economic value assessments of tourism in the west, central and southern African LME regions.

Reliance on Benefit Transfer and Replacement Cost Methods

The estimated use values for the GCLME and CCLME coastal ecosystem services may prove useful for a "global trade-off analysis" of the whole LME region, but they are not intended for local decision-making and management.[218] All of the coastal ecosystem regulating service values and the timber and non-timber values provided by the west and central African studies are based on valuations of foreign sites. Biodiversity and cultural service measures are based on figures extracted from the COPI report or from a global meta-analysis, despite differences in methodologies and significant uncertainties.[219] Due to lack of data on the linkages between GCLME and CCLME mangrove forests and fishery production, the economic impact of fish nurseries is determined by applying a 10 per cent figure taken from a foreign valuation (see section 3.3).[220] Reliance on values from foreign studies is not ideal as "mangrove ecosystems often have very unique features that cannot be found in other regions of the world."[221] Furthermore, the "transferred values" are, for the most part, replacements costs that do not incorporate the benefits provided by ecosystem services (see section 1.5).[222]

The Need for Primary Data

As decision makers in the region increasingly work to manage ecosystems due to their value, it will be important to have primary valuation studies on the many services discussed above in west, central and southern Africa. In addition, managers would also benefit from having data regarding ecosystems and human activity within these ecosystems. Interwies (2011) and Interwies and Görlitz (2013) identify data gaps that include:

- national fish-landing figures with specific timelines[223]
- maximum sustainable yield levels, i.e. the necessary percentile reductions[224]
- IUU fishing activity statistics[225]
- the ratio of industrial to artisanal and subsistence fishers[226]
- climate regulation functions of marine and coastal ecosystems, especially the deep-sea,[227] and carbon capture levels in local mangrove forests[228]
- quantitative and qualitative values of ecosystem services from seagrass beds and meadows, sandy beaches and coastal lagoons, and the size and spatial scale of coral reefs in Cape Verde and other possible reef locations[229]
- estuary ecosystems and the share of land and water coverage within these systems[230]
- regional data regarding timber/non-timber production, prices and affected ecosystems[231]
- national and local statistics on coastal tourism[232]
- specific data on coastal protection works and sewage-treatment and water-purification projects, infrastructure and costs[233]
- national data on the linkage between mangrove and seagrass contributions to fish nurseries[234]
- regional data regarding cultural, provisioning and regulating benefits of marine and coastal ecosystems[235]
- non-use values of marine and coastal ecosystems, perhaps based on evaluation studies involving local populations to encourage mobilization and participation in decision-making[236]

4.3 **Decision-Making and Management**

Assessments and Management at National and Local Levels

The first step in management processes for LME conservation is to agree on objectives such as the quality and quantity of natural resources to be maintained, the levels of biodiversity, the need for social equity and the requirements of future generations.[237] To compromise on these target levels requires thorough consultation and negotiation between stakeholders. Decisions will be limited by government budgets, the socioeconomic situation of various countries and international policies and agreements.[238] Although expensive and time-consuming, mobilization of local stakeholder participation in decision-making and management is necessary to ensure broad policy support. As Berkes et al. (2008) note, "Top-down resource management does not work for a multitude of reasons, and the era of expert-knows-best decision-making is all but over."[239] Assessments and the value of ecosystem services can be discussed at the local level, both for developing societies that may depend on the provision of food and other resources from local ecosystems and for developed societies that rely on ecosystem services for purposes of general well-being.[240]

The west, central and southern African LME valuations are a first step towards national assessments and natural capital accounting.[241] The recognition of natural capital as an asset "with special value to those users in particular who have little access to other forms of capital, brings with it the opportunity of protecting and investing into it."[242] With additional primary data, the rough estimates provided by the west, central and southern African studies can be honed for inclusion in natural capital accounting, to ensure that ecosystem wealth is accounted for along with economic, social and human capital. With further ecosystem service assessments, governments can inject the socioeconomic-environmental balance into national development plans, infrastructure investment strategy, and regulations.[243]

To reach sustainability goals, valuations are just one component in adjusting the interaction between human activity and the environment; stakeholders, beneficiaries and cultural activity must be identified and included in the "balancing" process. Already, some national efforts have complimented the Abidjan Convention's advancements in governance and management. For instance, South Africa's "Operation Phakisa" programme, designed to "fast track the implementation of solutions on critical development issues,"[244] held an "Oceans Economy Lab" from July to August 2014. Initiatives formulated by participants to properly manage areas of ocean economic growth are now being implemented and monitored within set time frames.[245] Meanwhile, Gabon Bleu, a Presidential marine conservation initiative, has been working in partnership with the World Conservation Society (WCS), Gabon's National Park Agency (ANPN) and the University of Exeter to research and collect data on turtle migration and nesting habitats, fish catch and other fishing and ocean habitat data, and possible management solutions for the oil and gas industry.[246] In 2014, Gabon initiated a marine park network that has expanded to cover 23 per cent of the marine exclusive economic zone (EEZ), and banned or limited commercial and community fishing in these areas.[247] In addition, Senegal's Ecological Monitoring Centre (CSE) project, financed by the Adaptation Fund, has rebuilt and prepared infrastructure for three coastal towns affected by climate change. The CSE has worked to develop regulations and coastal management policies, adopt the law on the littoral, and build awareness campaigns.[248] All of these national efforts have improved the livelihood and well-being of coastal populations in west, central and southern Africa.

Sustainable development is achieved by finding the right balance among the three pillars of social equity, economic development and environmental protection (see section 1.1).[249] For example, within the context of the west, central and southern African LMEs, in order to meet social and economic objectives such as job generation in the fishing industry, it is critical that productive fish stocks are maintained.[250] If fisheries are overexploited, the environmental pillar falls, taking the socioeconomic goals with it. Once sustainability thresholds and target levels have been agreed on, and local populations are on-board, various economic instruments can also help achieve the three-pillar balance. Below is a brief description of such instruments, presented in Interwies (2011), that may be relevant to the sustainable management of the west, central and southern African ecosystems (see also appendix H for a list of useful publications, also referenced in Interwies (2011)).

Economic Instruments for Sustainable Fisheries

Economic and legal instruments on various geographical scales can serve fishing sustainability goals. The fisheries industry is part of a global market and therefore must be addressed at the international level within convention and treaty frameworks. Additional measures can be taken at the national and local levels, including the implementation of transferable rights of fishing quotas; the elimination of environmentally harmful subsidies; eco-labelling; an increased capacity for small-scale fisheries; and the prevention of IUU fisheries[251] (see appendix H for publications that discuss these measures in detail).

Economic Instruments for Pollution Prevention and Control

To achieve affordable access to clean water for west, central and southern African coastal populations, the

provision of water must be financially viable for both the service provider and low-income households.[252] If poorer regions are unable to reach full cost recovery with tariffs or taxes, development aid is crucial. As Official Development Assistance (ODA) organizations condition donated funds on the demonstration of effective spending, it is important that poorer countries find competent leadership of water or sewage service initiatives.[253] Stakeholders along the west, central and southern African coast will have to work together towards a common understanding of affordability, financing (taxes, subsidies) and implementation of water supply and sanitation service plans.[254]

Liability schemes can be effective for pollution avoidance, especially where damage is concrete, quantifiable and can be monitored.[255] Pollution by ships and vessels, however, can only be resolved at the international level. The International Convention for the Prevention of Pollution from Ships, ratified in 1973 and modified by the Protocol of 1978, contains a comprehensive set of annexes with technical standards that member states must transpose to national law.[256]

Economic Instruments for Financing Biodiversity Conservation

Once the monetary and non-monetary values of ecosystem services have been assessed, the locations of these services mapped and the effect of human activity determined, financial and contractual mechanisms can be created to better manage these ecosystem benefits, specifically payments for ecosystem services (PES).[257] At the global level, "buyers" who benefit from conserving the global commons such as the oceans, atmosphere and biodiversity may pay users, communities or management agencies to restore, oversee or refrain from using coastal and ocean ecosystems. In return, the buyers gain from biodiversity, sustainable fisheries, carbon sequestration, coastal protection or other ecosystem services.[258] PES schemes can also work within the market at the local level as an alternative to conventional tourism entrance or activity fees and charges to businesses operating within protected areas that flow to government agencies responsible for a marine area's management.[259] Instead, PES funds may go directly from the beneficiaries to the providers of the ecosystem service, without being diverted to other agencies or initiatives.[260] For example, tourists may pay "user" fees directly to a fishing cooperative[261] or a tourism operator may pay a local community to abstain from destruction of ecosystem services.[262]

Government, ODA funders, and private and corporate donors are gaining new perspectives on the connection between the environment and socioeconomic growth.[263] They understand that biodiversity conservation goes beyond the traditional concept of maintaining protected areas.[264] Innovative instruments such as debt-for-nature swaps, benefit- and revenue-sharing mechanisms and biodiversity enterprise funds (BEFs) involve more stakeholders than just conservationists and donors. Through debt-for-nature swaps, an outside agency may purchase a country's public debt in exchange for the respective government's commitment to conservation activities.[265] Benefit sharing may involve redirecting local investments from environmentally harmful industry to alternative employment options or transferring protected area management or use rights to local people, who are more willing to accept restrictions if compensated or involved.[266] BEFs provide credit to conservation enterprises such as ecotourism, and BEF investors expect returns on their investments.[267]

Beyond government and external funding, market instruments can bring in revenue for both socioeconomic growth and biodiversity conservation. Additional market instruments, including resource extraction and bioprospecting fees may – provided that overexploitation is avoided and conservation goals adhered to – simultaneously further social, economic and conservation goals.[268] "Habitat banks" (entities that restore or preserve habitats using a pool of developer credits purchased in advance of destructive projects) offer opportunities to link valuable ecosystem and protected areas that have higher habitat values.[269]

4.4 **Achieving Sustainable Development in the West, Central and Southern African Coastal Regions**

The rough estimates provided in the west, central and southern African LME studies show that marine and coastal ecosystems are integral to the lives of people living along the continent's coast. As the "flow of value" changes, so do the different forms of capital that affect the social, cultural and economic landscape of the regions, as well as the ecosystems that influence human lives, culture and well-being. The west, central and southern African management regimes must use and build on the data and information presented and work towards properly reinvesting in the LME services. When social equity, economic growth and environmental protection are balanced, sustainable development prevails.

Addendum: A brief update based on recent efforts

Africa's Blue Economy and/or Blue Growth[270] framework has recently become spotlighted in the Africa's Union's Agenda 2063,[271] the African Integrated Maritime Strategy (AIM Strategy 2050)[272] and the recent UNECA initiative on Harnessing the Blue Economy for Africa's development.[273] Agenda 2063 states for instance that "Africa's Blue economy", which covers three times the size of its landmass, shall be a major contributor to continental transformation and growth." In this regard, the 2050 AIM Strategy provides a broad framework for the protection and sustainable exploitation of the African Maritime Domain (AMD) for wealth creation while the recent UNECA initiative provides a step-by-step guide on how to mainstream the Blue Economy into continental, sub-regional, and national policies, plans, laws, regulations, and practices for the development of African Sustainable Blue Economy strategies.[274]

Africa's Blue Economy framework includes the diverse range of uses of marine resources in the 23 Atlantic coastal countries. These uses contribute to the creation of economic wealth, to providing food and energy and to maintaining the general well-being of coastal communities in rural areas. Major contempary sectors include:

- Oil and gas extraction done mainly offshore and in the wider Niger delta. Nigeria and Angola extract about ¾ of the 5.5 million of barrels produced every day by the 23 countries.[275] About 13 countries are now producing oil while other countries such as Senegal, Guinea Bissau, Guinea, etc. have recently identified some offshore oil reserves and could start exploiting these fields in the coming years. With respect to gas, about 45 billion cubic meters was produced in 2015 with 90% coming from Nigeria and, to a lower extent, Equatorial Guinea. A hand set of countries are currently producing gas offshore.[276] The value of the oil and gas production is estimated at EUR 100 billion[277] and 10 billion respectively while the country revenues depend on the lease contract made with extracting companies. In 2014, Countries like Nigeria got around 60 billion EUR of revenues from oil and gas exploitation.

- Fishing activities (capture of fish and other aquatic animal and the collection of molluscs and other invertebrate on the coast) account for more than 5,5 million recovered tonnes in 2014 with an estimated value of almost EUR 4,7 billion.[278] The artisanal and industrial fleets with a flag from one of the 23 countries account for approximately 75% of the catches while distant water fleets (Russia, Spain, Lithuania, Netherland, etc.) catch the remaining 25%. Most of the demersal and small pelagic fish stocks are fully exploited (except deep demersal species) while the tuna species, managed by ICCAT, are in satisfactory state. The prospect of an increase in the production level is therefore very limited. Mariculture is very limited (currently to Namibia mainly) but has a real potential for development (Mauritania set-up its mariculture development plan in 2013).[279]

- Coastal seabed mining is currently limited to Namibian and South African waters for diamonds and aggregates. Namibia is yet to decide whether it will lift the moratorium on phosphate mining.[280] No official data exist on the production and the value of the diamond extraction. According to the World Bank, the deep sea exploration of minerals and resources is increasing across the globe, but its short- and long-term impacts on the environment, economy and society in general remain largely unknown (World Bank, 2016). The potential development for African Atlantic bordering countries is mainly on offshore diamonds, marine phosphates, iron sands, gas hydrates and metalliferous sediments.[281]

- Coastal tourism can be estimated at 1,5 million people per year for the 23 countries (UNWTO, 2016). Cabo Verde, The Gambia, Ghana and Senegal benefit the most from this industry (from a GDP point of view) which contributes 15, 7, 2 and 4% respecgively to their GDP.[282] With a current annual increase of 4%[283] and projections of 75 million tourists in Africa by 2025, Sub-Saharan countries will likely increase their revenues from tourism,[284] boosting their economies. However, in this context, very little attention is given to coastal tourism. The 2013 World Bank Report and the 2015 African Development Bank Report on tourism in Africa don't mention coastal tourism as a priority development area.[285]

African Marine and coastal ecosystems also provide services that are not accounted for in financial terms as they are not subject to any market or trade activities in the way that fish or oil are. In order to take their importance into consideration for policy making, economists assign values to a set of services that don't have any market values such as regulation services[286] (carbon sequestration and storage, fish biomass production, water treatment, coastal protection against erosion for instance) and for non-use values (existence value, bequest and heritage value, cultural and religious values, etc.). A detailed estimation, using a robust approach has been done in 2011–14 in West Africa.[287] It provides a value of the regulation services that is about 2.7 times higher than the one for provisional services (fisheries, wood cutting, etc.)[288] in non protected areas and about 4 times higher in marine protected areas. Extrapolated to the 22 African countries of the Atlantic front, it gives a rough estimates of EUR 5 billions[289] for these services. A more precise and detailed assessment should be set-up in order to provide a more tangible support for the development and implementation of Payment for Ecosystem Services that don't exist yet on the coastal and maritime areas despite already being applied to the forestry sector.

Fish stock management and responsible fishing constitute one of the most critical ecosystem elements requiring constant decision maker attention. Data, information and knowledge related to fish stocks off the coasts of western, central and southern Africa is contstantly being updated and revised. Since the publication of the LME reports that are the source of this synthesis, the latest stock figures point to an alarming trend for which recommendations have been provided by authoritative sources. It is important for decision makers to be informed as to the status of the fish stocks, according to the most recent FAO/CECAF Working Group on the Assessment of Resources[290] (with reports available):[291]

- **Demersal stocks:** the majority of the stocks assessed are overexploited, the others are fully exploited (the Subgroup North met in Fuengirola, Spain, 18 to 27 November 2013).[292] The results of the assessments confirm the conclusion reached at the last meeting in 2010.

- **Small pelagics:** most of the major stocks are overexploited or fully exploited (Subgroup North, Banjul, Gambia, 19–24 May 2014 and Subgroup South, Pointe Noire, Congo, 17–23 March 2014). Reduction of fishing effort or maintaining catch level to average of last 5 years is recommended for the majority of the stocks.

The 3 major tuna stocks, managed by ICCAT present the following status:

- The Atlantic yellowfin tuna stock was estimated to be overfished in 2010; a new assessment should be done in 2016 but as catches were, over the last years, lower than the TAC of 110,000 t implemented in 2011, the likelihood of the stock recovery is high.[293]

- The Atlantic bigeye tuna stock was estimated to be overfished and overfishing was occurring in 2014. Projections indicate that catches at the current TAC level of 85,000 t will have around 30% of probability to recover the population to a level that is consistent with the Convention objectives by 2028. Therefore, the Committee recommends to reduce the TAC to a level that would allow the recovery of the stock with higher probability.[294]

- The skipjack stock status is not fully determined due to the lack of quantitative findings for the eastern stock assessment. It is nevertheless recommended that the catch and effort levels do not exceed the level of catch in recent years (around 30,000 t).[295]

Overall, the majority of the fish stocks are in a precarious state and therefore, no increase of the catches can be expected (or should be promoted) in the near future. The reduction of the size of the distant water fleet testifies of the reduction of the attractiveness of the Atlantic African waters

For the Abidjan Convention, it is essential to monitor ecosystem services in the LMEs, to ensure that sound political decisions are taken at all levels for the maintenance of these services in the context of global change. A standard method has to be used based on the following examples of practical steps:

- Mapping of ecosystems and assessment of their health status, using existing material available in national biodiversity assessments (i.e. for the CBD), integrated costal zone management plans, regional surveys, etc.

- Identification of ecosystem services and corresponding direct uses (current ones such as fishery, coastal tourism, mangrove wood collection, and potential ones such bio-products for pharmaceutical and food) and indirect uses (coming from regulating and provisioning services such as carbon sequestration and storage, coastal protection, water treatment, biomass protection, etc.),

- Quantification and valuation of services and uses.

The convention can coordinate with FAO, UNEP, WTO (World Tourism Organisation), UNECA (UN Economic Commission for Africa), RFMO (Regional Fishery Management Organisations), RFO (Regional Fishery Organisations), the various REC (Regional Economic Commissions) and the countries for purposes of data collection, treatment and validation.

Notes

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3. Ibid.
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5. Abidjan Convention Secretariat background, Abidjan Convention website, http://www.abidjanconvention.org/index.php?option=com_content&view=article&id=88&Itemid=256&lang=en(accessed August 1, 2016).
6. Introduction to Abidjan Convention COP 11, Abidjan Convention website, http://cop11.abidjanconvention.org (accessed August 1, 2016).
7. Interwies, E. (2011). The Economic and Social Value of the Guinea Current Ecosystem – a First Approximation, p. 11. http://gclme.iwlearn.org/publications/our-publications/the-economic-and-the-social-value-of-gclme
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13. Ibid.
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15. Ibid.
16. Ibid.
17. Ibid.
18. Pendleton, L. and A. Kaup (2015). The Future Management of Marine and Coastal Ecosystem Services for People. In: Neumann et al. (2015) The Ocean and Us. GRID-Arendal, Arendal, Norway. pp. 44-46.
19. Sumaila, U.R. (2015). Socio-Economic Benefits of Large Marine Ecosystem: the Case of the Benguela Large Marine Ecosystem. Environmental Development, vol. 7: 244-248. http://dx.doi.org/10.1016/j.envdev.2015.10.002
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21. Protection of the Canary Current Large Marine Ecosystem, FAO website http://www.fao.org/sids/resources/projects/detail/en/c/242048/ (accessed August 1, 2016).
22. Sumaila (2015), p. 248.
23. Interwies (2011). pp. 1-134.
24. Sherman and Hempel (2008), p.117.
25. Ibid.
26. Interwies, E. and S. Görlitz (2013), Protection of the Canary Current Large Marine Ecosystem (CCLME) - Economic and Social Valuation of the CCLME Ecosystem Services, pp. 1-52. https://www.researchgate.net/publication/261471610_Protection_of_the_Canary_Current_Large_Marine_Ecosystem_CCLME_-_Economic_and_Social_Valuation_of_the_CCLME_Ecosystem_Services
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36. Sherman and Hempel (2008), pp. 7-8.
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39. United Nations Development Programme (2013). Towards Ecosystem-Based Management of the Guinea Current Large Marine Ecosystem, p. 3. http://lme.edc.uri.edu/images/Content/Downloads/EcosystemBasedManagement_GCLME.pdf
40. Ibid., 4.
41. The CCLME Project, Canary Current LME Project website, http://www.canarycurrent.org/en/about (accessed August 1, 2016).
42. Sherman and Hempel (2008), pp. 7-8.
43. Sumaila (2015), p. 244-245.
44. Neumann, C., T. Bryan, L. Pendleton, A. Kaup, J. Glavan (eds)(2015). The Ocean and Us. GRID-Arendal, Arendal, Norway, Introduction, p. 8.
45. Interwies (2011), p. 9.
46. Interwies (2011) and Interwies and Görlitz (2013) use "habitat services" (in reference to fish nurseries) in lieu of "supporting services."
47. UNEP (2003). Millennium Ecosystem Assessment: Ecosystems and Human Well-being — A Framework for Assessment, Chapter 6: Concepts of Ecosystem Value and Valuation Approaches, p. 127-147. In Interwies (2011), p. 14. http://pdf.wri.org/ecosystems_human_wellbeing.pdf
48. Interwies (2011), p. 23.
49. UNEP (2003), Millennium Ecosystem Assessment, p. 133.
50. Interwies (2011), p. 24.
51. Pascual, U. et al. (2010) Chapter 5: The economics of valuing ecosystem services and biodiversity, pp. 14-16. In: TEEB (2010). The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations. Edited by Pushpam Kumar. Earthscan, London and Washington, http://www.teebweb.org/our-publications/teeb-study-reports/ecological-and-economic-foundations/. See also http://www.teebweb.org/resources/ecosystem-services/.
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53. The World Bank Data website http://data.worldbank.org/indicator/SP.POP.TOTL (accessed August 1, 2016). Population is the summed populations of the Angola, Namibia and South Africa.
54. Sherman and Hempel (2008), pp. 111-112.
55. Ibid.
56. Ibid., 110.
57. Sumaila, R.U., C. Ninnes and B. Oelofsen (2002). Management of Shared Hake Stocks in the Benguela Marine Ecosystem. p. 143. In: Papers presented at the Norway-FAO Expert Consultation on the Management of Shared Fish Stocks. Bergen, Norway, 7-10 October 2002. FAO Fisheries Report. No. 695, Suppl. Rome, FAO (2003) 240p.

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58. Sumaila (2015), pp. 244-245.
59. Ibid., 245.
60. ORNL (2003). Landscan 2002. Oak Ridge National Laboratory. https://www.ornl.gov. In: Sherman and Hempel (2008), pp. 125-126. Sherman and Hempel (2008) provide a GCLME total population estimate of 300 million (which includes the Angolan population).
61. The World Bank Data website. http://data.worldbank.org/indicator/SP.POP.TOTL (accessed August 1, 2016). Population is the summed populations of the 16 GCLME countries listed in Interwies (2011).
62. Sherman and Hempel (2008), p. 126.
63. Interwies, (2011), p. 11.
64. The World Bank Data website. http://data.worldbank.org/indicator/SP.POP.TOTL (accessed August 1, 2016). Population is the summed populations of the 7 CCLME countries listed in Interwies and Görlitz (2013).
65. Sherman and Hempel (2008), p. 138.
66. Ibid.
67. Ibid., 138-139.
68. Interwies and Görlitz, (2013), p. 12.
69. Interwies (2011).p. 94-95; Interwies, and Görlitz (2013). p. 26-27.
70. Pascual et al. (2010), p. 14-16. In: TEEB (2010).
71. Chukwuone, N.A. et al. (2009). Valuing the Guinea Current Large Marine Ecosystem: Estimates of Direct Output Impact of Relevant Marine Activities. Ocean and Coastal Management, vol. 52, p. 192-193. doi:http://dx.doi.org/10.1016/j.ocecoaman.2008.12.008
72. A "shadow price" may be used if the market price doesn't reflect the "actual price in relation to the economy." The market price is therefore "corrected" based on an exchange rate premium. For traded goods, this is unnecessary and the direct price in the international market is used. Chukwuone et al. (2009), p. 192-193.
73. From an economic perspective, the value of services available on a market is usually measured using a value added calculation (revenues less intermediary consumptions), which gives a better idea of the value created and an opportunity to link it to the GDP (sum of the value added).
74. Chukwuone et al. (2009), p. 192-193.
75. Ibid., 192.
76. UNEP (2003). Millennium Ecosystem Assessment: Ecosystems and Human Well-being — A Framework for Assessment, Chapter 6 "Concepts of Ecosystem Value and Valuation Approaches, p. 135. http://pdf.wri.org/ecosystems_human_wellbeing.pdf
77. Ibid.
78. Ibid.
79. Ibid.
80. Interwies (2011), p. 90.
81. UNEP (2003). Millennium Ecosystem Assessment, p. 135-136.
82. Sumaila (2015). p. 245.
83. Interwies (2011), p. 115.
84. Ibid., 32.
85. Sumaila (2015), pp. 245-246.
86. Sumaila (2015), p. 246 (citing Sea Around Us database: www.seaaroundus.org – (for catch) Watson, R., Kitchingman, A., Gelchu, A., Pauly, D., 2004. Mapping global fisheries: sharpening our focus. Fish Fish. 5, 168–177; (for landed value) Sumaila, U.R., Marsden, A.D., Watson, R., Pauly, D., 2007. A global ex-vessel fish price database: construction and applications. J. Bioeconomics 9 (1), 39–51. DOI 10.1007/s10818-007-9015-4
87. Sumaila (2007), p. 40.
88. Sumaila (2015) p. 246.
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90. Sumaila (2015) (citing sources for harvest include Anglini, R., Vaz-Velho, F., (2011). Ecosystem structure and trophic analysis of Angolan fishery landings. Sci. Mar. vol. 75, no. 2, 309–319; Fisheries Protocols of the BCLME Countries, last accessed 22 August 2015.)
91. Sumaila (2015), p. 247.
92. Ibid.
93. Ibid.
94. "Recreational fishing" is defined as "fishing where the main motivation is not consumption, trade or sale of the catch." Sumaila (2015), p. 247.
95. Sumaila (2015), p. 247.
96. Ibid.
97. For the purposes of the BCLME valuation, South Africa's national participation, employment and direct expenditure values are pro-rated using a BCLME fish catch to total national catch ratio (as only part of South Africa borders the BCLME). Sumaila (2015), p. 247.
98. Sumaila (2015), p. 247.
99. Dyck, A.J., Sumaila, U.R. (2010). Economic impact of ocean fish populations in the global fishery. J. Bioeconomics, vol. 12, pp. 227–230. In: Sumaila (2015).
100. Ibid.
101. Sumaila (2015), pp. 246-247.
102. Sumaila (2015), pp. 246-247.
103. Sumaila (2015), p. 247.
104. Cisneros-Montemayor, A.M., Sumaila, U.R., (2010). A global estimate of benefits from ecosystem-based marine recreation: potential impacts and implications for management. J. Bioeconomics, vol. 12, no. 3, 245–268, p. 248. http://dx.doi.org/10.1007/s10818-010-9092-7. Note that Cisneros-Montemayor (2010) and Sumaila (2015) used the benefit transfer method when confronted with gaps in country data.
105. Interwies (2011), p. 11; Interwies, and Görlitz (2013), p. 11-12.
106. Ibid.
107. Interwies, and Görlitz (2013), p. 12.
108. Interwies (2011), p. 99 (citing Ukwe, Chika (2007): Combating Living Resources Depletion and Coastal Area Degradation in the Guinea Current Large Marine Ecosystem through Ecosystem-based Regional Actions. BDCP Report, Vienna). These figures are also provided in Chukwuone et al. (2009), p. 194.
109. "30 per cent IUU quota adapted by BDCP is congruent with international research." Interwies (2011), p. 99 (citing EFTEC (2008). Costs of Illegal, Unreported and Unregulated (IUU) Fishing in EU Fisheries, pewenvironment-as4.webbased.co.uk/resources/view/id/114567?download=true).
110. The 25 per cent IUU estimate for CCLME IUU is a "low estimate, being well below the estimation by Brown and MRAG." Interwies and Görlitz (2013), p. 25 (citing Brown B.H. (2013). Illegal, Unreported and Unregulated (IUU) Fishing. Draft Document; Marine Resources Assessment Group Ltd (MRAG) (2005). Review of Impacts of Illegal, Unreported and Unregulated Fishing on Developing Countries, Final Report. London.)
111. Interwies (2011), p. 89.
112. See Addendum for an update.
113. Interwies (2011), p. 89 (citing Sukhdev, P. and Kumar, P. (2009). The Economics of Ecosystems and Biodiversity; Tobor, J. G. (1990) The fishing industry in Nigeria-Status and potential for self-sufficiency in fish production.); Interwies and Görlitz (2013), p. 26 (citing Sambe, B., and Lymer, B. L. (2011). Reversing the degradation of the Canary Current Large Marine Ecosystem. Annual ICES Conference, 19-23 September 2011 - LME Thematic Session; FAO/CECAF (2010). FAO Fishery Committee for the Eastern Central Atlantic - Report of the FAO/CECAF Working Group on the assessment of demersal resources – Subgroup North. CECAF/ECAF Series. No. 00/00. FAO, Rome; Caramelo, A. M. (2010). Resources and Fisheries in the CCLME – some perspectives of management. Paper prepared for the CCLME Inception Workshop, Dakar, Senegal, November 2010).
114. Interwies, (2011), pp. 91-92; Interwies, and Görlitz (2013), p. 37 (both citing World Bank (1996). _ Environmental and social review of the buffer zone component, Report no. E-239, Coastal Wetlands Protection and Development Project, the World Bank; and Emerton, L./Kekulandala, L. D. C. B. (2003). Assessment of the economic value of Muthurajawela wetland. Occasional Papers of IUCN Sri Lanka).
115. This figure seems over-exaggerated as it gives an average value per tonne of US$11 000. (knowing that catches are 70% composed by small pelagics (with an ex-vessels price of around US$ 300-700 depending of the season), that the more valuable species, that weigh far less than 10% of the total catches are shrimps and cephalopods with an ex-vessel price comprised between US$ 4000 and 7000). See the Addendum chapter below for update figures.
116. Chukwuone et al., (2009), p. 194. Interwies (2011) uses figures from Chukwuone et al. (2009) as a basis to calculate the sustainable DOI, but cites an earlier unpublished work as source (Ukwe, Chika (Project Manager) (2007). Combating Living Resources Depletion and Coastal

Area Degradation in the Guinea Current Large Marine Ecosystem through Ecosystem Based Regional Actions: Technical report: Preliminary Report on Economic Valuation of Ecosystem Services and TDA, Prepared for the United Nations Industrial Development Organization, Vienna, not published.) As source for fish landing data, Chukwuone et al. (2009) cites FAO. FISHSTAT Plus. A PC system for extended time series of global catches. Rome: FAO Fisheries Department; 2000.

117. Interwies, (2011), p. 99; Chukwuone et al. (2009), p. 194.
118. Ibid.
119. Interwies and Görlitz (2013), p. 12-13. Data regarding countries' share of fisheries of GDP obtained from: Sambe, B., and Lymer, B. L. (2011). Reversing the degradation of the Canary Current Large Marine Ecosystem. Annual ICES Conference, 19-23 September 2011 - LME Thematic Session.
120. Interwies and Görlitz (2013), p. 32.
121. Ibid.
122. When the DOIs from the BCLME mariculture and recreational fisheries are added, the total DOI adjusts slightly upward to US$ 23.44 billion. The values of GCLME and CCLME mariculture and recreational fisheries are not examined.
123. Interwies, (2011), p. 99; Chukwuone et al. (2009), p. 194 ; Interwies, and Görlitz (2013), p. 32. These per hectare figures are not adjusted for MSY and still include fish nurseries.
124. Sumaila (2015), p. 246; Interwies (2011), p. 99; Chukwuone (2009), p. 194.
125. Interwies, (2011), p. 34.
126. Ibid., p. 93.
127. Ibid., p. 34.
128. Ibid., p. 93.
129. Ibid., p. 95.
130. Ibid.,
131. Pascual et al. (2010), p. 15. In: TEEB (2010).
132. Ibid.
133. Interwies (2011), p. 93-94 (citing Braat, L./ten Brink, P. (2008). The Cost of Policy Inaction (COPI): The case of not meeting the 2010 biodiversity target. http://www.globio.info/downloads/85/Report%20-%20Braat%20&%20ten%20Brink%20eds%20(2008)%20The%20Cost%20of%20Policy%20Ina.pdf).
134. The COPI report suggests that unless biodiversity loss stops, Africa will lose 17 per cent of its GDP from years 2000 to 2050, or about US$ 4 trillion 3.15 trillion euro. Since the GCLME countries maintain 23 per cent of Africa's GDP (2009), the GCLME would experience a proportionate US$ 920 billion (724.5 billion euro) loss over the 50-year period. The CCLME's 8.5 per cent share of Africa's GDP (2009) correlates to a US$ 356.2 billion (267.75 euro) biodiversity loss over the same time period. Interwies, (2011), p. 107; Interwies and Görlitz (2013), p. 40.
135. Interwies, (2011), p. 109.
136. Ibid., p. 93. The COPI report assigns 2.1% of biodiversity loss to cultural diversity and identity, heritage, recreation and ecotourism. Interwies (2011) divides the 2.1 per cent number among three "non-use" categories that include biodiversity, ecotourism and recreation, and "other non-use values," so that each holds a 0.7 per cent share of "existence value." 0.7 per cent of the fisheries DOI of $53.7/ha/a is US$0.40/ha/a. Ecotourism and recreation is not included as a non-use value for the purposes of the GCLME study as tourism is already considered as a coastal use value. Interwies, E. (2011), pp. 93-94.
137. Ibid., p. 107-108. "Other non-use values" include spiritual and religious, aesthetic, inspirational, educational, sense of place and cultural heritage. Interwies (2011), pp.94-95.
138. Brander , L.M. et al. (2006). The Empirics of Wetland Valuation: A Comprehensive Summary and a Meta-Analysis of the Literature. Environmental and Resource Economics, vol. 33, pp. 223-250. In Interwies and Görlitz (2013), p. 40.
139. Interwies and Görlitz (2013), p. 40.
140. Beaumont et al. (2008) specifies an existence value of 0.5-1 billion British pounds for the British seas, based on a contingent valuation study regarding conservation of marine mammals around the British coast. It would, however, be difficult to transfer this value to the west, central and southern African LMEs, due to large disparities in terms of socioeconomic and geographical factors. Beaumont, N. J., Austen M.C., Mangi S.C., and Townsend M. (2008). Economic valuation for the conservation of marine biodiversity. Marine Pollution Bulletin 56, pp. 386–396. In Interwies and Görlitz (2013), p. 40.
141. Interwies, (2011), p. 94; Interwies and Görlitz (2013), p. 40.
142. Interwies and Görlitz (2013), p. 13.
143. Interwies (2011), p.109, Interwies and Görlitz (2013), p. 15.
144. Interwies and Görlitz (2013), pp. 13-15.
145. Interwies (2011), p. 87.
146. Interwies, and Görlitz (2013), p. 19.
147. Interwies (2011), p. 90.
148. Interwies and Görlitz (2013), p. 22.
149. Interwies (2011), p. 100, 109; Interwies and Görlitz (2013), p. 33-34, 41.
150. Interwies (2011), p. 100, 109; Interwies and Görlitz (2013), pp. 33-34, 41.
151. Nam Do, T.; Bennett, J. (2005). An economic valuation of wetlands in Vietnam's Mekong Delta: a case study of direct use values in Camau Province. Asia Pacific School of Economics and Government. Canberra. In: Interwies (2011), p. 100 and in Interwies and Görlitz (2013), p. 33.
152. L. Emerton (ed) (2005). Values and Rewards: Counting and Capturing Ecosystem Water Services for Sustainable Development. IUCN Water, Nature and Economics Technical Paper No. 1, IUCN — The World Conservation Union, Ecosystems and Livelihoods Group Asia. In: Interwies (2011), p. 100 and in Interwies and Görlitz (2013), p. 33.
153. The estimation of the regulating services does not take into account the health status of the ecosystems. For instance, mangroves in the Niger Delta don't provide the same quality and quantity of services of the very healthy ones in the Cacheu estuary in Guinea Bissau. The quantity of services provided by an unhealthy ecosystem may be one twentieth that of a healthy one of equal size. More information regarding the value of west, central and southern Africa's regulating services is provided in the Addendum below.
154. Interwies (2011), p. 91.
155. Interwies (2011), p. 104-105, 109; Interwies and Görlitz (2013), p. 36, 41.
156. Interwies (2011), p. 105.
157. Studies used for sewage treatment estimates: Emerton, L. et al. (1999). The Economic Value of Nakivubo Urban Wetland, Uganda, Uganda National Wetlands Programme, Kampala and IUCN — The World Conservation Union, Eastern Africa Regional Office, Nairobi; and Gerrard, P. (2004). Integrating Wetland Ecosystem Values into Urban Planning: The Case of That Luang Marsh, Vientiane, Lao PDR, IUCN – The World Conservation Union Asia Regional Environmental Economics Programme and WWF Lao Country Office, Vientiane. In: Interwies, (2011), p. 104 and in Interwies and Görlitz (2013), p. 36. The "borrowed" values are adjusted to account for West African price levels, but also to account for differences between the Uganda site's high population density and the GCLME and CCLME coastal strip populations. Population density data is not available for Lao region.
158. Emerton, and Kekulandala (2003). In Interwies (2011), p.105. The drinking water value is from a Sri Lanka wetland replacement cost valuation. A unit benefit transfer is conducted and the figure is adjusted, using GDP per capita, to a West African price level.
159. Interwies (2011), p. 91.
160. Interwies (2011), pp. 103-104, 109; Interwies and Görlitz (2013), pp. 34-35, 41.
161. Interwies (2011), p. 104. Two coastal projects used in GCLME valuation are Keta Sea Defence in the Volta Region of Ghana and the construction of five stone jetties between Gounoukopé and Aného, Togo. The five transferred values came from the following studies: Emerton and Kekulandala (2003); Emerton (2005) Values and Rewards – Counting and Capturing Ecosystem Water Services for Sustainable Development; Sathirathai, S. (1998). Economic Valuation of Mangroves and the Roles of local Communities in the Conservation of Natural Resources: Case Study of Surat Thani, South of Thailand; Batagoda (2003), cited in Kathiresan, K. (2007). Importance of Mangrove Ecosystems. Centre of Advanced Study in Marine Biology; Tallis, H. et al. 2008. An ecosystem services framework to support both practical conservation and economic development.
162. Interwies (2011), pp. 103-104.
163. Interwies and Görlitz (2013), pp. 34-35. In the CCLME valuation, the same five transferred values listed in footnote 159 are used with the addition to Barbier, E. B. 2007. Valuing ecosystem services as productive inputs. Economic Policy 22:177–229.
164. Interwies and Görlitz (2013), pp. 34-35.
165. Interwies (2011), pp. 105-106, 109; Interwies and Görlitz (2013), p. 36, 41.
166. Interwies (2011), pp. 105-106. Studies used for the GCLME are: Batagoda (2003) in Kathiresan, K. (2007) and Sathirathai, S. (1998).

The value from Sathirathai is reduced by a factor of 0.58 to adjust to the "momentary prices for carbon."

167. Interwies and Görlitz (2013), p. 36. The annual carbon accumulation estimate is from Bouillon et al. cited in Siikamäki, J., Sanchirico J. N. and Jardine, S.L. (2012). Global economic potential for reducing carbon dioxide emissions from mangrove loss. PNAS September 4, 2012 vol. 109.
168. Interwies, (2011), pp. 105-106; Interwies and Görlitz (2013), p. 36.
169. Interwies, (2011), p. 91-92; Interwies and Görlitz (2013), p. 23.
170. Interwies, (2011), p. 105, 109; Interwies and Görlitz (2013), p. 37, 41.
171. Interwies (2011), pp. 91-92; Interwies and Görlitz (2013) p. 37.The 10 per cent quota figure is "transferred" from Emerton and Kekulandala (2003) because the calculated reproduction rate of fish species in mangroves and seagrass for the GCLME and CCLME areas is not available.
172. Interwies (2011), p. 89; Interwies and Görlitz (2013), p. 25.
173. Interwies and Görlitz (2013), p. 39.
174. Ibid.
175. Interwies (2011), p. 86. Interwies (2011) considers GCLME tourism as a "direct use value / provisioning service." For purposes of this synthesis, tourism is considered a "direct use value / cultural service." Pascual et al. (2010), p. 14-16. In: TEEB (2010).
176. Interwies (2011), pp. 101-102. The ratio of coastal tourism to total tourism income is based on data from Ghana, "as it is the only reliable data on this ration available." Interwies (2011), p. 101.
177. Interwies and Görlitz (2013), p. 38-39. Interwies and Görlitz (2013) considers "possibilities for tourism and recreation" as a CCLME "non-use value/cultural service." For this synthesis, in accordance with international standards, "possibilities for tourism and recreation" is categorized as a "future direct use value / cultural service." Pascual et al. (2010), p. 14-16. In: TEEB (2010).
178. Ibid. If not differentiating between ecosystems, tourism in the CCLME generates an approximate income of US$ 1.1million/km of coastline. Interwies and Görlitz (2013), p. 39.
179. Ibid., p. 39.
180. Interwies (2011), p. 102.
181. For Morocco, a separate "custom" value was determined based on available data on the distribution of guest nights between Atlantic and Mediterranean regions. Interwies and Görlitz (2013), p. 38-39.
182. Interwies and Görlitz (2013), p. 38 (sources: Sambe and Lymer (2011), adapted through QUEST; IMF; Princeton University; Kamili, Abel 2013. Personal Communication.)
183. Interwies (2011), p. 93.
184. Neumann et al. (2015), p. 8.
185. Interwies, (2011), p. 107-109; Interwies and Görlitz (2013), p. 41.
186. Tourism is excluded from the total coastal value for the sake of comparison. Tourism is considered a coastal ecosystem service in the GCLME study, but "opportunities for tourism" are presented as an overall "coastal and ocean" service in the CCLME study. Interwies (2011), p. 86; Interwies and Görlitz (2013), p. 39.
187. Interwies (2011), p. 109.
188. Interwies and Görlitz (2013), p. 41.
189. Interwies (2011), pp. 106-107. To arrive at US$ 10.3/ha, Interwies takes 0.7 per cent (see Section 2.5) of the total coastal ecosystem "use value" of US$ 1,470.2/ha which is the summed values/economic impact of timber products, non-timber products, carbon sequestration, coastal protection, sewage treatment, drinking water and fish nurseries (excludes tourism as per hectare value is unavailable).
190. Interwies, E. and S. Görlitz (2013), p. 39-41.
191. Ibid., p. 41.
192. Interwies (2011), p. 109; Interwies and Görlitz (2013), p. 41.
193. Ibid.
194. Interwies (2011), p. 109.
195. Interwies and Görlitz (2013), p.41.
196. Interwies (2011), p. 109; Interwies and Görlitz, p.41.
197. Interwies, (2011), p. 110. "Next 50 years" likely means from 2011 to 2061.
198. Interwies and Görlitz (2013), p. 45.
199. Sumaila (2015), pp. 246-247.
200. The World Bank databank website: World Bank National Accounts data, and OECD National Accounts data files. http://data.worldbank.org/indicator/NY.GDP.MKTP.CD?page=1&order=wbapi_data_value_2011%20wbapi_data_value%20wbapi_data_value-first&sort=asc (accessed 1 August 2016). The World Bank lists 2006 GDP figures in current dollars (Angola: $41.8 billion; South Africa: $271.6 billion; Namibia: $8.0 billion). Multiplying each country's GDP (2006 in current dollars) by 0.836, GDP figures are adjusted to 2006 dollar values (Consumer Price Index inflation converter). Each countries TEI (2006) from ocean ecosystem services (Angola: US$ 394 million; South Africa: US$ 471 million; Namibia: US$ 1.5 million) is then divided by the respective country's GDP in 2006 dollars.
201. Sumaila (2015), pp. 246-247.
202. The World Bank databank website: International Labour Organization, Key Indicators of the Labour Market database, Employment to population ratio, 15+, total (%). http://data.worldbank.org/indicator/SL.EMP.TOTL.SP.ZS/countries (accessed 1 August 2016).
203. Interwies (2011), p. 101; Interwies and Görlitz (2013), p. 41.
204. The World Bank databank website: World Bank National Accounts data, and OECD National Accounts data files. http://data.worldbank.org/indicator/NY.GDP.MKTP.CD?page=1&order=wbapi_data_value_2011%20wbapi_data_value%20wbapi_data_value-first&sort=asc (accessed 1 August 2016). The World Bank lists 2009 GDP figures in current dollars. Multiplying each of the sum of GCCLME country GDPs and CCLME country GDPs (2009 in current dollars) by 0.890, GDP figures are adjusted to 2009 dollar values (Consumer Price Index inflation converter).
205. Interwies, (2011), p. 101; Interwies and Görlitz (2013), p. 41. Note that some countries are considered within more than one LME (Angola is in the BCLME and GCLME; Guinea and Guinea-Bissau are in the GCLME and CCLME).
206. Ibid.
207. Pascual et al. (2010), p. 14. In: TEEB (2010).
208. Ibid.
209. Interwies (2011), pp. 94-95; Interwies and Görlitz (2013), p. 27-28.
210. Pascual et al. (2010), p. 16. In: TEEB (2010).
211. Interwies (2011) categorizes GCLME tourism as "provisioning services" which differs from the TEEB "cultural service" categorization, but both provisioning and cultural services are direct use values under TEEB. Interwies (2011), p. 35; Pascual et al. (2010), p. 16. In: TEEB (2010).
212. Interwies and Görlitz (2013), p. 27.
213. Pascual et al. (2010), p. 14-15. In: TEEB (2010).
214. Ibid, p. 15.
215. Ibid.
216. Chukwuone et al. (2009). pp. 192-193.
217. Talberth, J. (April 14, 2010). Measuring What Matters: GDP, Ecosystems and the Environment, World Resources Institute website, http://www.wri.org/blog/2010/04/measuring-what-matters-gdp-ecosystems-and-environment (accessed August 1, 2016).
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219. Interwies (2011), pp. 88-110; Interwies and Görlitz (2013), pp. 19-42.
220. Interwies (2011), pp. 105; Interwies and Görlitz (2013), pp. 23.
221. Interwies and Görlitz (2013), p. 45.
222. Interwies (2011), p. 83.
223. Interwies (2011). p. 110-111.
224. Interwies and Görlitz (2013), p. 45-46.
225. Ibid.
226. Interwies (2011), p. 111.
227. Interwies and Görlitz (2013), p. 46.
228. Interwies (2011), p. 114.
229. Interwies (2011), p. 115; Interwies and Görlitz (2013), p. 46.
230. Interwies and Görlitz (2013), p. 19.
231. For the GCLME and CCLME studies, it was assumed that "every hectare of a certain ecosystem equals all other hectares of the same ecosystem, neglecting social and ecologic region-specific factors that would certainly influence the values of ES." Interwies and Görlitz (2013), p. 45; Interwies (2011), p. 116.
232. Interwies (2011), p. 112; Interwies and Görlitz (2013), p. 45-46.
233. Interwies and Görlitz (2013), p. 46.
234. Ibid., p. 45.
235. Interwies (2011), pp. 110-115..
236. Interwies and Görlitz (2013), p. 46.
237. Interwies (2011), p. 77.
238. Ibid.
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(eds.). Adaptive Co-Management. Collaboration, Learning and Multi-Level Governance. UBS Press, Vancouver, pp. 308-327. In Interwies and Görlitz (2013), p. 43.

240. Interwies and Görlitz (2013), p. 43.
241. Interwies (2013) tries to provide national experts with some guidance as to how to adjust the GCLME ecosystem service per hectare values to national levels. It is clear that more comprehensive and detailed data would improve the quality of the results and allow for application of more reliable valuation methods. Interwies (2013), pp. 110-115.
242. Neumann, C. (2015). Policy Actions That Ensure Marine and Coastal Ecosystem Services Support the SDGs. In: Neumann et al. (2015) The Ocean and Us. GRID-Arendal, Arendal, Norway. p. 42..
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250. Interwies (2011), p. 56.
251. Interwies (2011), pp. 60-63.
252. Ibid., p. 65.
253. Ibid., p. 66.
254. Ibid., p. 65-67.
255. Ibid., p. 68, 53.
256. Ibid., pp. 68-69.
257. Ibid., pp. 53-54.
258. Ibid., p. 55.
259. Herr, D. T. et al. (2015). Coastal "blue" carbon. A revised guide to supporting coastal wetland programmes and projects using climate finance and other financial mechanisms. Gland, Switzerland: IUCN, p.35.
260. Ibid., p. 35.
261. Ibid.
262. Interwies (2011), p. 54.
263. Ibid., p. 70.
264. Ibid.
265. Ibid., pp. 71-73.
266. Ibid., pp. 71-72.
267. Ibid., p. 73.
268. Ibid., p. 74.
269. Ibid., p. 75.
270. The Blue Economy incorporates technologies that are mature or post-mature stage such as oil & gas, tourism, shipping and fishing. Blue Growth is the long term strategy to support sustainable growth within the Blue Economy incorporating life-cycle assessment. It encompasses technologies that have high growth and job potential and by their nature they are early stage and novel (definition taken from the EU Research project MARIBE, see: https://maribe.eu/project/
271. See: http://agenda2063.au.int/en/sites/default/files/Final%20Draft%20Agenda%202063%20Framework%20-Formatted%20TOC-1.pdf
272. Developed in 2013 (see: http://pages.au.int/maritime).
273. A large meeting has been organised in March 2015 while a Policy handbook has been produced in 2016. See: http://www.uneca.org/stories/blue-economy-africa%E2%80%99s-future
274. In that perspective, special attention will be placed on key sectors such as: Coastal Tourism, Marine Biomedicine and cosmetic Industry, Marine Chemical Industry, Marine Communications and Transportation Industry, Marine Electric Power Industry, Marine Fishery and Aquaculture, Marine Salt Industry, Ocean Mining Industry, Offshore Oil and Gas Industry, Seawater Utilization Industry, Marine Engineering, Shipbuilding and Repair Industry.
275. https://www.cia.gov/library/publications/the-world-factbook/rankorder/2241rank.html
276. Mainly Côte d'Ivoire, South Africa and Angola.
277. Average price of US$ 60 the gallon and US$2 per 1000 cubic meters.
278. Estimation made for the preparation of the Document "Inputs for the design of an EU strategic approach to the coastal and marine biodiversity in Africa" (under press) using FAO Fishstat data for 2014 and an average price of EUR 700 per tonne.
279. Damiano R., M.- E. Guélé, E. Panequin, J. Hambrey, M. O. Sidina et P. Failler (2012), Étude relative au développement de la mariculture dans la baie du Lévrier, Plan de développement de la mariculture dans la baie du Lévrier, 41 p.
280. In 2013, the government placed a moratorium on planned marine phosphate mining off the country's coastal waters until an environmental impact study had shown that mining will not destroy the fishing industry.
281. The other key deep sea mining products such as seafloor massive sulphides, polymetallic nodules and cobalt-rich crust are mainly found in the Pacific area.
282. Monnereau I. and P. Failler (2014), Unlocking the full potential of the blue economy: Are African Small Island Developing States ready to embrace the opportunities? African Climate Policy Center and Economic Commission for Africa, http://www.climdev-africa.org/sites/default/files/DocumentAttachments/Blue%20Economy_19Sept14.pdf
283. Which is with Asia (6%) one of the world fastest-growing tourist destinations.
284. According to the 2016 World Bank report on tourism in Sub-Saharan Africa.
285. Except for Kenya for political and terrorism reasons including the conflict with Somalia and despite the fact that a 5-year large project set-up by UNEP/GEF/UNWTO/UNIDO named COAST (2009-2013) has been devoted to the improvement of the sustainability of costal tourism in 9 African countries (see: http://coast.iwlearn.org/en/about).
286. Following the Millennium Ecosystem Assessment nomenclature, see: http://www.millenniumassessment.org/en/index.html
287. Covering Senegal, Cabo Verde, Guinea Bissau and Guinea.
288. No oil and gas exploitation in these countries yet.
289. Based on the estimated value added of the fishery sector (around 40% of the EUR 4 billion revenues) and the one of the mangrove wood cut (around 10% of the one of the fishery). Calculation: 40% x 4.4 x 2.7 = 4.8
290. All reports can be viewed at: http://www.fao.org/publications/search/fr/?sel=ZmRyX2Nfc2VyaWVzOiJodHRwOi8vYWltcy5mYW8ub3JnL2Fvcy9zZXJpZXMvY182MCI%3D
291. See list: ftp://ftp.fao.org/FI/DOCUMENT/cecaf/Cecaf_SSC7/inf4e.pdf
292. Full report available at: http://www.fao.org/publications/card/en/c/bad88156-011e-4cb4-aed5-c6e00f6def46/
293. See full report: https://www.iccat.int/Documents/SCRS/ExecSum/YFT_ENG.pdf
294. See full report: https://www.iccat.int/Documents/SCRS/ExecSum/BET_ENG.pdf
295. See Appendix for updated values; also additional information available at https://www.iccat.int/Documents/SCRS/ExecSum/SKJ_ENG.pdf

Appendices

A. Annual Economic Value of Ocean Ecosystem Services to the BCLME Countries

B. Annual Economic Value of Sustainable Fish Landings to the GCLME countries (2003)

C. Annual Economic Value of Sustainable Fish Landings to the CCLME countries (2007–2011)

D. Annual Economic Value of Ocean Ecosystem Services to the BCLME, GCLME and CCLME Countries

E. Tourism Sector Income in the GCLME Countries (2009)

F. Tourism Sector Income in the CCLME Countries (various years)

G. Annual Economic Value of Coastal Ecosystem Services to the GCLME and CCLME Countries

H. Economic Instruments for Sustainable Fisheries, Pollution Prevention and Control, and Financing Biodiversity Conservation: Resources Cited in Interwies (2011).

Appendix A

Annual Economic Value of Ocean Ecosystem Services to the BCLME Countries

	Angola	Namibia	South Africa	Total
Subsistence and commercial fisheries sector for 2006				
Catch (thousand tons)	160	418	388	**966**
Direct Output Impact (million US$)	105	303	109	**517**
Total Economic Impact (million US$)	372	1,462	341	**2,175**
Wage Impact (million US$)	76	265	72	**414**
No. of jobs generated	31,000	14,000	30,000	**75,000**
Mariculture sector (year not given)				
Harvest (tons)	550	570	3,806	**4,926**
Direct Output Impact (million US$)	1.7	1.7	11.4	**14.8**
Total Economic Impact (million US$)	5.8	8.3	35.8	**49.9**
Wage Impact (million US$)	1.2	1.5	7.6	**10.3**
No. of jobs generated	1,161	1,640	7,108	**9,909**
Recreational fisheries sector for 2003				
Participants (thousands of people)	30	20	398	**448**
Direct Output Impact (million US$)	8.9	8.6	52.9	**70.4**
Total Economic Impact (million US$)	15.9	15.3	94.2	**125.4**
Wage Impact (million US$)	6.5	7.5	35.1	**49.1**
No. of jobs generated	316	281	667	**1,264**

Source: Sumaila (2015).

Appendix B

Annual Economic Value of Sustainable Fish Landings to the GCLME countries (2003)

Country	Landings in metric tons	Landed Value (L.V.) L*$12,100 (US$ millions)	Sustainable Landings: 80% Landings metric tons	Sustainable L.V. S.L.*$12,100 (US$ millions)	Total Sust. L.V.: Sust. L.V. –10% for fish nurseries (US$ millions)
Angola	213,799	2,586.9	171,039	2069.6	1862.6
Benin	11,997	145.12	9,597	116.1	104.5
Cameroon	56,339	681.7	45,071	545.4	490.8
Republic of the Congo	22,044.2	266.7	17,635	213.4	192.0
Côte d'Ivoire	56,400	682.4	45,120	546.0	491.4
Democratic Republic of the Congo	4,569	55.3	3,655	44.2	39.8
Equatorial Guinea	2,500	30.3	2,000	24.2	21.8
Gabon	32,135.8	388.8	25,708	311.1	280.0
Ghana	347,048.2	4,199.3	277,638	3359.4	3023.5
Guinea	94,465.6	1,143	75,572	914.4	823.0
Guinea-Bissau	3,867	70.8	3,093	37.4	33.7
Liberia	7,806.6	94.5	6,244	75.6	68.0
Nigeria	27,0476.6	3,272.8	216,380	2618.2	2356.4
Sao Tome and Principe	3,403	41.2	2,722	32.9	29.6
Sierra Leone	48,200	583.2	38,560	466.6	419.9
Togo	17,843.2	215.90	14,274	172.7	155.4
Total	**1,221,934.4**	**14,458**	**954,308**	**11547.1**	**10392.4**
IUU # (30% total)*	**366,580**	**4,337.4**	**293,264**	**3548.5**	**3193.6**
Total+IUU	**1,588,514.4**	**18,795.4**	**1,247,572**	**15095.6**	**13586.1**
GCLME area: 252,797,700 ha		**74.3 US$/ha**		**59.7 US$/ha**	**53.7 US$/ha**

* Interwies (2011) uses 30% as the IUU percentage; Chukwuone et al. (2009) uses 23%.
Sources: Interwies (2011), p. 99 and Chukwuone et al. (2009),, p. 194.

Appendix C

Annual Economic Value of Sustainable Fish Landings to the CCLME countries (2007–2011)

Country	GDP (nominal, US$ millions)	Annual percentage share of fisheries in GDP (average 2007–2011)	Annual value of total fish landings (DOI) (US$ millions)
Cape Verde	1,899	1.25	23.7
Morocco	9,753	2.5	2,438.3
Mauritania	4,199	6	252
Senegal	13,864	1.9	263.4
The Gambia	918	2.2	20.2
Guinea	5,632	3.6	202.8
Guinea-Bissau	870	3.7	32.2
Total			**3,232.6**
Total including IUU (+25%)			**4,040.8**
Per hectare value **Area of CCLME marine ecosystem 1,123,887 km2**			**$35.9/a**
Total MSY (-20%)			**3232.6**
Sustainable per hectare value **Area of CCLME marine ecosystem 112,388,700 ha**			**$28.8/ha/a**
Total (-10% fish nurseries value)			**2,909.3**
Sustainable (excl. fish nurseries) per hectare value **Area of CCLME marine ecosystem 112,388,700 ha**			**$25.9/ha/a**

Source: Interwies and Görlitz (2013), p. 32.

Appendix D

Annual Economic Value of Ocean Ecosystem Services to the BCLME, GCLME and CCLME Countries

LME	BCLME (2006)	GCLME(2003)	CCLME (2007–2011)	Total
Total Catch (metric tons)	966,000	1,588,514.72*	NA	NA
Direct Output Impact (US$)	$517,000,000	$18,795,400,000*	$4,040,800,000*	$23,353,200,000
Per hectare DOI (US$)	NA	$74.3/ha	$35.9/ha	NA
DOI of Mariculture (US$)	$14,800,000	NA	NA	NA
DOI of Recreational Fisheries (US$)	$70,400,000	NA	NA	NA
Sustainable (MSY) DOI (US$)	NA	$15,095,621,200*	$3,232,600,000*	NA
Sustainable (MSY) DOI (US$) per hectare	NA	$59.7/ha	$28.8/ha	NA
MSY DOI (-10% fish nurseries) (US$)	NA	$13,586,059,080*	$2,909,300,000*	NA
MSY DOI (-10% fish nurseries) (US$) per hectare	NA	$53.7/ha	$25.9/ha	NA
Total Economic Impact of fisheries** (US$)	$2,175,000,000	NA	NA	NA
No. of jobs generated	75,000	NA	NA	NA
No. of jobs generated at MSY fishery levels	NA	NA	NA	NA
Total Wage Impact of fisheries** (US$)	$414,000,000	NA	NA	NA
Biodiversity and Cultural Services	NA	$101,119,080 $101,119,080	$2,584,940,100	NA
Biodiversity and Cultural Services per hectare	NA	$0.40/ha $0.40/ha	$23/ha	NA

* Includes IUU quantities
** Doesn't include mariculture or recreational fisheries
Sources: Sumaila (2015), Interwies (2011), Interwies and Görlitz (2013), Chukwuone et al. (2009).

Appendix E

Tourism Sector Income in the GCLME Countries (2009)

Country	GDP 2009 (US$ billion per year) (various years)	Tourism contribution to GDP (%)	Total tourism income (US$ million/a)	Total coastal tourism income (US$ million/a) 70% of total tourism income	Length of coast (km)	Value of tourism per coastal km (US$ per year)
Angola	19.7	0.3	59	41.3	1,600	25,812
Benin	3.4	2	68	47.6	121	393,388
Cameroon	8.7	0.4	34	23.8	402	59,203
Republic of the Congo	3.5	0.5	17	11.9	169	70,414
Côte d'Ivoire	15.4	0.5	77	53.9	169	318,935
Democratic Republic of the Congo	6.5	0.01	0.65	0.45	37	12,162
Equatorial Guinea	1.3	0.38	5	3.5	296	11,824
Gabon	5.6	0.26	14	0	NA	NA
Ghana	8.8	5.3	466	326.2	700	466,000
Guinea	4	0.75	30	21	320	65,625
Guinea-Bissau	0.236	0.85	2	1.4	350	4,000
Liberia	–	0	0	0	(560)	–
Nigeria	72.2	0.2	144	100.8	853	118,171
Sao Tome and Principe	0.046	22	10	7	209	33,492
Sierra Leone	4.9	1.7	83	58.1	402	144,527
Togo	1.7	2	34	23.8	56	425,000
Total	**155.982**			**720.8**	**5,124**	**140,671**

Source: Interwies (2011).

Appendix F

Tourism Sector Income in the CCLME Countries (various years)

Country	GDP (nominal, US$ million)	Tourism contribution to GDP (%)	Total tourism income (US$ million/a)	Length of coast (km)	Value of tourism per coastal km (US$ million per year)
Cape Verde	1.899	15.3	290.5	239	1,200,000
The Gambia	918	8.2	75.3	80	940,000
Guinea	5.632	2	112.6	320	400,000
Guinea-Bissau	870	NA	NA	125	NA
Mauritania	4.199	5	210	754	300,000
Morocco	97.53	8.7	3,302	2,410	1,400,000
Senegal	13.864	5	693.2	531	1,300,000
Total			**4,684**	**4,220**	**1,100,000**

Source: Interwies and Görlitz (2013) (citing as sources: Sambe and Lymer (2011), adapted through QUEST; IMF; Princeton University; Kamili (2013).

Appendix G

Annual Economic Value of Coastal Ecosystem Services to the GCLME and CCLME Countries

Ecosystem Service	GCLME (US$/ha/a)	GCLME (US$ millions per year)	CCLME (US$/ha/a)	CCLME (US$ millions per year)	Total (US$ millions per year)
Provisioning Services					
Timber Products	$10.1	$18,455,124	$12 (2012)	$7,909,200	$26,364,324
Non-Timber Products	$54	$98,670,960	$67.5 (2012)	$44,489,250	$143,160,210
Regulating Services*					
Sewage Treatment	$23.5	$42,940,140	$30.8	$20,300,280	$63,240,420
Drinking Water	$5.2	$9,501,648	NA	NA	$9,501,648
Coastal Protection	$465.9	851,311,116	$1,340.6	$883,589,460	1,734,900,576
Carbon Sequestration	$83.5	$152,574,540	$335.5	$221,128,050	$373,702,590
Habitat (Supporting) Services					
Fish nursery	$828 for mangroves	$1,512,954,720	$425.6 for mangroves	$280,516,084	$1,836,254,720
			$425.6 for seagrass	$42,783,916	
Cultural Services					
Tourism	NA	$720,800,000	NA	NA	$720,800,000
Opportunities for Tourism and Recreation	NA	NA	$1,100,000/coastal km	$4,684,000,000	$4,684,000,000
Bequest and Existence and Cultural Services					
Biodiversity and Cultural Services	$10.3 Biodiversity	$18,820,572	$23 for mangroves	$15,159,300	$55,112,519
	$10.3 Cultural Services	$18,820,572	$23 for seagrass	$2,312,075	
			$23 for beaches	NA	
Total Without Including Tourism		**$2,724,049,392**		**$1,518,187,615**	**$4,242,237,007**
Total Including Tourism		**$3,444,849,392**			

* As the health status of the ecosystem haven't been considered and as the economic differentiation of countries in GCLME and CCLME is minor, figures per ha should be the same.
Sources: Interwies (2011), Interwies and Görlitz (2013).

Appendix H

Economic Instruments for Sustainable Fisheries, Pollution Prevention and Control, and Financing Biodiversity Conservation: Resources Cited in Interwies (2011).

Economic Instruments	Relevant Material
Transferable Rights of Fishing Quotas Similar to cap-and-trade, individual fishing quotas are distributed to eligible fishermen who are allocated a specific portion of the total allowable catch. Interwies (2011), p. 60.	The PEW Environment Group (2009). *The Pew Environment Group's European Marine Programme contribution to the consultation on the reform of the Common Fisheries Policy, December 2009: Annex III Design Matters - Making Catch Shares Work*, http://www.pewtrusts.org/~/media/legacy/uploadedfiles/peg/publications/report/catchsharepdf.pdf Kerr, S., S. James, R. Newell. (2002). *Fishing Quota Markets, Discussion Papers dp-02-20*, Resources For the Future, http://www.rff.org/documents/RFF-DP-02-20.pdf
Elimination of Environmentally Harmful Subsidies Harmful subsidies include: • Subsidies encouraging over-investment in fishing capacity • Buy-back programmes of older boats for modernized boats with increased fishing capacity • Contradictory regulations allowing people to ignore fishing laws • Laws with unintended effects such as the prohibition of selling by-catch leading to increased discards Interwies (2011), p. 60.	Commission of the European Communities (2009). *Green Paper – Reform of the Common Fisheries Policy*, COM(2009)163 final, Brussels, http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0163:FIN:EN:PDF.
Eco-labelling Encourages sustainable fishing practices by allowing producers to differentiate their products. Interwies (2011), p. 61.	Marine Stewardship Council (MSC), http://www.msc.org FAO (2009). *FAO Appendix 1: Guidelines for the Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries, Revision 1*, Rome. http://www.fao.org/docrep/013/i1948e/i1948e08.pdf
Increased Capacity for Small-scale Fisheries Contributes to poverty alleviation and the well-being of coastal communities. Interwies (2011), p. 61.	FAO (2005b): *Increasing the contribution of small-scale fisheries to poverty alleviation and food security, technical guidelines for responsible fisheries*, ftp://ftp.fao.org/docrep/fao/008/a0237e/a0237e00.pdf
Prevention of Illegal, Unregulated and Unreported (IUU) Fisheries Global and national instruments must address IUU fisheries. The OECD definition for IUU fishing is "fishing activities that are inconsistent with or in contravention of the management or conservation measures in force for a particular fishery." Interwies (2011), p. 62 (citing OECD (2004)).	OECD (2004). *Fish Piracy: Combating Illegal, Unreported and Unregulated Fishing*. OECD, OECD Publishing, http://www.oecd.org/tad/fisheries/fishpiracycombatingillegalunreportedandunregulatedfishing.htm EFTEC (2008): *Costs of Illegal, Unreported and Unregulated (IUU) Fishing in EU Fisheries*, http://www.pewtrusts.org/en/research-and-analysis/reports/2008/11/04/costs-of-illegal-unreported-and-unregulated-iuu-fishing-in-eu-fisheries EJF (2007). *Pirate Fish on Your Plate – Tracking illegally-caught fish from West Africa into the European market*. Environmental Justice Foundation, London, UK. http://ejfoundation.org/sites/default/files/public/pirate_fish_on_your_plate_ejf.pdf EJF (2009). *Lowering the Flag – Ending the use of Flags of Convenience by Pirate Fishing Vessels*. Environmental Justice Foundation, London, UK. http://ejfoundation.org/sites/default/files/public/Lowering%20the%20flag.pdf EJF (2009). *Dirty Fish – How EU Hygiene Standards facilitate illegal fishing in West Africa*. Environmental Justice Foundation, London, UK. http://ejfoundation.org/sites/default/files/public/report-dirty%20fish.pdf

Appendix H *(continued)*

Economic Instruments	Relevant Material
Improving the Water and Sanitation Sector Economic instruments may include: • Development aid conditioned on effective management • Taxes for water abstraction • Water pricing • Sewerage and effluent charges • Water pollution charges • Subsidies • Tradeable permits • Liability for damage to waters Interwies (2011), pp. 65-68.	Winpenny J (2003). *Financing Water for All: Report of the World Panel on Financing Water Infrastructure*. Geneva: World Water Council/Global Water Partnership/3rd World Water Forum, http://www.worldwatercouncil.org/fileadmin/world_water_council/documents_old/Library/Publications_and_reports/CamdessusReport.pdf OECD (2009a). *Managing Water for All – An OECD Perspective on Pricing and Financing*. OECD Publishing, http://www.oecd.org/tad/sustainable-agriculture/44476961.pdf OECD (2009b). *Working Party on Global and Structural Policies – Pricing Water Resources and Water and Sanitation Services*. OECD Publishing, http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/EPOC/GSP(2009)17/FINAL&docLanguage=En OECD (2010). *Innovative Financing Mechanisms for the Water Sector*. OECD Publishing, http://www.oecd-ilibrary.org/environment/innovative-financing-mechanisms-for-the-water-sector_9789264083660-en Sunman, Hilary (1993). *The application of charging schemes for the management of water pollution – Experience and prospects*. Natural Resources Forum, 17:2, pp. 133-141. http://onlinelibrary.wiley.com/doi/10.1111/j.1477-8947.1993.tb00168.x/abstract Zabel, T. F., K. Andrews, and Y. Rees. (1998). *The Use of Economic Instruments for Water Management in Selected EU Member Countries*. Water and Environment Journal, 12:4, pp. 268-272. http://onlinelibrary.wiley.com/doi/10.1111/j.1747-6593.1998.tb00184.x/abstract OECD (2006a): *Subsidy Reform and Sustainable Development – Economic, Environmental and Social Aspects*. OECD Publishing, https://www.cbd.int/financial/fiscalenviron/several-subsidiesreform-oecd.pdf Stavins, R.N. (2001). *Experience with Market-Based Environmental Policy Instruments, Resources for the Future*, Washington. http://www.rff.org/documents/RFF-DP-01-58.pdf EEA (2005). *Market-based instruments for environmental policy in Europe*. EEA technical report, Copenhagen, http://www.ieep.eu/assets/280/MarketbasedInstr_reduced.pdf
Pollution by Ships and Vessels Resolution takes place at the international level. Interwies (2011), p. 68-69.	*International Convention for the Prevention of Pollution from Ships (MARPOL)*, International Maritime Organization website (accessed August 1, 2016). http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx Krause, K. (2007). *Market-oriented environmental policy in maritime transport – incentives to reduce atmospheric emissions from burning marine fuels*, Thesis, http://agris.fao.org/agris-search/search.do?recordID=AV20120115951 International Petroleum Industry Environmental Conservation Association (IPIECA) (2007). *Maritime air emissions and MARPOL Annex VI: Strategies and consequences*, http://www.world-petroleum.org/docs/docs/socialres/marpol.pdf

Appendix H *(continued)*

Economic Instruments	Relevant Material
Financing Biodiversity Conservation with Government and Donor Funds and Market-Based Fees - Attracting government, ODA and private charity, - Debt-for-nature swaps -Benefit sharing and revenue sharing -Biodiversity enterprise funds (BEFs) -Tourist charges -Resource extraction fees -Bioprospecting charges -Habitat banking Interwies (2011), pp. 69-76.	Gutman, P. and S. Davidson (2008). *A review of innovative international financial mechanisms for biodiversity conservation, with a special focus on the international financing of developing countries' protected areas*, WWF-MPO. http://assets.panda.org/downloads/final_z.pdf Emerton, L., Bishop, J. and Thomas, L. (2006). *Sustainable Financing of Protected Areas: A global review of challenges and options.* IUCN, https://cmsdata.iucn.org/downloads/emerton_et_al_2006.pdf The OECD Environment Programme (2003). *Harnessing Markets for Biodiversity: Towards Conservation and Sustainable Use.* OECD Publishing, http://chm.moew.government.bg/nnps/upload/Common/Baurle_literature_NOF/Local Publish/OECD_Harnessing_Markets_for_Biodiversity.pdf UNDP/GEF and the Zambian Ministry of Tourism, Environment and Natural Resources, (2004). *A financial and economic analysis of the costs and benefits of managing the Protected Area.* Development Services and Initiatives. http://fsg.afre.msu.edu/zambia/resources/Economic Analysis of Protected Areas1 zambia report.pdf Ali, P. A. U. and K. Yano (2004). *Eco-finance: The legal design and regulation of market-based environmental instruments.* The Hague: Kluwer Law International. http://www.worldcat.org/title/eco-finance-the-legal-design-and-regulation-of-market-based-environmental-instruments/oclc/56413492 R. Gillepsie and D. Hill (2007) Habitat Banking – a new look at nature and development mitigation. Town & Country Planning 76:4, pp. 121-125. http://www.environmentbank.com/docs/TCPA_HBplusCov.pdf Spang, W. D.; Reister, S. (2005): Ökokonten und Kompensationsflächenpools in der Bauleitplanung und der Fachplanung, Berlin. Böhme, C. ; Bruns, El. et al. (2005): Flächen und Maßnahmenpools in Deutschland, Bonn.
Payment for Ecosystem Services PES schemes are mutually beneficial contracts between suppliers and consumers of ecosystem services. Interwies (2011), p. 53-54; 75	Wunder, S. (2005). *Payments for environmental services: Some nuts and bolts.* Center for International Forestry Research, http://www.cifor.cgiar.org/publications/pdf_files/OccPapers/OP-42.pdf Smith, M., de Groot, D., Perrot-Maître, D. and Bergkamp, G. (2006). *Establishing payments for watershed services*. IUCN, Switzerland, https://portals.iucn.org/library/efiles/edocs/2006-054.pdf Hope, R. A. et al (2007). *Negotiating watershed services.* International Institute for Environment and Development, http://pubs.iied.org/pdfs/15508IIED.pdf Duraiappah, A. K. (2006). *Markets for Ecosystem Services – A Potential Tool for Multilateral Environmental Agreements*. International Institute for Sustainable Development, https://www.cbd.int/doc/external/iisd/iisd-economics-ecosystem-ens.pdf The GEF (2008). *Financing the Stewardship of Global Biodiversity, Global Environmental Facility.* http://www.thegef.org/gef/sites/thegef.org/files/publication/financing-stewardship-global-biodiversity.pdf WWF (2003). *From Goodwill to Payments for Environmental Services: A Survey of Financing Options for Sustainable Natural Resource Management in Developing Countries*, Edited by Pablo Gutman. Macroeconomics for Sustainable Development Programme Office, http://assets.panda.org/downloads/fin_alt.pdf Shilling J.D. and J. Osha (2003). *Paying for Environmental Stewardship – Using Markets and Common-Pool Property to Reduce Rural Poverty while Enhancing Conservation*, Technical paper, Economic Change, Poverty, and the Environment. Washington, DC: Macroeconomics for Sustainable Development Program Office, World Wildlife Fund. http://www.panda.org/downloads/policy/shilling.pdf

Source: Interwies (2011).

People living along the west, central and southern African coast are directly dependent on the health of Large Marine Ecosystems (LMEs) for sustenance, economic development and their way of life. The west, central and southern African coastal populations' well-being, economies and cultures are interlinked with their ability to properly govern and manage their own activity within these ocean and coastal ecosystems. Over the last 30 years, amid serious conflicts and extensive poverty, these coastal communities, nations and regions have been unable to effectively counteract rapid development, extensive pollution growth, habitat loss and unsustainable use of resources. They have missed opportunities to effectively manage the highly productive ocean and coastal ecosystems and to unlock the economic potential that accompanies sustainable development.

In order to shift the ever-changing relationship between humans and their environment to a sustainable status quo, governing bodies and stakeholders must understand the value that the west, central and southern African LMEs provide. In addition to establishing a baseline of ecological data regarding the coverage, ecological outputs and functions of LMEs and responding to changes thereto, policymakers must also be aware of the people dependent on and acting within these coastal and ocean ecosystems, and the value placed on their associated benefits.

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