ASCLME Regional Cost-Benefit Economic Valuation

Economic valuation of Agulhas and Somali Current Large Marine Ecosystem

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1.0. Introduction

The Agulhas and Somali Current Large Marine Ecosystems (ASCLME) is one of the 66 identified Large Marine Ecosystems of the world. The countries of the ASCLME region benefit from the goods and services supported by the ASCLME. Coastal and marine ecosystem goods and services play a crucial role in supporting the livelihoods of the people and national economies that use this ecosystem. Yet, the Millennium Ecosystem Assessment (2005) reports that these ecosystems are deteriorating worldwide, and with them the capacity to support human well-being. This deterioration in turn is estimated, by the World Bank (2009), to have resulted in economic losses of about US$50 billion anually, a result which is reinforced by data from the FAO (2011). In this regard, the GEF IW is supporting the countries of the region in implementing an ecosystem-based management approach so as to optimize and sustain the benefits for meeting Millennium Development Goals (MDGs) and the targets reached during the World Summit on Sustainable Development (WSSD).

A phased approach is used in the implementation of the ASCLME project, which progressively builds the knowledge base and strengthens technical, managerial and decision-making capabilities at the national and regional scales so as to address environmental concerns and transboundary developments in all relevant sectors. The project aims to build political will to undertake threat abatement activities while leveraging finances proportionate to management and governance needs.

The activities within the ASCLME Project, for the first phase, are focused on the collection of coastal and offshore data and information and capacity building. The overall objective of this data capture is to deliver, in the first instance, national Marine Ecosystem Diagnostic Analyses (MEDAs) that feed into national policy and governance, regional Transboundary Diagnostic Analyses (TDAs), and a comprehensive Regional Strategic Action Programme (SAP). To help support decision making in the sustainable use and management of the resources of the ASCLME region, it is very important that the economic value of all ecosystem goods and services is recognized, and their contribution to sustainable economic welfare estimated.

In this regard, the ASCLME Steering Committee commissioned the current report to undertake a cost benefit assessment (or economic valuation) of marine and coastal resources in the ASCLME. Through this analysis, policy and decision makers would be appraised and engaged in the decision with regards to the outcomes of the MEDAs and the SAP, and that this will result in their support for the leveraging of finances considered critical for the sustenance of the resources.

This report seeks to promote sustainable development in the coastal areas of the ASCLME by providing stakeholders with a powerful economic analysis for decision-making based on the economic value of the ASCLME. The overall objective of this contribution is to promote sustainable use by identifying the contribution of coastal and marine ecosystem goods and services to the economy of the countries of the ASCLME.

To achieve this, we (i) collect, compile and measure the economic value of ASCLME's key ecosystem goods and services (fishing, fish farming, tourism, etc.); (ii) measure the incomes and other benefits generated by these goods and services and their distribution among ASCLME countries; and (iii) undertake an economic risk assessment on marine and coastal resources of the region. These are then used to carry out economic analyses of major policy issues related to the coastal and marine ecosystem management of the ASCLME.

Specifically, we carry out a cost benefit assessment on the resources of the Western Indian Ocean Region by: (i) providing a broad overview of the total economic value of the ASCLME and the resources it supports, and their contribution to the economy; (ii) analysing the distribution of economic benefits among different regions/countries of the ASCLME; (iii) assessing the contribution of the marine and coastal resources towards poverty alleviation in the countries of the region; (iv) using the economic results, provide local resource managers with indicators and policy analyses about the economic impact of different options for the sustainable use of the ASCLME and the economic trade-offs among different uses of the marine ecosystem (e.g., tourism-fish farming, fishing tourism); (v) developing appropriate indicators to track any changes or anomalies within the cost benefits and values of ecosystem services in order to better advice any need for alterations in management practices and/or policy. A final and important component of this work is the goal of increasing capacity for government and other stakeholders in the ASCLME region to use environmental economics effectively in their decision-making.

We focus on valuation of the major ecosystem goods and services: fishing, fish farming, and tourism, and thus estimate 1) value of ecosystem goods and services; and 2) net benefits generated by these goods and services both regionally and nationally. Data about the number of fishers, boats and gear of different types for each ASCLME country is compiled and analysed from the Coastal Livelihoods Assessment reports and counterpart cost benefit reports (Turpie and Wilson, 2011; Tovondriaka, 2011, Razack, 2011). Supplementary data are collected to fill in the gaps. Such data include the catch/volume of production of fishing, fish farming and tourism; data on prices, costs, wages to fishers, etc. The benefits to be analysed here include total revenues, profits and wages that are made from each of these activities.

The integration of policy analysis with economic valuation is an essential part of this work as it would ensure that the project has an impact on stakeholders responsible for, and affected by, coastal and marine management, from government officials to the general public. I identify policy priorities where economic valuation can make the greatest contribution and develop indicators and analyses to support these priorities. For example, quantify the economic trade-offs among different uses of the marine ecosystem (e.g., tourism-fish farming-fishing), or the impact of promoting different segments of the tourism market. This assessment should be able to directly inform and contribute to the finalization of MEDA (at country level), TDA and SAP.

2.0. Theoretical framework for economic valuation

The economic theory of valuation of natural and environmental resources calls for a comprehensive compilation of all values into a total economic value (Krutilla, 1967; Goulder and Kennedy, 1997; Berman and Sumaila, 2006. The theory stipulates that the total economic value (TEV) should include use and non-use values, which include (i) direct use value; (ii) indirect use value; (iii) option value; (iv) existence value (Krutilla, 1987); and bequest value.

Direct use values may be generated through the consumptive or non-consumptive use of marine resources. Some ecosystem goods and services are directly used for consumptive purposes, in which case the quantity of the good to other users is reduced. On the other hand, other goods and services are non-consumptive (e.g., whale watching), implying that their use does not result in a reduction in the quantity of the goods or services available. These are known as non-rival, non-excludable goods and services.

Many ecosystem services are used as intermediate inputs to the production of goods and services to humans, and therefore are said to have indirect use value. Examples of such services are water cycling, waste assimilation and other services leading to clean air, water and thus reduced health risks.

Even though people may not currently be deriving any utility from an ecosystem, it may still hold what is termed option value. That is, the potential that the ecosystem will provide currently unknown valuable goods and services in the future. This value can be captured as the premium that people are willing to pay in order to ensure the supply of something, the availability of which would otherwise be uncertain or even non-existent. Many species of sea-life have yet to be identified, let alone evaluated economically. Even well known species can possess characteristics that have future use or non-use values.

Another classification of benefits from marine and coastal resources is provided by the Millenium Ecosystem Assessement (MEA), which classifies these benefits into the following categories:

- Provisioning services are goods obtained from marine ecosystems (e.g., fish catch);
- Regulating services are benefits obtained from regulation of ecosystem processes (e.g., water cycling);
- Cultural services are non-material benefits obtained from ecosystems (e.g., spiritual values);
- Supporting services are necessary for the production of other ecosystem services. These services impact the wellbeing of people indirectly by maintaining processes necessary for provisioning, regulatory and cultural services.

In this regional study, we focus on determining direct use values or provisioning services from the ASCLME. For non-use values, the reader is referred to national valuation studies (Turpie and Wilson, 2011; Tovondriaka, 2011, Razack, 2011).

3.0. Coastal and marine resources of the ASCLME and the countries that exploit them

Up to seven different resource types [including fisheries, coastal tourism, coastal agriculture and forestry, mariculture/aquaculture, coastal mining and energy, ports and coastal transport] from the ASCLME have been identified by (Andrew et al., 2011). A summary of the findings of this report is given in an Appendix. Data from the *Sea Around Us* database reveal that nine ASCLME countries [i.e., Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa, Somalia, Tanzania] accessed the resources and services of the ecosystem. In addtion over 10 non-regional countries also access the resources of the ecosystem.

4.0. Quantification of use direct values

To be able to produce a reasonable report in the face of data limitations, we calculate the contribution to GDP from the coastal and marine resources of the ASCLME, and carry out more in depth analysis of the values from the fisheries of the ASCLME, for which data is more readily available.

4.1. Contribution to GDP of major coastal and marine resources of the ASCLME

The method

The GDP or gross domestic product of a country refers to the market value of all final goods and services produced within the country in a given period. GDP is usually determined in three ways, that is, the output, the income, and the expenditure approaches. The easiest of the three approaches is the output approach, which sums the outputs of every class of enterprise to arrive at the total. The expenditure approach works on the principle that all of the product must be bought by somebody, therefore the value of the total product must be equal to people's total expenditures in buying things. The income approach works on the principle that the incomes of the productive factors must be equal to the value of their product, and thus the GDP can be determined by finding the sum of all producers' incomes.

For the period between 2008-2010, the GDP per year for Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa and Tanzania are estimated at US$0.55, US$35.80, US$8.50, US$10.30, US$11.70, US$0.97, US$5.70, US$383.10 and US$23.30 billion, respectively.

The data

To arrive at an estimate of the contribution of the goods and services derived from the ASCLME, we relied on a number of sources including the CLA (Andrew et al, 2010), the national reports of Turpie and Wilson (2011); Tovondriaka (2011), the *Sea Around Us* and Fisheries Economics Research Unit databases. The national valuation reports provide estimates of GDP contributions in US$ while the CLA provides contributions in terms of percentage of GDP. We use these percentatges together with published GDP numbers to calculate contributions to GDP in US$. The *Sea Around Us* and Fisheries Economics Research Unit have reported catch data (Watson, 2004), ex vessel prices (Sumaila et al., 2007) and input output multipliers for fisheries worldwide (Dyck and Sumaila, 2010). We use these data to calculate the contribution to GDP for ASCLME countries. We report in Table 1, the main types and sources of data we used to estimate the contribution to GDP of the coastal and marine resources of the ASCLME.

Table 1. Data contribution to GDP

Country/ Entity	Fisheries (US$ million)	Coastal tourism (# of visitors '000)	Coastal tourism (% of GDP)	Coastal tourism (US$ mil.)	Coastal Agr & Forestry (US$)	Mari/aqua culture Catch (t)	Mari/aquac ulture (US$)	Coastal mining & energy (% of GDP)	Port/coastal transport (1000 tonnage/# of ports)
ASCLME countries									
Comoros	**45.2**	*24*	2-4.1		**0.86**	0		**1.02**	4 ports
Kenya	***4.6***	*4,091*	11.6					0.50	*10,224*
Madagascar	**586.6**	225	3.7	**308.2**	**20.5**	*7007*		1.00	6 ports
Mauritius	**208.1**	*759*		**1,190.0**	**11.0**	750			*5,284*
Mozamb.	**356.0**			**145**		*542*	**6.7**	1.60	10 ports
Seychelles	**313.7**	*134*	25.6		**5.33**	*1,084*			1 port
Somalia	***36.9***	*0*	0.0	*0.0*		*0*			4 ports
South Africa	**769.3**	*6,551*	8.5	**1,734**	**264**	*5,474*	**9.6**	9.50	*153,576*
Tanzania	***31.0***	*560*	17.2	0		*7,000*		4.00	5 ports

Notes:
Data in italics are from Hoagland and Jin (2006).
Data in bold italics are own calculations (Sea Around Us and Fisheriees Economics Research Unit databasis).
Data in bold is from national reports.
Data in normal font are from the CLA.
Blank either means we could not find data or the activitiy is insignificant.

As can be seen in the table, we have reasonable amounts of information that would allow us to provide estimates of GDP contribution for all ASCLME countries for fisheries, coastal tourism and coastal agriculture and forestry, etc.

The results

Our estimates of the contribution of coastal and marine resources to the economies of the ASCLME are presented in Table 4.

Table 4: Contribution to GDP (mill US$)

Country/entity	Fisheries	Coastal tourism	Coastal Agr & Forestry	Mariculture/ aquaculture	Coastal mining & energy	Port/coastal transport
ASCLME countries						
Comoros	**45.2**	16.7	**0.86**	*7.6*		24
Kenya	***4.6***	*4,153*		*0.8*	179	100
Madagascar	**586.6**	**308.2**	**20.5**	**6.7**	85	36
Mauritius	**208.1**	**1,190.0**	**11**	*0.3*		52
Mozambique	**356.0**	**145**	***526.5***		**82.5**	**60**
Seychelles	**313.7**	247.0	**5.33**	**9.6**		6
Somalia	***36.9***	*0*	***729.6***	*4.3*		24
South Africa	**769.3**	**1,734**	**264**	*7.6*	**1,450**	**1,500**
Tanzania	***31.0***	4,008	***2097***	*0.8*	932	30
Regional total	2,351	11,801	3,655	29	2,730	1,832

Notes:
Data in italics are from Hoagland and Jin (2006).

Data in bold italics are own calculations (Sea Around Us Project and Fisheries Economics Research Unit).
Data in bold are from national reports.
Data in normal font are from the CLA.

For the data we have, we calculate that the total contribution to GDP from the coastal and marine resources of the ASCLME is almost US$22.4 billion a year. This is a significant amount, especially, when one takes into account that coastal communities that depend on these resources are generally poorer that the more urban population. Coastal tourism contributed the largest to GDP at over US$11 billion a year, followed by coastal agriculture and forestry.

4.2. A detail valuation of ASCLME fisheries

The ASCLME is part of the Western Indian Ocean (WIO) and therefore their fisheries should be discussed in the context of the WIO as a whole. Figures 1 provides a summary of the landings and landed values of fish caught in the WIO, split according to the various large marine ecosystems [the Red Sea, Somali Coast, Agulhas Current, Arabia Sea and the High Seas] within the WIO.

Figure 1: Marine fish landings from the Western Indian Ocean by marine ecosystem

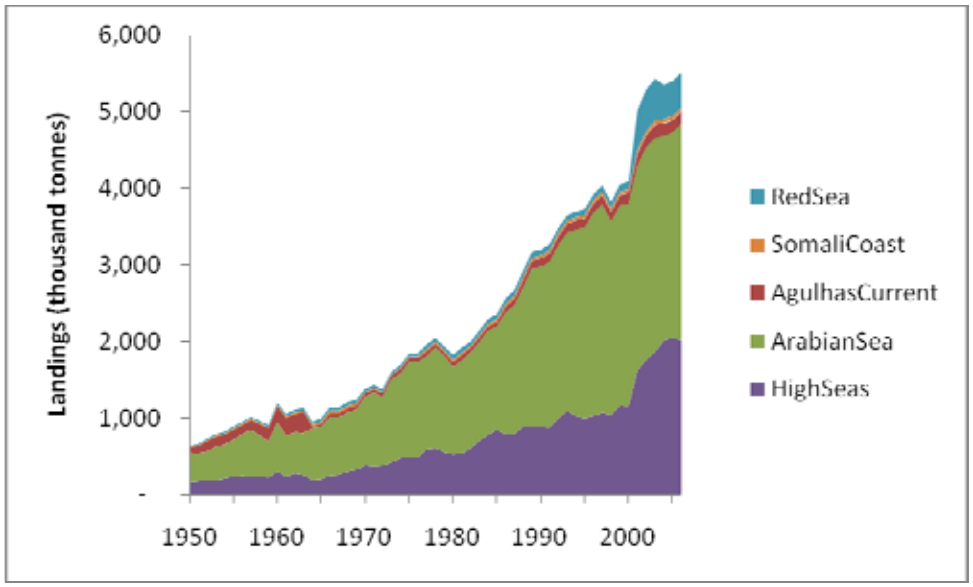

Figure shows that the ASCLME produces a relatively small catch compared to the total ctach from the WIO as a whole. As we will demonstrate later, this relatively small catch is still important to both the countries of the ASCLME and some countries outside of the region.

The method

We compute the following economic and social indicators to capture a broad view of the value of resources extracted from the ASCLME by both regional and non-regional countries: (i) normal profit or payment to investors in the sector; (ii) wages or payments to owners of labour; (iii) the resource rent generated or payments to the owners of the resource; and (iv) the economic impact throughout the economy.

We assume that each economic indicator is related to catch (L) in the following manner:

$$Normal\ Profit = L * \pi \quad (1)$$
$$Wages = L * w \quad (2)$$
$$Rent = L * p - L * c \quad (3)$$
$$Impact = L * p * M \quad (4)$$

where π, w and c denote normal profit, wages and costs adjusted for subsidies per tonne of fish landed. The parameter, M, represents the economic impact multiplier for fisheries in a given country as estimated by Dyck and Sumaila (2010).

The data

To compute each of the above indicators for countries fishing in the ASCLME, we relied on the catch database of Watson *et al.* (2004); the ex vessel price and landed values of Sumaila *et al.* (2007); the subsidies database of Sumaila *et al.* (2010) and the cost of fishing database of Lam *et al.* (2011), and last but not the least, nationally compiled and reported data in counterpart national reports (Turpie and Wilson, 2011; Tovondriaka, 2011 ; Razack, 2011).

The data used for the calculations here are reported in Table 2 below.

Table 2: Economic data on the fisheries active in the ASCLME

Country/entity	Catch (thousand t)	Ex vessel price (US $/t)	Average variable fishing cost (US $/t)**	Catch value or revenue (mill US $)	Total fishing cost (mill US $)	Subsidies (US $/t)	Total subsidies (mill US$)
ASCLME countries							
Comoros	26.87	214	128.49	5.75	3.45	45	1.21
Kenya	1.30	1,207	724.02	1.57	0.94	680	0.89
Madagascar	136.86	1,082	649.23	148.09	88.85	123	16.83
Mauritius	11.54	1,082	649.23	12.49	7.49	226	2.61
Mozambique	121.80	1,201	720.50	146.26	87.76	730	88.91
Seychelles	86.15	294	176.41	25.33	15.20	268	23.09
Somalia	17.85	701	420.34	12.51	7.50	144	2.57
South Africa	17.12	1,260	756.05	21.57	12.94	85	1.45
Tanzania	18.66	612	366.98	11.41	6.85	181	3.38
France	7.54	2,630	1,577.77	19.83	11.90	762	5.75
Regional total	445.69			404.82	242.89	-	146.69
Non-ASCLME region							
Pakistan	0.79	1,717	1,030.27	1.35	0.81	402	0.32
Yemen	1.24	1,522	913.02	1.88	1.13	354	0.44
Mayotte	5.77	584	350.33	3.37	2.02	762	4.40
Taiwan	0.88	3,861	2,316.73	3.41	2.05	355	0.31
India	5.39	896	537.87	4.84	2.90	320	1.73

Italy	0.92	5,576	3,345.67	5.14	3.08	816	0.75
Maldives	2.26	4,206	2,523.83	9.53	5.72	350	0.79
Japan	2.24	5,928	3,556.97	13.26	7.96	1,151	2.57
Spain	20.42	951	570.50	19.42	11.65	791	16.15
Others	6.28	1,188	713.07	7.47	4.48	589	3.70
Non-ASCLME region	46.20			69.66	41.80		31.17
Total	491.89			474.48	284.64		177.86

The data reveals that about half a million tonnes of fish are caught from the ASCLME, with the bulk of it caught by ASCLME countries. This catch brings in about half a billion US dollars, with over 80% of it captured by ASCLME countries. The total cost of fishing is estimated at US$284.64 million a year, with subsidies of US$ 177.86 million provided by governments annually.

The results

We present in Table 5 our estimates of resource rent, wages and normal profits earned by the fisheries of the ASCLME both by country within and outside the region.

The fisheries of the ASCLME are estimated to generate a resource rent of just about US$68 per year currently, of which about US$59 million are generated by ASCLME countries and the reminder by countries outside of the region. The largest resource rent is generated in Madagascar, at US$ 42 million per annum.

The fisheries are estimated to support almost 2.7 million people, generating wages of about US$366 million per year. For owners of fishing capital, we estimate normal profits of US$60 million per year (Table 5).

Table 5: Estimates of economic indicators

Country/entity	Jobs ('000)	Wages to fishers (mill US$)	Earnings to fishing enterprise (mill US $)	Resource rent (mill US $)
ASCLME countries				
Comoros	160	4.14	1.59	1.09
Kenya	51	1.13	0.16	-0.26
Madagascar	630	114.03	15.38	42.40
Mauritius	23	6.25	0.15	2.39
Mozambique	900	108.23	14.43	0
Seychelles	7	18.24	7.22	0
South Africa	66	9.00	3.69	2.43
Somalia	480	14.24	2.13	7.17
Tanzania	190	12.55	2.18	1.19
France	1.85	22.41	0.93	2.19
Regional total	2509	310.22	47.86	58.86
Non-ASCLME				
Pakistan	27	0.78	0.12	0.22
Yemen	1	0.47	0.11	0.31
Mayotte	0.31	2.43	0	0
Taiwan	1	3.31	0.14	1.05
India	172	2.56	0.57	0.21
Italy	2	2.62	0.14	1.3
Maldives	3	7.33	0.25	3.02
Japan	0.22	11.40	0.37	2.73
Spain	3	19.42	9.36	0
Others	23	5.14	1.23	0
Non-ASCLME	233	55.47	12.31	8.84
Total	2,742	365.69	60.16	67.70

We report in Table 6, the direct output impact, the output multiplier, and the eonomy-wide impacts of the activities dependent on the the coastal and marine resources of the ASCLME.

We see from this table that while the direct output impact or landed value of catch from the ASCLME is about US$475 million a year, the total economic impact is more that 2 times the DOI, estimated at about US$1,150 million a year.

Table 6. Direct output, income and economic impacts

Country/entity	Direct output (million US $)	Output multiplier	Economic impact (US $)
ASCLME countries			
Comoros	6	2.95	17
Kenya	2	2.95	5
Madagascar	148	2.34	347
Mauritius	12	1.62	20
Mozambique	146	1.83	268
Seychelles	25	2.95	75
South Africa	13	2.95	37
Somalia	22	3.13	68
Tanzania	11	2.72	31
France	20	4.11	82
Regional total	405		948
Non-ASCLME region			
Pakistan	1	2.16	3
Yemen	2	1.02	2
Mayotte	3	2.95	10
Taiwan	3	3.28	11
India	5	1.36	7
Italy	5	1.75	9
Maldives	10	2.97	28
Japan	13	2.75	36
Spain	19	3.86	75
Others	7	2.46	18
Non-ASCLME region	70		200
Total	474		1,147

4.3 Economic wealth generated under different scenarios

The method

Here, we provide an estimate of the economic wealth, as captured by resource rent, wages and economic impact generated by the fisheries of the ASCLME under two scenarios. In Scenario 1, the wealth generated currently by the fisheries operating in the ASCLME is computed.

Next, we compute in Scenario 2 the wealth that could be generated if overcapacity is eliminated and the fisheries of the ASCLME are rebuild and sustainably managed thereafter.

Fisheries around the world are known to be plagued by overcapacity (e.g., Porter, 1998), and the fisheries of the ASCLME are no exception. This overcapacity results in overfishing and higher than necessary fishing costs. We compute in Scenario 2 the wealth (resource rent, wages and economic impact) that could be generated if overcapacity is eliminated and the fisheries of the ASCLME are rebuild and sustainably managed thereafter. The work in this section is based on Sumaila *et al.* (in prep.).

The data

The key data generated by Sumaila et al. (in prep.) that are relevant for the ASCLME and for the estimation of wealth generated in this ecosystem are presented in Table 3.

Table 3: Estimated landed values, costs and subsidies under current and rebuilding scenarios (million USD)

Country	Current landed value	Rebuilt landed value	Current costs	Rebuilt costs	Current subsidies	Rebuilt subsidies
Comoros	5.75	5.66	3.45	1.73	1.21	0.90
Kenya	1.57	1.56	0.94	0.47	0.89	0.21
Madagascar	148.09	145.98	88.85	44.43	16.83	14.58
Mauritius	12.49	12.51	7.49	3.75	2.61	1.18
Mozambique	146.26	146.20	87.76	43.88	88.91	17.21
Seychelles	25.33	25.44	15.20	7.60	23.09	5.21
Somalia	12.51	15.42	7.50	3.75	2.57	2.39
South Africa	21.57	29.25	12.94	6.47	1.45	0.95
Tanzania	11.41	11.98	6.85	3.42	3.38	1.83
France	19.83	21.82	11.90	5.95	5.75	1.70
Total	404.82	415.82	242.89	121.44	146.69	46.15

The data reported in Table 3 shows that most of the gains from rebuilding fisheries of the ASCLME will come mostly from reducing cost and fishing the resources more efficiently, including eliminating or redirecting harmful subsidies currently provided by governments.

The results

We compute and display in Table 7, the gains in resource rent, income and economic impacts that could be expected if fisheries of the ASCLME are rebuilt and sustainable managed through time.

Table 7: Gains in economic indicators from a rebuilt ASCLME (million US$)

Country	Gain in rent	Gain in income impact	Gain in economic impact
Comoros	1.94	0	0
Kenya	1.13	0	0
Madagascar	44.57	0	0
Mauritius	5.20	0.01	0.03
Mozambique	115.52	0	0
Seychelles	25.59	0.08	0.34
Somalia	6.85	2.10	8.60
South Africa	14.66	5.07	24.06
Tanzania	5.54	0.63	1.55
France	0.77	2.24	8.15
Total	221.77	10.13	42.73

Rebuilding and effectively managing fisheries of the ASCLME would result in annual gains in economic rent of US 221 million while wages and economic impact are likely to increase by US$10 million and $43 million per year, respectively. The latter two do not increase significantly because to rebuild, fishing capacity and therefore wages and normal profits need to be reduced.

4.4 Distribution of benefits among different countries of the ASCLME

The method

Using the economic values computed above, it is possible to provide analsysis of the distribution of benefits between (i) ASCLME and non-ASCLME countries; (ii) ASCLME countries themselves; and (iii) labour, capital and the state. This analysis would in turn serve as a basis for discussing the poverty implications of current patterns of resource use at the regional, national and sectoral levels.

The results

The results obtained in this study indicate that the bulk of the economic benefits from the coastal and marine resources of the ASCLME remain in the countries of the regions. We also see that wages are a multiple higher than earnings to owners of capital, which is both an indication of the labour intensive nature of resource sectors in the region, and the fact that workers such as fishers, capture a good part of the revenues generated in these sectors.

4.5. Indicators of improved economic and social performance

The method

This section identify key indicators that can help managers monitor the progress they are making with respect to achieving sustaianable development.

<u>Indicators of improved economic and social improvements</u>

A key criterion here is that we track changes in long term economic net benefits from the resource:

a. Direct economic impacts (DOIs): Track changes – everything being equal, an increase is good;

b. Normal profits or payments to capital: Changes in profits or payment to capital – everything being equal, an increase is good;

c. Payments to labour: Changes in wages paid to workers. The number of workers and the average income are needed – everything being equal, an increase is good;

d. Net present value of resource rent or royalty: Changes to payments to the resources, i.e., citizens of Angola, Namibia and South Africa – everything being equal, an increase is good.

Indicators of social equity and poverty reduction

Key criteria are (i) share of economic benefits from marine and coastal living resources that accrues to lower income earners in a country; and (ii) reduced malnutrition among coastal and fisher households because of increased protein supply from increased abundance and productivity of marine and coastal resources.

a) Share of direct economic impacts (DOIs) that accrues to lower income earners – everything being equal, an increase is good;

b) Share of normal profits that accrues to lower income earners – everything being equal, an increase is good;

c) Share of payments to labour that accrues to lower income earners – everything being equal, an increase is good;

d) Share of resource rent or royalty that accrues to lower income earners – everything being equal, an increase is good;

e) Trends in number of coastal and fisher households with income that are above the poverty line – everything being equal, a positive trend is good;

f) Trends in the percentage of coastal and fisher households that are not undernourished – everything being equal, a positive trend is good.

The results

The current study provides initial numbers that could serve as the beginning of a time series that could be used for the analsysis of economic and social performance over time.

5.0. Conclusions and Recommendations

ASCLME Regional Cost-Benefit Economic Valuation

We set out to accomplish the follwoing in this study: (i) estimate the contribution of coastal and marines of the ASCLME and the economic activities they support on the GDP of countries of the ASCLME; (ii) compute the values of a number of economic and social indicators to capture a broad view of the value of resources extracted from the ASCLME by both regional and non-regional countries; (iii) estimate the economic wealth, as captured by resource rent, wages and economic impact generated by the fisheries of the ASCLME under two scenarios; and (iv) provide a brief indication of distributional and equity analysis over time .

Our main findings are:

- We estimate that the coastal and marine resources of the ASCLME contribute almost US$22.4 billion a year to the GDP of the countries of region. Coastal tourism contributed the largest to GDP at over US$11 billion a year, followed by coastal agriculture and forestry;
- The fisheries of the ASCLME are estimated to generate a resource rent of just about US$68 million per year currently, of which about US$59 million are generated by ASCLME countries and the reminder by countries outside of the region. The largest resource rent is generated in Madagascar, at US$ 42 million per annum;
- The fisheries of the ASCLME are estimated to support about 2.7 million full and partime workers, generating wages of about US$366 million per year. On the other hand, owners of fishing capital earn normal profits of US$60 million per year;
- Rebuilding and effectively managing fisheries of the ASCLME could result in annual gains in economic rent of US 221 million while wages and economic impact are likely to increase by US$10 million and $43 million per year, respectively;
- In terms of distribution and equity, we find that most of the economic benefits from the coastal and marine resources of the ASCLME remain in the countries of the region. Also, workers in the sector capture a multiple of what owners of capital cpature from the gross revenues generated from the resources of the ASCLME.

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Appendix: Marine resources in countries of the ASCLME

In this section, we describe the marine resources in the ASCLME that are used by the peoples of the nine ASCLME countries [i.e., Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa, Somalia, Tanzania]. This section will rely heavily on the work reported in the "Overview of Coastal Livelihoods in the Western Indian Ocean" Report prepared by Dr. Tim Andrew and his collaborators.

Mauritius

Small-Scale Fisheries

The Fisheries in Mauritius employs an estimated 11,000 people and contributes 1.5% to GDP. Artisanal fishers have an income level of around Rs300[1] per day, while monthly consumption expenditures for all fishers are, on average, above Rs 4,000. Total domestic catch in the sector is valued at Rs 1 billion. However, catch by the artisanal sector dropped by nearly 360 tonnes between 2004 and 2008, which correlates to the declines in total catch during the same period.

The fisheries sector employs an estimated 2,000 people, 78% of whom are between the ages of twenty to forty five. The number of fishers increased between 2005 and 2008, while production in the sector, unlike Mauritius, increased during the same period. The artisanal sub-sector supplies the majority of fish caught domestically, however, 60% of all domestic fish consumption is imported.

Tourism

Tourism is a signifact and fast growing sector of the Mauritius economy, growing at 9% annually between 1985 and 2005. Even though growth has been less steady since 2005, it is still impressive, with investment in the hotel and restaurant sector increasing from Rs 4.2 billion to Rs 12.2 billion between 2005 and 2009, and total tourist arrivals increasing from 761,063 to 871,356 during the same period. The sector employed 26,922 people in 2009, out of which 19,241 were male. The tourism sector declined by about 6% in real terms that year. The hotel and restaurant sub-sector has also seen declines between 2007 and 2009, real growth rate falling by between 6 to 14%.

Mariculture

Only one mariculture farm is active in Mauritius and Rodriguez, with cage culture being utilized to produce goldlined sea bream, red drum and cobia in Mahebourg. The farm produces both for domestic consumption and export, employing 65 people and, in 2008, produced an estimated 750 tonnes of fish. The sector is not yet a major part of the country's economy, however, six mariculture licenses have been granted as of 2009 and the government has identified the sector as having great potential for growth, thus, activity is likely to increase in the near future.

Agriculture and Forestry

Agriculture represents 5.5% of total GDP, with 43% of land being used for agricultural purposes. 90% of this land is utilized to cultivate sugar, which makes up 70% of the agricultural sector's total contribution to GDP. In terms of production, sugar, tea and tobacco contribute 52% to overall output, food crops and others 19%, livestock and poultry 14% and

[1] 100 Mauritian rupees = 3.66 U.S. dollars as at May 8, 2011.

fishing 4%. Despite the importance of agriculture to the overall economy, the sector has been in perpetual decline in terms of GDP, decreasing from 30% of GDP in the 1970s to 5.5% in the present. Agricultural land has als and 6,000 tonnes of salt was produced in 2000.

Coral sand mining was traditionally practiced in lagoon areas in the coastal region, however, due to the destruction of adjacent marine habitats, as well as coastal erosion, the government placed a moratorium on lagoon sand mining in 2001. Hence, substitute technologies are now being used for crushing rock used for construction purposes.

Madagascar

Small-Scale Fisheries

The small-scale fishery in Madagascar made up of subsistence, artisanal/traditional and recreational fishing, is largely concentrated on the country's west coast. This sector employs 36% and 27% of the workforce in the province's of Toliara and Mahajanga, respectively. Traditional fishing, undertaken mostly by canoe, represents nearly 68% of total fish catch, largely focusing on export products, such as crustaceans, holothurians and cephalopods. Men make up 97% of the workforce. In 2003, the small-scale fisheries, as a whole, contributed nearly 26% of the total tonnage of fisheries export and nearly 9% of the total value of exports, worth an estimated $142 million USD.

Tourism

Tourism and the hotel sector represented 3.7% of GDP in 2008, an increase from 2.8% in 2003. The sector is the second largest foreign exchange earner in the country, bringing in $116 million in 2009. This however, down from $210 million in 2007 and $303 million in 2008. The sector also directly employed nearly 27,300 people in 2009, an increase of over 6,000 people from 2005. This increase correlates pretty well with the 5% annual growth rate in the sector as a whole. Antananarivo, Toliara and the national park of Isalo are the most frequented destinations, while France is the largest visitor market, representing 70% of all arrivals.

Mariculture

Mariculture is a developing sector in the Madagascan economy. There is currently ongoing research and pilot projects studying the feasibility of farming mud crab, sea cucumber, blue-green algae, oyster and eel. There are also commercial activities present, seen with the large scale farming of prawn for export and domestic consumption, as well as small-scale production in seaweed. Prawn farming, in particular, has been very successful in providing employment for rural communities, supplying 4,325 permanent and 30,000 part time jobs in 2003. The sub-sector has a strong export component worth an estimated $62 million USD.

Agriculture and Forestry

Agriculture and forestry are clearly a significant component of the Madagascan economy, providing a base for employment and subsistence for over 75% of the population and contributing 35% to total GDP. Traditional agriculture makes up between 30% - 60% of total production, whereby, rice is cultivated by 86% of households, accounting for 37% of agriculture cash income. Small business accounts for less than 10% of household income along the coast, thus, over-dependence on natural resources is clearly a problem in the coastal

zone. 34% of the population also lives within 100 Km of the coast, which, in conjunction with extensive population growth, places even further strain on the country's coastal resources. Due to the aforementioned over-dependence, the over-exploitation and degradation of coastal resources has inevitably become problematic. Madagascar has lost nearly 85% of its forests due to illicit logging, and slash & burn agriculture, which has had a serious impact on adjoining ecosystems.

Ports and Coastal Transport

Ports and rail have been documented as the two key modes of transport in the Madagascan coastal zone. Six ports have been identified, all of which are crucial to economic life due to the difficulty of inland movement. The most important ports, in terms of cargo and trade, are Mahajanga and Toamasina. Toamasina is highly significant as it is not only connected to Antananarivo by rail, but it is also an important point for both exports and imports. Mahajanga also provides transshipment services, however, a cyclone in 2006, as well as limited water depth, has constrained activity. Ports in Madagascar are largely state-controlled, however, some privatization has been seen with the ports in Toamasina and D'Ehoala, while further concessions are being made to the private sector due to capital constraints and a need for modernization. With regard to rail services, the private company, Madarail, is the most significant provider, carrying 94% of rail freight and 86% of passenger rail traffic in the country. In 2008, the transport of commercial and consumer goods by rail accounted for 45% of total tonnage in the country, a clear testament to the importance of rail services in the country.

Coastal Mining

Mining contributes less than 1% to GDP in Madagascar, however, the $5.5 billion total investment in the Illeminite mine in Fort Dauphin and the nickel-cobalt mine in Moramanga and Tamatave was documented as the largest investment in Madagascar’s history. Expenditures on construction, for both mines, have been estimated to be the largest sources of hard currency in the country. Actual production has already begun at the Fort Dauphin mine, while production will begin in Moramanga and Tamatave in 2011. Sapphire, ruby, gem and gold are also prevalent in the country, with over 500,000 artisanal miners identified to be mining gold on a part-time basis.

The production of heavy minerals from sands, and limestone in Toliara, as well as iron in Soalala, are all currently in the study and permitting phase. Direct and indirect employment is clearly one great benefit from coastal mining. In Fort Dauphin, the construction phase provided over 6,000 jobs, while over 2,000 jobs are provided in the operation phase. Construction at the mines in Moramanga and Tamatave have provided over 11,000 direct and indirect jobs.

The companies operating the mines, Qit Minerals Madagascar and Ambatovy, are also large contributors to community development. Qit Minerals Madagascar has not only developed an enterprise development program, but it has also developed initiatives around microfinance, education and health care. Likewise, Ambatovy has developed a project to assist local populations in developing job skills, as well as created a center for agricultural training. Both mines do, however, present environmental challenges, particularly around the destruction of flora and fauna, which could certainly become problematic in the future.

South Africa

Small-Scale Fisheries

It has been estimated that nearly 100,000 people are directly involved in the sector, while upwards of 28,000 households are dependent on subsistence fisheries. The commercial fishery, which also includes some aspects of the small-scale sector (for example west coast rock lobster and traditional linefish), contributes 0.5% to GDP and brings in R80 billion annually. As a whole, small-scale fishing along the east coast has traditionally focused on shore-based activity as a means of livelihood, while small-scale fishers along the west coast have normally been drawn into the commercial fishery.

Tourism

Tourism is the third largest contributor to GDP, the fourth largest source of foreign exchange and accounts for 7.4% of all jobs in South Africa, making it a vital sector in the country's economy. Tourism is also one of South Africa's fastest growing sectors, with contributions to the national economy growing from 4.6% in 1993 to 8.3% in 2007, while foreign arrivals and revenue from foreign tourism increased by 7.8% and 23.4% respectively between 2007 and 2008. Domestic tourism is also vibrant, generating R16 billion annually, making up 67% of all activity in the sector. Provincially, Gauteng and Western Cape are the most frequented destinations for foreign travelers, while KwaZulu Natal is the largest beneficiary in the domestic market.

Mariculture

Medium and large-scale mariculture activity is well established in South Africa, with commercial farming prevalent in abalone, seaweed, mussels and oysters, and pilot commercial projects underway in dusky kob, silver kob and yellowtail finfish. Research is also ongoing for the production of clownfish, white margined sole, west and east coast rock lobster, scallop and blood worm. Small-scale production is, however, scarce in the country, as most projects are being developed by the private-sector with an emphasis on pump ashore systems. This lack of small-scale production has been attributed to several factors, including poor environmental conditions, inadequate participatory approaches, poor fish growth, very low returns, lack of interest and neglect. Medium and large-scale farms are, nevertheless, providing employment outside urban areas, particularly in the Eastern and Western Cape.

Agriculture and Forestry

Agriculture and forestry in the coastal zone is utilized for both subsistence and commercial purposes, with the value of benefits from its goods and services on a national level estimated to be equal to 35% of GDP. The forestry sector alone accounts for 4.1% of total export earnings, while deciduous fruit exports account for 15% of total agricultural export earnings.

Livestock production and the dairy industry are also significant sub-sectors, with 4,300 milk producers employing an estimated 60,000 workers and indirectly providing employment for an additional 40,000 people. The slaughter of broilers and other fowls also grossed nearly $1.24 million USD in 2001, making it the most important contributor to the value of agricultural production in South Africa. 25% of South Africa's population lives within 60km of the coastline and 70% of this population is considered poor.

Ports and Coastal Transport

South Africa has six major commercial ports, all of which are connected to inland areas through road and rail. Durban is the largest point for imports and exports to and from inland South Africa, while the port at Richards Bay is the country's largest bulk port. Port Elizabeth is the Eastern Cape's busiest port, handling ore transports from the Northern Cape and providing container services for the city's vibrant automobile industry, while the port at Mossel Bay is almost solely dedicated to the handling of petroleum products. The port in East London mainly serves the Border and Transkei areas, while the port in Ngqura has largely been developed as a catalyst for industrial development. Ports, terminals, as well as the country's rail services, are all state-owned and operated by Transnet National Ports Authority, while road transport is provided and maintained by the private sector.

Coastal Mining

South Africa has the world's largest reserves of chrome, gold, vanadium, manganese and platinum group metals, making mining the most dominant sector in the country's economy. In 2008, mining accounted for 9.5% of GDP, 41% of total exports and employed over half a million people. On the west coast alluvial diamonds are recovered both in the coastal zone and further offshore and forms the basis of a significant industry. However, on the east coast, mining activity is less prevalent in the coastal zone, focused around heavy mineral sand mining near in Richards Bay and elsewhere in KwaZulu Natal, and limestone for cement.

Much of the mining activity on the east coast is also being utilized as a means to develop adjacent communities. For example, Richards Bay Minerals has implemented a Black Economic Enterprises program, which has helped historically-disadvantaged populations develop small-businesses and supply goods and services, now worth $61 million USD, to Richards Bay Minerals. Similarly, Pretoria Portland Cement has also developed employment and skills in the New Brighton Township with the Latita soap making project, while Exxaro, Lafarge and Natal Portland Cement have all done work focusing on education in disadvantaged communities. All mining activity along the coast also provides the government with taxes and royalties, which could be utilized to support social services in adjacent communities.

Seychelles

Small-Scale Fisheries

The small-scale fishery in Seychelles, which includes the artisanal and semi-industrial sub-sectors, contributes between 1% and 2% to GDP annually, while the fisheries sector, as a whole, contributed 7.7% in 2008, an increase of 1.3% from 2004. Seychelles has very limited land-based opportunities, thus, the fishery is a vital source of income, employment, food security and foreign exchange in the country. This reliance on the sector is most evident in the fact that 17% of the total population is employed in the fishery, 30% of which are active in the small-scale sector, while 10% of the population is directly dependent on the small-scale sector.

Tourism

Tourism contributed a massive 25.6% to GDP in 2010, an increase of 2.2% from 2007, directly employing 25% of the labor force and generating an estimated SR 2,437 million in foreign exchange in 2008. Despite reaching its peak in 1996, revenue increased from SR 938 million to SR 2437 million between 2004 and 2008, while bed occupancy increased from

44% to 57% between 2005 and 2008. The European market accounts for an overwhelming 76% of total visitors, with France, Germany, Italy and the UK being the most predominant.

Mariculture
Few mariculture activities are currently operational in Seychelles, with only prawn, giant clam and pearl oysters being produced in small-scale commercial operations.
Prawn and clam production has also been decreasing in recent years, with clam production falling from 1,960 tonnes in 1996 to 585 tonnes in 2006 due to weak demand, while prawn production fell from 1175 tonnes in 2004 to 704 tonnes in 2006.
Farming of clam and pearl oysters are not labor intensive practices, thus, little employment has been generated around the sub-sectors, and while the prawn farm on Coetivy Island employs 350 people, only 18% are actually native Seychellois.

Agriculture and Forestry
There are few land-based opportunities in Seychelles, thus, agriculture and forestry naturally contributes far less, economically, than the more dominant tourism sector.
Subsistence agriculture, forestry and fishing does, however, contribute 6% to GDP and agriculture alone employed nearly 6% of the labor force in 1995.

Ports and Coastal Transport
Seychelles has only one port in Port Victoria, which is relatively limited in throughput. The port is, however, the central point of economic activity in the country, being vital for the fishery and the country's bulk imports, particularly fuel, which is the most significant sector of general cargo.

The fishery is also a large component of port activity, as it generates demand for processing and transshipment facilities, as well as fuel, supplies and associated commodities. Cruise ships and leisure vessels have also been documented as important contributors to activity. The port is managed by the Seychelles Port Authority, however, the government has shown a willingness to facilitate greater private sector activity in recent years.

Coastal Mining
Mining activity in Seychelles is very limited, with production concentrated in construction materials such as clay, coral, sand and stone. All production is informal, hence, no companies have been identified in the report. Coastal sand and coral mining was widely practiced until the 1990's, however, both activities were widely reduced due to coastal erosion, as well as the passing of the Removal of Sand and Gravel Act and the Environment Protection Act. Experimental granite quarrying was also attempted in the 1980's, however, environmental opposition led to the termination of activity.

COMOROS

Small-Scale Fisheries

The Small-scale fisheries in Comoros employs 6% of the country's population, with women mainly being employed in post-catch operations, while 30% of the population is dependent on the fishery. The sector contributes 8% to GDP, 24% to agriculture GDP and also makes up 5% of total foreign exchange annually, making fishing not only a net supplier of foreign exchange, but also a key component of the country's balance of payments. The small-scale fishery is, in this respect, a vital link to the global economy for the Comoros.

Tourism

Tourism contributed between 2% and 4.1% of total GDP in 2005, generating 500 direct jobs, 80% of which were in the hotel sector. Tourism also generated 500 indirect jobs in 2005, largely around the food-supply and handicrafts sectors. 90% of total bed capacity in the sector is located on the island of Grand Comore, which contains the country's only international airport and business hotel. International arrivals have been increasing in recent years, however, both total arrivals and leisure-based travel has been declining, with leisure based travel decreasing from 27,000 in 1994 to just 3,000 in 2007.

Mariculture

With no designated mariculture zones, limited fresh or brackish water resources, and limited areas suitable for culture, there are currently no operating mariculture activities in the country.

Agriculture and Forestry

Agriculture and forestry currently employs between 70% and 80% of the total Comoros population, accounting for nearly 45% of GNP and totaling 98% of all exports. It continues to grow at an annual rate of 2%. Vanilla is the most dominant commodity in the sector, making up 60% of all exports, making it the principal source of foreign exchange in the country. National agricultural production, however, accounts for only 40 per cent of the country's food needs, wherein, production for domestic consumption contributes some 47 per cent of the sector's added value. Food imports, particularly rice, thus consume much of the country's foreign exchange.

Ports and Coastal Transport

There are four major ports in Comoros, located in Moroni, Fomboni, Mutsamudu and Mayotte. The main port in Moroni is accessible by road, however, dangerous currents and water depth force ships to dock away from the port, leaving ship cargo to be transferred to the port through smaller vessels. The port in Mutsamudu has access to important fish-processing storage facilities, while the Fomboni and Mayotte ports also both have links to the fishing industry.

While the government continues to operate the port in Mayotte with French assistance, the operation of the other ports has been contracted out to Gulf-state companies, most recently with the UAE based container port management company Gulftainer at Moroni and Mutsamudu. This business with Gulf-state partners has also created opportunities for tourism from other countries in the Middle East, as well as made possible the potential upgrades in port operations and technology.

Coastal Mining

There are no commercially exploitable mineral resources in the country, thus, energy, cement, steel and other materials are imported.

SOMALIA

Small-Scale Fisheries

There is an operative small-scale fishery in Somalia with approximately 50 fishing centers and an estimated 30,000 people from coastal communities engaged. Despite rich bio-diversity and an extensive coastline, exports of fishery products only account for around 3% of total exports and contribute about 2% to GDP. Household income in the sector also fluctuates by season, with fishers earning $1.5 USD per day during monsoon season and an estimated $40 USD per day during fishing season.

Tourism

Security in Somalia is inevitably a constraint on tourism in the country's coastal zone, however, its long scenic coastline, rich biodiversity and favorable climate make it an ideal region for future tourism development. The country's close proximity to the Middle East, along with its historic Islamic culture, also make it a convenient destination for nearby travelers. All opportunities are, however, dependent on improvements in the security situation.

Mariculture

A dedicated report on mariculture has not been included in this country report due to the current difficulty in obtaining detailed information on the potential of this sector in Somalia.

Agriculture and Forestry

Accounting for an estimated 64% of GDP, agriculture and forestry is the most dominant sector in Somalia. Despite livestock movement bans, animal exports account for about 60% of Somalia’s employment opportunities, generating about 40% of GDP and 80% of foreign currency earnings. Taxation of livestock trade and export is one of the major revenue sources for the regional administrations. The main food crops are sorghum, millet, maize and rice, while the majority of cash crop exports are bananas, sugar and cotton. Bananas were once a key export and source of foreign exchange, however, the El Nino floods in 1998 largely collapsed the sector.

Hence, as livestock is the main source of income and employment for the majority of the Somali population, droughts, fluctuating environmental conditions and market volatility all have a great impact on the people and the economy. Acacia and Commiphora shrub and woodland habitat are widespread in the country and are extensively utilized for a variety of purposes. While large swaths of the resource have been cleared for agriculture, as well as fuelwood and charcoal production, woodlands still provide numerous goods, particularly in dry times. Deforestation is, however, a significant problem in the northern areas and the Jubba Valley. Forests are not predominant in the coastal zone, however, mangroves remain important, valued at around $91 million USD.

Ports and Coastal Transport

There are four major ports in Somalia, each under the control of independent local clans. Kismaayo, the most southerly port, handles exports of charcoal and bananas from the Juba valley and receives vehicle imports from the Gulf. Merka, which lies 100 km south of Mogadishu, has no operational infrastructure, therefore, ships are forced to anchor offshore with cargo brought inshore by smaller vessels. The Mogadishu port, which was rebuilt with the US and UN finance in the early 1990's, is largely controlled by different factions and clans. The port does, however, reportedly have some adequate warehouses that could

potentially be used for imports. The port in Eyl is only noted as a stronghold for piracy. None of these four ports are considered to be fully operational.

Coastal Mining

Deposits of tin-tantalum in Puntland, simpsonite in Berbera, and deposits of salt and gemstone throughout the country, all highlight the fact that there are numerous documented opportunities for mining in the country. Similarly, despite the lack of reliable data, a US geological survey also noted that 1,500 tonnes of gypsum, 600 tonnes of marine salt and 6 tonnes of sepiolite was mined, each year, from 1998 to 2002. Nevertheless, data for all minerals remains constrained by the present security situation. The only reported mining activity along the coast was in cement, which was subsequently concluded in 1996. There have been no indications of mining activity in the coastal region since then. Again, similar to inland mining, the country's security situation has inevitably constrained any mining activity in the region.

KENYA

Small-Scale Fisheries

The small-scale fisheries in Kenya, defined as artisanal in the country report, employs 10,000 people and supply's 95% of the country's total marine catch, generating an estimated US$ 3.2 million per year and accounting for between 2% and 6% of total fish production in the country. An estimated 60,000 coastal residents depend on the sector, wherein, the level of dependence is higher in regions with low development, less salaried employment and high poverty rates. Hence, while the entire fisheries sector only contributes 0.5% to national GDP, it is nevertheless a vital component to economic activity in the coastal regions.

Population growth, along with high levels of poverty in the coastal regions, has contributed to increases in the number small-scale fishers, with a 34% increase documented between 2004 and 2008. This has, in turn, placed great strain on fish stocks along the coast, resulting in the over-exploitation of fisheries resources. This has subsequently resulted in an overall decline in small-scale landings, evident in the 50% decrease in demersal coral reef fish yields through the 1990's. Rabbit fish and scavengers, which make up nearly 40% of the small-scale fishers' landings, also declined by 40% in the 1990's, while the catch of tuna has been declining since 2004. Destructive fishing techniques, such as trawling, as well as the use of seine nets and spear guns, have also facilitated these declines; however, population growth and poverty in the coastal regions have been documented as the key attributing factors.

Tourism

Tourism contributes 5% to total GDP, however, when considering all linkages within the sector, it is estimated that tourism contributes upwards of 11.6%, which would make it the country's third-largest contributor to GDP. The sector makes up 4% of total employment in the country, providing nearly 483,000 jobs in 2008, and contributes 18% to total foreign exchange earnings, between 52% and 68% of which is derived from coastal tourism activity.

The sector has also been strong in recent years, with arrivals increasing from 814,000 in 1990 to over 2 million in 2007 and revenue increasing from Kshs56.2 billion to Kshs65.4 billion between 2006 and 2007, representing an 11.6% growth rate. However, like most countries, 2008 saw sharp declines in revenue, with earnings decreasing by 16.2%. Comparatively, the sector is nevertheless quite dominant in the African continent, receiving 6% of all international tourist arrivals to Africa.

Mariculture

There are several mariculture activities currently in the experimental stage along the south coast of Kenya. This includes eight finfish farms, six crab farms and four prawn farms, all of which are currently producing for domestic consumption. This development is a reflection of not only the high-quality seawater in the coastal region, but also the enthusiasm of coastal communities to develop mariculture activities. Many mariculture operations, particularly crab and finfish, are also being developed as community-based initiatives, again a testament to the willingness of coastal residents to become involved in the sector. Thus, despite inadequate coordination and planning in the sector, mariculture is a developing field in the Kenyan economy.

Agriculture and Forestry

Employing 70% of the total work force, supplying 70% of raw materials for domestic agro-industry and making up 80% of total export earnings and 45% of government revenue, agriculture and forestry is clearly the most dominant sector in the Kenyan economy. Agricultural activity in the coastal zone is also significant, producing food and non-food products for both subsistence and commerce, with cashews, bixa, sisal, as well as fruits and vegetables, all being produced for export.

Ports and Coastal Transport

Kenya has five ports, the main ports being Mombasa in the south, and Malindi and Lamu in the north, while smaller fishing ports exist at Kilifi and Shimoni. All the ports are administered by the Kenya Port Authority and governed by the Ministry of Transport, however, the private-sector has become increasingly involved, with the Japan Bank for International Cooperation funding a new container terminal in Mombasa, while upgrades in the Lamu corridor has attracted interest from investors from around the world.

The port in Mombasa, which is the country's only international port, has recently undergone numerous reforms. A new Vessel Tracking Management System, Global Maritime Distress Signalling System, as well as new safety regulations and a shift to 24-hour services, have all increased efficiency at the port, resulting in increases of 2.8% in throughput and 10.8% in transit, occurring between 2007 and 2008 respectively. Likewise, potential development of the Lamu corridor, including a new deepwater port and terminal for mining exports, could potentially not only produce similar increases, but it could also open up the interior for further development. Planned improvements to the Northern Development Corridor are also expected to create opportunities for development in coastal communities. Development of the Central Corridor in Tanzania could, however, provide competition.

Coastal Mining

Mining accounted for only 0.5% of total GDP in 2008, with mineral exports making up between 2% and 3% of total exports, employing an estimated 50,000 people. There are deposits of gold, gemstone fluorspar and soda ash throughout the country, however, mining activity in the coastal zone is largely focused on cement for local construction, with production concentrated in coral limestone, shale, and sand. The three largest cement mines are located in Mombassa, while informal mining is prevalent in the Kilifi and Kwale districts. There are also plans for a heavy sands mine in Kwale, with production expected to begin in 2013.

A clear strength of mining activity in the coastal zone, other than providing full-time employment for over 1,000 people, is the community development being promoted by the two largest active companies, Bamburi Cement Ltd. and Athi River Mining Ltd. Bamburi, for example, has invested in a school refurbishment program as a part of its community education support program, which includes the development of schools in disadvantaged communities in Mombassa. Athi River Mining Ltd. has also been active in the community, particularly in the Mavoko Municipal area, by constructing roads, donating food and clothing, as well as building dormitories for female children. Both companies also contribute taxes and royalties to the government, which has the potential to be invested in social services for coastal communities.

TANZANIA

Small-Scale Fisheries

The small-scale fisheries in Tanzania accounts for 98% of total fish production, 1.3% of GDP and makes up 9.9% of fish exports worth an estimated $12.4 million USD. While its contribution to GDP may appear marginal, the sector is a vital source of food security, employment and income for coastal communities, which subsequently stabilizes the five coastal regions which, when including all sectors, make up 32% of Tanzania's GDP.

Tourism

Tourism is a massive component of the Tanzanian economy, accounting for 17.2% of GDP, making up 25% of foreign exchange earnings and employing 288,700 people. The sector also continues to grow, with foreign exchange receipts from tourism increasing from US$259.44 million in 1995 to $1,269.68 million in 2008 and total arrivals increasing from 295,312 to 770,376 over the same period. While much of this activity is concentrated around wildlife-based tourism in the hinterland, coastal tourism is witnessing some growth, evident on Mafia Island where arrivals increased from 484 in 2000 to 3,107 in 2007. Coastal tourism is not, however, growing as rapidly as inland tourism, which has been partly attributed to the lack of a national strategy in regards to diversifying the sector into the country’s coastal regions.

Mariculture

Mariculture is clearly a vibrant sector in the Tanzanian economy, with finfish, seaweed and mudcrab being farmed in all coastal regions, and pearls and prawns also being farmed in Mafia and Tanga,. Regulation and infrastructure development has lagged behind in this sector, however, high quality seawater, large numbers of candidate species and existing research and support capacity highlight the untapped potential in the sector.

Agriculture and Forestry

Agriculture and forestry is the country's leading sector, employing 82% of the population, contributing 45% of GDP and 60% of total export earnings. The sector employs three million people, with forestry alone accounting for 4% of GDP, making up 10% of foreign exchange earnings equal to 14 million USD annually. Subsistence farming is, however, the most dominant form of income generation in the coastal zone, thus, any increases in unemployment are expected to place further strain on the region's natural resources. Fuelwood also accounts for more than 92% of the country's energy use, also placing extensive strain on the country's coastal forests.

Ports and Coastal Transport

Tanzania clearly has an established ports and coastal transport sector, with ports in Mtwara, Lindi, Kilwa, Dar Es Salaam and Tanga, as well as an extensive rail and road network. While the ports are managed by the Tanzania Ports Authority (TPA), the rail network is jointly managed by the Zambian government and the Tanzania Railway Corporation. Some concessions have been proposed, however, the transport sector is largely funded and managed by the public sector, which does constrain capacity and service delivery in the sector.

Coastal Mining

Being Africa's third largest gold producer, the world's sole producer of the gemstone tanzanite, and a producer of cement, diamonds, sapphire and garnet, Tanzania clearly has an extensive and diverse mining sector. The sector contributes nearly 4% to GDP; it formally employs 8,000 people and also makes up an extensive 42.9% of total foreign exchange earnings. An estimated 500,000 artisanal miners are also active throughout the sector. The majority of precious metal mining takes place inland; however, the coastal zone does have mining operations focused on cement, coral and lime, with both lime and cement being produced for export throughout East Africa.

Companies controlling these operations, such as Tanga cement, have also invested in community development, a testament to the social benefits provided by coastal mining activities. The Twiga and Tanga cement projects have also produced over 200 billion TZS in tax revenue, which could potentially be reinvested into the coastal communities with the construction of housing, schools and clinics. Likewise, recent investments in the Twiga and Tanga mines are expected to generate more employment and training for employees in the coastal region.

Mozambique

Small-Scale Fisheries

Comprising of subsistence, semi-industrial and artisanal fishing, the small-scale fishery in Mozambique employs over 351,700 people, 2% of which are women, and accounts for 93% of the country's total marine catch, 91% of which is caught by the subsistence and artisanal fishers and 2% by the semi-industrial sub-sector. Income levels in the small-scale fisheries are largely dependent on position within the sector, whereby, three broad positions are classified in the report; Boat and gear owners, crew (employees) and fishers fishing by foot/collectors. Income in the sector is also dependent on region and subsequently distances to market.

Mariculture

Mariculture employs 2,000 people in commercial seaweed farming, 80% of which are women, and 1,000 people in commercial prawn farming, and is thus a strong developing sector in the Mozambican economy. There are also experimental projects underway in finfish and mudcrab, which highlight the opportunities for further development in the sector. The country's high quality seawater, its ideal environment for prawn farming, along with its large areas identified as suitable for mariculture development, should only accentuate these growing opportunities.

Agriculture and Forestry

Contributing 22.5% to GDP in 2005 and between 10% and 15% of total exports, agricultural and forestry is clearly a huge facet of the Mozambican economy. Cassava and Maize represent 50% of the value of production and it has been estimated that a 20% increase in output in these staples could potentially reduce poverty by 19%. Livestock has also become an important source of income, with 31% of households utilizing it as a source of income in 2002, an increase of 17% from 1996. The sector has, however, receded in recent years, most evident in the fact that 42% of households received some income from non-farm enterprises in 2002. This drop in production has been attributed to the development of aluminium exports, along with the increase in other large export projects since 2000.

Energy

Activities in oil and biofuels are currently limited, with only natural gas being produced from twelve wells at the Pande/Temane gas fields. The field's present capacity is 120 mill GJ/year (3 billion cu.m/yr), with the government accruing 5% of the revenue from production. The downstream oil industry is dependent on imports to the ports in Maputo, Beira, and Nacala, all of which provide a supply corridor to adjacent, landlocked countries. The country has one processing facility in Temane, along with three pipeline routes, two of which are gas pipelines with links both to domestic customers as well as to South Africa, while one oil pipeline is linked to Zimbabwe. Mozambique is considered to have the largest biofuels production potential in Africa, but no commercial activities have yet been initiated.

Ports and Coastal Transport

An extensive coastline, along with ten documented ports, highlights the strength and promise of coastal transport in Mozambique. Traditionally, the government played a large role in the administration of ports, however, since the end of civil conflict in 1992, reforms to introduce joint ventures into the transport system has facilitated rapid reconstruction and development in the sector, with the ports of Maputo, Beira and Nacala now all effectively operated by private-sector port operators. Reconstruction of rail services that were destroyed in civil conflict have also facilitated growth in trade with South Africa and further rehabilitation could expand cargo exports from the DRC, Zambia, Zimbabwe and Malawi, which could be beneficial to both coastal economies and the agriculture sector. Due to its low lying coastal plain, most of the ports have, however, developed in shallow bays.

Coastal Mining

Producing aluminum, titanium, zircon, rutile and sand from dunes, mining is one of Mozambique's fastest growing sectors, representing 1.6% of total GDP in 2006 with investments increasing from $101 million USD in 2004 to $804 million USD in 2008. All the aforementioned minerals, with the exception of sand from dunes which is mainly an artisanal practice, are also being produced for export, making the sector a vital source of foreign exchange and an essential means of facilitating economic growth.

The processing of alumina in the Mozal aluminum smelter alone accounts for over half of the country's export earnings. In the coastal zone, only the Moma mine is currently operational.