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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

Based on the work by

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EXECUTIVE SUMMARY

Overview

The Guinea Current Large Marine Ecosystem (GCLME) which is one of the world's most productive marine areas include the Exclusive Economic Zones (EEZ) of sixteen countries, namely, Angola, Benin, Cameroon, Congo, Côte d'Ivoire, Democratic Republic of Congo, Gabon, Ghana, Equatorial Guinea, Guinea, Guinea Bissau, Liberia, Nigeria, Sao Tome & Principe, Sierra Leone and Togo. The area is rich in fishery resources, petroleum production, and an important global region of marine biological diversity supporting the livelihood of approximately 40% of the region's 280 million people living in the coastal areas. However, despite its resources and support to livelihood systems, the GCLME is facing a lot of challenging problems, namely, population explosion and urbanization, fisheries depletion, water pollution, public health and sanitation, habitat degradation, coastal erosion, loss of biological diversity, and land-use all of which have been exacerbated by human activities. Based on these problems and others as identified in the transboundary diagnostic analysis (TDA), the GEF project "combating living resources depletion and coastal area degradation in the Guinea Current Large Marine Ecosystem through ecosystem-based regional actions" implemented by UNIDO aims to reverse these trends and to achieve long-term development goals. These include, recover and sustain depleted fisheries; restore degraded habitats; and reduce land and ship-based pollution by establishing a regional management framework for sustainable use of living and non-living resources in the GCLME. The economic valuation of ecosystem services and marine resources of the guinea large current marine ecosystem is a sub-component of the project towards achieving the stated goals.

Terms of Reference of the Valuation Project

The tasks involved in the valuation assignment as detailed in the terms of reference include to:

- review the Transboundary Diagnostic Analysis (TDA) of the Guinea Current Large Marine Ecosystem (GCLME) project and identify gaps in socioeconomic and governance issues;
- recommend and/or develop appropriate valuation methodology for potential application in the valuation of ecosystem services in the GCLME countries;
- compile and aggregate estimates of the direct output value of goods and services for each of the relevant marine sectors of the 16 countries bordering the GCLME;
- develop case studies of the potential economic effects of prospective GEF funding for the GCLME;
- Estimate the scale of resource rents that could be obtained from the economically optimal management of the marine resources of the case studies and how the rents can be invested in sustainable management of the area;
- outline how ecosystem value estimates can be used (1) to modify the system of national accounting in the GCLME countries;
- identify what appropriate economic, demographic, public service, fiscal and social analysis techniques are available for analysis/projection of socioeconomic impacts of developing the GCLME resource;
- based upon the analyses in tasks above, prepare a report to UNIDO summarizing the estimates for the GCLME and the results of the case studies;

- ❖ arrange for a review of the final report by outside experts and submit the Report to UNIDO.

Review of Transboundary Diagnostic Analysis: The transboundary diagnostic analysis (TDA) was reviewed. The TDA contains a lot of relevant information. Most of the issues raised and made available to UNIDO in our initial preliminary report have been incorporated in the updated TDA.

Appropriate Valuation Methodology: The rationale for economic valuation, approach to be used, review of valuation studies in the marine area, details of available valuation methodologies and specific methods to be used for the GCLME was outlined. Table 1 of the executive summary (Table 1ES) shows the specific valuation techniques to be used for goods and services in the GCLME.

Table 1ES: Valuation techniques to be used for goods and services in GCLME

Goods and Services	Kinds of Value	Economic Valuation Techniques
Fishery	Direct Use Value	Economic rent/contingent valuation/change in productivity approach
Recreation/tourism	Direct Use	Travel Cost
Ecological functions	Indirect and option	Contingent valuation
Cultural Values		Contingent valuation
Biodiversity generally	Direct use/indirect use	Choice experiment/ contingent valuation
Other mangrove resources	Direct use/indirect use and option	Contingent valuation/choice experiment

Source: Summary of valuation techniques as included in the study

Estimates of Direct Output Value of Goods and Services: The Direct Output Impact (DOI) methodology was applied in the estimation of the goods that could be obtained in the GCLME. The main products covered in this estimate of value of goods and services of GCLME are marine fisheries, offshore oil production, Non Timber Forest Products (NTFP), mining (Sand, Salt, Granite and Phosphate). The total value of the output from these sectors based on available data was $50,953,325,680

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Case Studies of Potential Economic Effects of Prospective GEF Funding: Two case studies were summarised in the report. The first case study showed that an increase catch/landing by 10% without an increase in cost of fishing due to GEF funding and subsequent restoration of the GCLME would lead to 21%, 75.82%, 20.24% and 53.86% increase in net returns for artisanal fishermen with hooks, artisanal fishermen with nets, semi-industrial outfits and trawling companies respectively. The second case study showed that a 10% decrease in direct cost for without any increase in the returns from fishing due economic optimal management of GCLME due to GEF funding will lead to 8.39%, 50.55%, 9.26% and 35.33% increase in net returns for artisanal fishermen with hooks, artisanal fishermen with nets, semi-industrial outfits and trawling companies respectively.

Estimates of Resource Rents and Effects on Fish Resources: The estimates show that, with 10% increase in returns to the fishermen and in the landing value of GCLME (case 1), the amount of rent to be obtained from the landing value of GCLME annually ($3,088,066,282)

will be over hundred times higher than the total GEF funding ($20,814,404.00). Thus investing ten percent of this amount annually into the proposed management that GEF funding will put in place will ensure the sustainability of the GCLME.

Proposal for Using the Ecosystem Value Estimates to Modify the System of National Accounting: The study described the present system of national accounts, identified the shortcomings in the system with respect to its disregard to ecosystem resources, outlined approaches to environmental accounting and recommended the procedure for generation of ecosystem value estimates and accounts to be generated for the GCLME countries.

Economic, Demographic, Public Service, Fiscal and Social analysis techniques for Analysis/Projection of Socioeconomic Impacts of Developing the GCLME Resource: The study identified and described various impact methodologies and approaches for both direct and indirect impact assessment and for ex-ante and ex-post assessments. Recommendations were made for impact analysis of the GCLME based on proposed/expected interventions. Table 2ES shows the summary of expected intervention /results of the GCLME project and socioeconomic impact approaches to be adopted.

Table 2ES: Expected intervention and results of the GCLME project and proposed socioeconomic impact approaches to be adopted

S/ No	Intervention/Results	Nature of Impact	Proposed Technique Before project	Proposed Techniques After project
1	Recovery and sustainability of depleted fisheries and living marine resources	Direct/Indirect	Social impact assessment (SIA), cost benefit analysis	SIA, propensity score matching/instrumental variable technique (IV) and other methods for ex-post analysis of assigned programs
2	Reduce land and sea –based pollution and improve water quality	Direct and Indirect	Social Impact Assessment (SIA)	SIA, Computable General Equilibrium (CGE)
3	Planning for biodiversity conservation, restoration of degraded habitats and develop strategies for reducing coastal erosion	Direct/indirect	SIA	
4	Improved institutional structure for conducting effective regional interventions for fisheries, biodiversity conservation and pollution prevention (emission payments and tradable permits issues may be involved)	Indirect		SIA, CGE
5	Improved legal/management structure and legislative reforms including rent and tax reforms for fisheries, land based activity and biodiversity	Indirect		SIA, Ex-post behavioural marginal incidence analysis
6	Nine successful demonstration projects	Direct/Indirect		SIA, Propensity Score Matching Technique, Double Difference, IV

Source: Recommendations by the authors

INTRODUCTION

Background and Problems of the GCLME

The Guinea Current Large Marine Ecosystem (GCLME) extends from Bissagos Island (Guinea Bissau) in the north to Cape Lopez (Gabon) and Angola in the south. The GCLME area (fig. 1) is considered to include the Exclusive Economic Zones (EEZ) of sixteen countries, namely, Angola, Benin, Cameroon, Congo, Côte d'Ivoire, Democratic Republic of Congo, Gabon, Ghana, Equatorial Guinea, Guinea, Guinea Bissau, Liberia, Nigeria, Sao Tome & Principe, Sierra Leone and Togo (GCLME project document, Koranteng 2001). The oceanography of the two Congos and Angola further to the south is influenced by the Guinea Current and thus their inclusion in the Guinea Current Large Marine Ecosystem (GCLME). The area is characterized by its tropical climate; in fact, climate is the primary force driving the LME, with intensive fishing as the secondary driving force. The coastline of the sub-region is generally low lying and interspersed with marshes, lagoons and mangrove swamps (UNEP, 2005). The physical system of the Guinea Current is highly variable and unstable with intensive seasonal upwelling in the northern sub-system especially of the coast of Ghana and Côte d'Ivoire from July to September. The southern half is generally thermally stable and depends on nutrient input originating from land drainage and river flood and turbulent diffusion, although less intensive and periodic upwelling have been reported.

The GCLME is one of the world's most productive marine areas that are rich in fishery resources, petroleum production, and an important global region of marine biological diversity supporting the livelihood of many communities, especially those living around the coast. Approximately 40% of the region's 280 million people live in coastal areas and are dependent on the lagoons, estuaries, creeks and inshore waters surrounding them. Fishery resources in the Guinea Current region include over 300 species of finfish, 17 species of cephalopods, 25 species of crustaceans, and 3 species of turtles (FAO, 2004).The fishery resources are exploited by both artisanal and industrial fishing fleets, the latter of which is made up of both local and foreign flag vessels. For example, in Nigeria, the artisanal canoe fleet exploits coastal waters up to 5 nautical miles from shore while 40 fishing and 266 shrimping vessels were licensed in 1997, and 62 fishing and 162 shrimping vessels in 1998 (FAO,2000). Generally, over 60% of national fish landings in the sub-region are made by artisanal fishers. FAO records show that there was a catch of 950,000 tons in 1990 and 900,000 tons in 1999, although there was a decline to 700,000 tons in 1994. The target species off the Coast, Ghana and Togo are *Sardinelia aurita, Sardinelia maderensis, Scomber japonicus* and *Engraulis encrasicolus*. Further south, from Benin to Democratic Republic of the Congo, the target species are *Ethmalosa fimbriata, Sardinella maderensis* and *lisha africana*. In Nigeria, the demersal target species exploited by artisanal fishing units are: croakers (*Pseudotolithus*), threadfins (*Galeoides, Pentanemus* and *Polydactylus*), soles (*Cynoglossidae*), marine catfish (*Arius*), brackishwater catfish (*Chrisichthys*), snapper (*Lutjanus*), grunters (*Pomadasyidae*), groupers (*Epinephelus*), and the estuarine white shrimp (*Palaemon*).

The mangroves areas, which form a great part of the eco-region, are also important areas for the local communities. These mangroves beside the species available in them act as spawning ground for fish species. Some of the mangrove species available especially in the Niger Delta area of Nigeria, the largest mangrove in Africa (9,730 km^2) and the third largest in the world, include *Rhizophara* sp, *Conocarpus* sp, *Avicennia* sp, *Mitragyna inermis*, *Laguncularia* sp.

Despite its resources, the GCLME is facing a lot of challenging problems, namely, population explosion and urbanization, fisheries depletion, water pollution, public health and sanitation, habitat degradation, coastal erosion, loss of biological diversity, and land-use (UNEP, 2005) all of which have been exacerbated by human activities. For example in Ghana, a marine prawn of the *Paenus* sp. which is a delicacy for the coastal community in the area is now on the endangered list due to over exploitation. In Nigeria the establishment of the oil industries close to the EEZ has caused high migrations to the coastal towns like Bonny, Eket and Port Harcourt. This results in a great increase in wastes discharges to water courses with accompanying negative impacts. Also, in the Niger Delta area of Nigeria, the construction of jetties, sand and gravel mining, dredging and removal of vegetation has worsened coastal erosion. Pollution is also a major issue. UNEP, (2006) in the final report of the Global International Water Assessment (GIWA) indicates that the main pollution problems are degraded water quality, the loss of critical habitats for migratory and non-migratory species, effluents in rivers flowing into the LME, the risk of offshore spills, marine debris and beach pollution, and industrial and solid waste. Pollution from oil and gas exploration is a major potential danger for coastal fisheries. For example, In Nigeria oil is produced from the Niger Delta (over 90 oil fields, about 6,200 km of flow lines and pipelines spread over 30,000 km2 of the Delta). The primary productivity surveys have revealed an increasing occurrence of harmful algal blooms indicating intense eutrophication and therefore excessive nutrient loading from anthropogenic sources, especially domestic/sewage. Based on the transboundary diagnostic analysis, the major problem experienced in the GCLME are:

- decline in GCLME fish stocks and unsustainable harvesting of living resources (fish trawlers landings manifest the degrading status of the stocks as landings are dominated by juveniles of the most common species, while certain highly valued/prized species have virtually disappeared);
- uncertainty regarding ecosystem status, integrity (changes in community composition, vulnerable species and biodiversity, introduction of alien species) and yields in a highly variable environment, including effects of global climate change;
- deterioration in water quality (chronic and catastrophic) from land and sea-based activities, eutrophication and harmful algal blooms;
- habitat destruction and alteration including *inter-alia* modification of seabed and coastal zone, degradation of coasts capes, and coastline erosion.

It is important to note that a rapidly decreasing fish stock will cause not only a problem in protein supply for the large populations around the coastal communities but the whole West Africa region, even as the livelihoods of commercial fishermen in the areas are threatened. In addition, the physical destruction of coastal habitats, including wetlands, causes the loss of spawning and breeding grounds for most living resources and the loss of the rich and varied fauna and flora of the region, including some rare and endangered species.

Based on these problems and others as identified in the transboundary diagnostic analysis (TDA), the GEF project "combating living resources depletion and coastal area degradation in the Guinea Current Large Marine Ecosystem through ecosystem-based regional actions" implemented by UNIDO aims to reverse these trends and to achieve long-term development goals. These include: recover and sustain depleted fisheries; restore

degraded habitats; and reduce land and ship-based pollution by establishing a regional management framework for sustainable use of living and non-living resources in the GCLME. The economic valuation of ecosystem services and marine resources of the guinea large current marine ecosystem is a sub-component of the project towards achieving the stated goals.

Figure 1: Map of Africa Showing the GLCME countries

Terms of Reference/Objectives of the Economic Valuation Assignment

The terms of reference as specified in the duties, specific tasks and expected results of the economic valuation project, as given by UNIDO, is indicated below.

Duties:

- information capture, exchange and networking between a wide range of participants in the GCLME including government officials, private sector, scientists, non-governmental organizations and the public at large on issues related to Economic Valuation of Ecosystem Services and updating of the socio-economic and governance aspect of the Transboundary Diagnostic Analysis (TDA).

The following specific tasks and expected results are stipulated:

Table1: Specific Tasks of the Economic Valuation Study

S/No	Main Duties	Expected Results

1	Review the Transboundary Diagnostic Analysis (TDA) of the Guinea Current Large Marine Ecosystem (GCLME) project and identify gaps in socioeconomic and governance information in the TDA. Analyze the identified information in the context of available documentation and update the socioeconomic and governance components of the TDA. Participate in the Regional TDA Task Team Meeting and present the report.	Socio-economic and governance aspects of TDA updated
2	Recommend and/or develop appropriate valuation methodology for potential application in the valuation of ecosystem services in the GCLME countries.	Valuation methodology prepared
3	Compile estimates of the direct output value of goods and services for each of the relevant marine sectors of the 16 countries bordering the Guinea Current Large Marine Ecosystem (LME). Aggregate these estimates for the Guinea Current Large Marine Ecosystem (LME)	Estimated of value of ecosystem goods and services compiled
4	Develop case studies of the potential economic effects of prospective GEF funding for the Guinea Current Large Marine Ecosystem (LME)	Case study developed
5	Estimate the scale of resource rents that could be obtained from the economically optimal management of the marine resources of the case studies. Explain how these rents can be sustainably invested in environmental protection and resource conservation efforts of the type that GEF is supporting in the Guinea Current Large Marine Ecosystem (LME).	Report on resource rent prepared
6	Outline how ecosystem value estimates can be used (1) to modify the system of national accounting in the GCLME countries to better reflect the value of ecosystem services and natural capital, and (2) for project appraisal in the GCLME countries such that ecosystem services lost must be weighed against the benefits of a specific project.	Report with recommendations prepared
7	Identify what appropriate economic, demographic, public service; fiscal and social analysis techniques are available for analysis/projection of socioeconomic impacts of developing the GCLME resource.	Report prepared
8	Based upon the analyses in tasks (3) and (4) above, prepare a report to UNIDO summarizing the estimates for the GCLME and the results of the case studies. The report will present a comparison of the value of regional marine sectors with the amount of funding needed for continuation of project activities in the next phase.	Report on comparison of values of regional marine sectors and available funding prepared
9	Arrange for a review of the final report by outside experts and submit the Report to UNIDO.	Final report prepared and submitted

A REVIEW OF THE TRANSBOUNDARY DIAGNOSTIC ANALYSIS (TDA) OF THE GUINEA CURRENT LARGE MARINE ECOSYSTEM (GCLME)

Overview: The TDA was prepared as a first step to the development of the regional strategic action programme (SAP) by the 16 countries of the GCLME. It is a scientific and technical assessment where all the identified problems of the GCLME, root causes and impacts are elucidated including socioeconomic and governance issues exacerbating these problems in the bio-region as well as the priority areas for future intervention. In identifying the problems and root causes, the TDA specifies the ones that are transboundary in nature and in addition lists and prioritize activities or solutions to address the issue/problems and their root causes. Within the context of TDA, transboundary environmental issues include among others: regional/national issues with transboundary causes/sources; transboundary issues with national causes/sources; national issues that are common to at least two of the countries and that require a common strategy and collective action to address; issues that have transboundary elements or implications (e.g. fishery practices on biodiversity/ecosystem resilience).

The objective of the TDA, hence, is to provide, on the basis of clearly established evidence, structured information relating to the degradation and changing state of the GCLME; to scale the relative importance of the causes and sources of the transboundary water-related problems; and to elucidate practical preventative and remedial actions to ensure the sustainable integrated management of this unique environment. The design of the present Guinea Current TDA, which is still preliminary, involved a collaboration of the 16 countries in GCLME working group workshop which was organised within the framework of the PDF B of the GCLME.

The TDA, as it is currently, contains a lot of relevant information. Most of the issues raised and made available to UNIDO in our initial preliminary report have been incorporated in the TDA. However, few issues remain putstanding.

Identified Gaps in the Transboundary Diagnostic Analysis (TDA)

Few gaps on socio-economic and development setting that may be included in the review. These include:

- Data on budgetary allocation to environment and sanitation in countries and percentage of total budget
- Fishing methods in terms of number of boats especially motorized ones used by fishermen, and number of vessels used by trawling companies in the GCLME
- Tourism in terms of area visited, flow of tourists and impact on the GCLME
- Oil and gas exploration, number of flow stations located in the area, data on number of oil spills and volume of oil released, gas flaring, number of licensed companies
- Infrastructure development in the countries especially at the coastal communities
- Sanitation and solid waste disposal methods in the areas, data on volume and how these affect the ecosystem and data on urban waste water treatment
- Agricultural practices and use of agrochemicals (including data on the volume of agrochemicals imported by chemical companies in the region), fertilizer use and data on supply in the countries
- Information on erosion and land use changes

- Number of industries located in coastal towns and types/outputs

VALUATION METHODOLOGY FOR POTENTIAL APPLICATION IN THE VALUATION OF ECOSYSTEM SERVICES IN THE GCLME COUNTRIES

Concept of Value

Different groups have different perspectives on the value of ecosystems. The economists' perspective reflects the monetary value of goods and services using private market transactions, while the ecologist is interested in the intangible value inherent in ecosystems such as watersheds protection and carbon dioxide fixation and storage. Environmental economists have gone some considerable way towards evolving the taxonomy of economic values by specifying the total value of natural environments. Generally, the *total economic value* (TEV) of a resource includes the *use value* (UV) and the *non-use value* (NUV). The use value of a resource also referred to as total user value is the benefit derived from the actual use or potential benefit of a resource while the non-use value is *existence value* (EV) which arises from the satisfaction of merely knowing that the asset exists, although the valuer has no intention of using it.

The use value is categorised into *direct use value* (DUV) and *indirect use value* (IUV) and *option value* (OV). Direst use values are ecosystem goods and services that are directly used by man. It can be consumptive and non-consumptive, for example, catching fish in the marine environment. Direct use value is determined by the contribution an environmental asset makes to current production or consumption (Munasinghe 1995). Use value can be reduced by pollution or certain types of development as in the case with GCLME. Indirect use values are benefits that arise due to the functional services of the environment e.g. ecological functions. Option value, on the other hand, is potential benefit. It is essentially an expression of preference, a willingness to pay, for the preservation of an environment against some probability that the individual will make use of it at a later date either by oneself (option value) or by others (bequest value); for example, the value of protecting a reservoir from nearby development activities because it might be needed as a future source of drinking water for a municipality. Non-use value refers to satisfaction/benefits people derive from something just by knowing that it exists although they do not obtain any direct benefit from it.

The concept can be expressed in equation form thus:

TEV = UV+NUV
TEV = DUV+IUV+OV+EV

Where:

TEV = Total Economic Value
DUV = Direct Use Value
IUV = Indirect Use Value
OP = Option Value
EV = Existence Value

According to Seenprachawong (2002), the analysis of economic values of coastal and marine resources can be done in line with the following functions:

(a) Ecological function: Marine and mangroves perform many important ecological functions for man. They serve for biodiversity regulation, nutrient recycling, air quality and climate maintenance, detoxification, and natural hazard regulation. They are also valuable in providing protection against coastal erosion and coastal storms.

(b) Consumption: Plants and animals in the mangroves and marine provide many goods which satisfy human needs. Mangroves serve as natural nurseries for the breeding of large numbers of commercially important species. Many coastal people have lived, fished, and hunted within mangroves, deriving valuable commodities from them such as timber, fuel, medicine and food. Besides, artisanal fishermen and industrial fishing fleets exploit the marine areas for several species of fish and novel products.

(c) Aesthetic value: Coastal tourism appears to be on the rise throughout coastal cities around the world. The potential of Mangroves for tourism is increasingly being explored in recent years.

(d) Future: The importance of conservation of the mangroves and marine ecosystems in general, takes on an added dimension as scientists are increasingly turning to the biodiversity of the sea in their search for medical cures and unique compounds.

(e) Existence**:** The diverse plants and animal species in the mangroves and marine ecosystems have a need to exist, regardless of their use to us. Some people wish to see them preserved, although they do not currently make use of them.

Figure 2 shows categories of Economic Value attributed to Coastal and Marine Resources

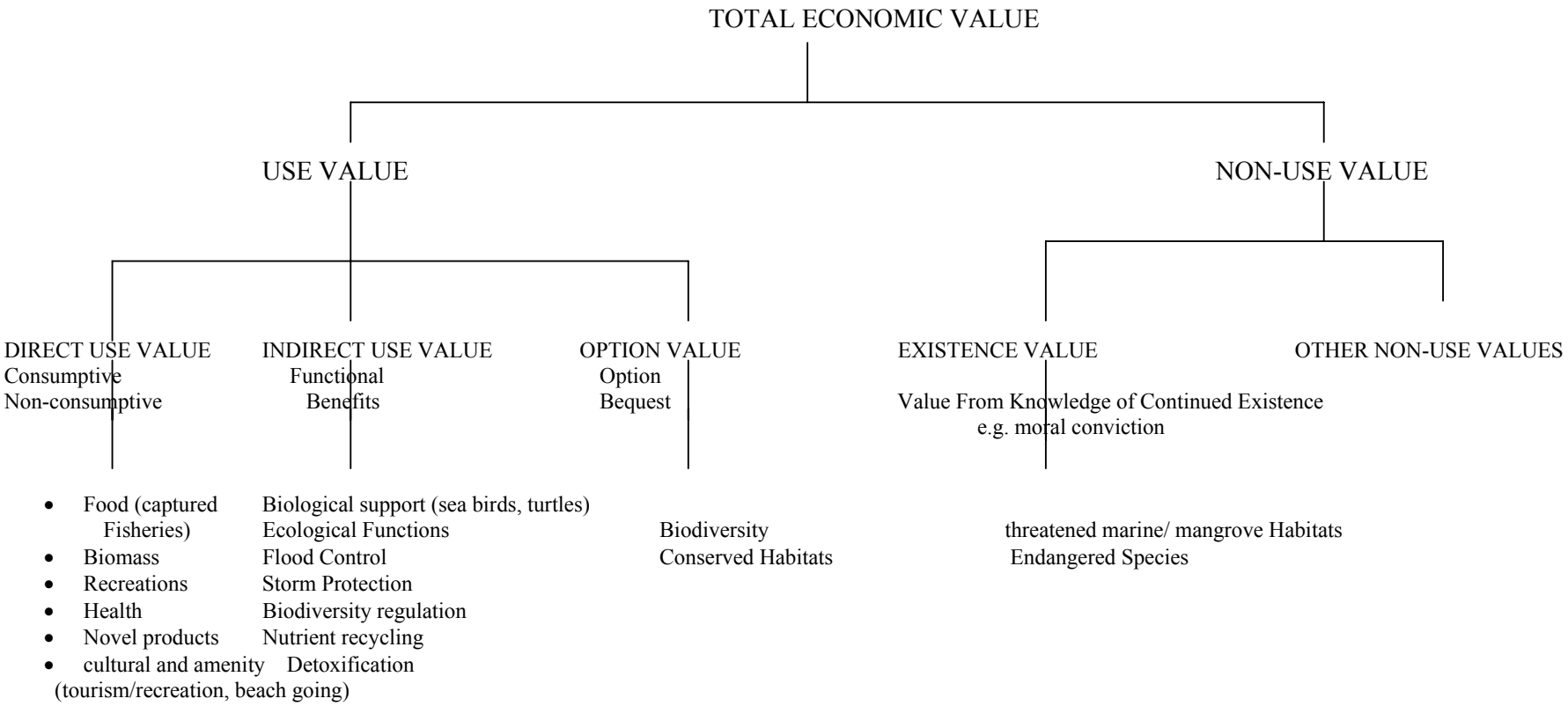

Fig 2: Categories of Economic Values Attributed to Coastal and Marine Resources, adapted from Barton, 1994 and Munasinghe, 1995

Rationale for Economic Valuation of Ecosystem Services

Initially, natural resources and ecosystems were thought to be gifts from nature and should be exploited to the fullest and there was no need to value them. Besides there are no markets where they are sold thus even if one wanted to attach value to them, there would not be any means by which it could be done. However, current thinking and experience shows that successful long term economic development depends on wise use of natural resources especially as natural ecosystems are under enormous pressure from growing demands placed on them. is increasingly evident that the major reason for excessive depletion of natural ecosystem is the failure to account for their value in development decisions. Thus concerns about the need to conserve natural ecosystems for the present and future generations based on the benefits derived from them, and the dangers of losing them, which sometimes are irreversible when damaged, have led to an explosion of efforts to value them and the services they provide. With valuation, the cost and benefits of an ecosystem, the beneficiaries, those who bear the cost (that is winners and losers), and financing mechanism for ecosystem conservation will be known. Valuation can help identify the main beneficiaries of conservation and the magnitude of benefits they receive, and help design measures to capture some of these benefits and contribute to financing of conservation (World Bank, 2004).

Furthermore, most countries especially developing countries rely heavily on agriculture, tourism, fishing, and forestry for job creation, poverty alleviation and export income. Although these activities depend on natural ecosystem to provide fertile soils for crop production, lush vegetation and wildlife to attract tourists, clean water and healthy mangrove swamps to sustain inland and off-shore fisheries and healthy forest for the production of timber, fuel wood and other commodities, their contribution to national economies are often not know or accounted for in the national accounts. This undermines the benefits from these ecosystems and subsequently little or no incentive for their conservation. However, estimating the economic value of the benefits provided by natural ecosystems can provide a much more accurate sense of how important those ecosystems are to the economy (World Bank, 2004). In addition, estimate of the benefits from an ecosystem will guide and justify spending for its conservation. By providing a means for comparing and measuring the various benefits of wetland and marine resources, economic valuation can be a powerful tool to aid and improve wise use and management of global/transboundry wetland and marine resources (Barbier, Acreman and Knowler, 1997). Generally, according to the World Bank (2004), economic valuation can help make conservation financially sustainable in two ways. First, by demonstrating the benefits that ecosystems generate, and the increased benefits (or avoided looses) that conserving these ecosystems can bring to stakeholders, valuation can help convince decision makers to allocate more resources to conservation. Secondly, valuation can provide invaluable support to these efforts by identifying and quantifying the major benefits provided by a given ecosystem.

As regards the GCLME, valuation is imperative if the current problems experienced in the region can be reversed or mitigated. In order to achieve the objectives of recovering and sustaining depleted fisheries; restoring degraded habitats; and reducing land and ship-based pollution, it will be important to understand the total value of the ecosystem's contribution to the society. Economic valuation would help to demonstrate and quantify its economic value in terms of raw materials, protection of natural and human systems, and maintenance of options for future economic production and growth, as well as the costs associated with the loss of these benefits through resource degradation. In addition, it will be important to know the value/effect of the impact of different management approaches; the

change in the value of the ecosystem if conservation action is undertaken, including opportunity cost of conservation; how the change will affect different stakeholders (that is who are the beneficiaries and the losers); and how beneficiaries could be made to pay for the services they receive to ensure that the GCLME is conserved and its services sustained – that is identifying and developing potential financing mechanisms and economic incentives for management. It will also assist in obtaining funding from insurance companies for mitigation measures if resources are damaged through an accident, such as an oil spill or ship wreck.

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Natural Resource Valuation Practice in a GCLME Country, Nigeria

Generally, the valuation practice in Nigeria like most of the GCLME countries is weak. The Legal basis for valuation of natural resources for compulsory or compensatory damage assessment is the Land Use Act, the Oil Pipeline Act, and the Petroleum Act. While the Land Use Act arbitrarily stipulates a fee for crops and economic trees, the Pipeline and Petroleum Act does not set a specific rate for valuation. For crops, the Land Use Act states that the valuation will be carried out as directed by the appropriate officer who is the Chief Land Officer of the state concerned or federation. In some states the Chief Land Officers are not professionals with respect to valuation and their recommendations can neither be progressively done or market based.

The Petroleum Act provides for fair and adequate compensation. In practice victims of compulsory acquisition and oil pollution rarely receive fair and adequate compensation when compared with international standard. It should be noted that the land use decree is effective on all land revoked from 29th day of March, 1978 while for all lands acquired before the decree and of which compensation has not been paid thereon was and still enforceable under the public land acquisition (Miscellaneous provisions) decree of 1976. Under the land use decree of 1978, claims could be made under the following headings:- Crops, Structures, and Land

For land what is to be paid for is the rent paid by the owner on the year of acquisition if he has paid the rent to the government. For crops, it is as recommended by the appropriate officer; Section 20 (11) of the Oil Pipeline Act provides that: "If a claim is made under subsection (3) of section 6 of this act, the court shall award such compensation as it considers just in respect to any damages done to any buildings, crops or profitable trees by the holder of the permit'. By implication whoever is not satisfied with the compensation paid to him may resort to the courts for justice, but the judgment of the court is ultimately based on existing legal framework.

In practice, natural resource valuation especially in the wetland area, the Niger Delta, is often based on the Oil Producers Trade Section (OPTS) scale. The OPTS which is a section of the Lagos Chambers of Commerce and Industry (LCCI), is an umbrella body for major oil producing companies in Nigeria. Under existing environmental laws and regulations, compensation is paid for damage to buildings, crops, fish and economic trees. The classification 'economic trees' has often meant that non-timber forest products (NTFPs) such as medicinal plants of global significance are assigned little or no values whatsoever. Often times, the compensation rates are abysmally low, unrealistic and have the consequence of promoting environmental degradation and subsequent loss of biodiversity. Thus assigning the full value to environmental resources has the potential to yield more efficient use of the resources, reduce the negative environmental impact of oil and

manufacturing activities, as well as compensate local communities for their stewardship of the nation's natural resources endowment.

These evidences of weak valuation practice are supported by the views of the discussants in a round table/focus group discussion among different stakeholders in the oil industry in Nigeria organized by Bioresources Development and Conservation Programme (BDCP), an international NGO based in Nigeria, in 2002. The discussants observed that there is no baseline data on natural resources in Nigeria and this affects natural resource valuation. They indicated that there should be a clearinghouse mechanism for biological resources in Nigeria. In addition, the discussants recognized that professionals are not involved in the valuation of environmental resources and in damage assessment in Nigeria and that resource valuation is not based on total economic value approach. As a result, the full value of natural resources is not captured in valuation practice in Nigeria.

Economic Valuation approach to be employed in the GCLME

Four distinct approaches will be employed in the economic valuation of Guinea Large Current Marine Ecosystem.

First, the value of the flow of benefits from the ecosystem will be determined. This is the value that will guide national accounting and transboundary decision making especially on issues relating to the value of services derived from the area. The stages and ways of realising this are discussed in the preceding sections.

Secondly, the net benefits of various proposed intervention that will alter the present condition of the ecosystem will be determined. This will help to determine changes in flows of costs and benefits and whether benefits of particular intervention would justify the cost. The compilation of direct output value and costs and development of case studies of potential economic effects of GEF funding for GCLME will assist in achieving this objective.

Thirdly, the distribution of costs and benefits experienced by different stakeholder groups in the ecosystem will be determined. It is expected that understanding which groups are motivated to conserve or destroy the ecosystem based on the benefits or costs they derive would help in the design of more effective conservation approaches. The preceding part of this report shows how this will be done, how socioeconomic impacts of proposed changes in GLCME will be measured and case studies of how benefits are distributed using available cost and return data.

Fourthly, potential financing sources for conservation would be identified. By knowing the main beneficiaries of the ecosystem and estimating the benefits they receive, the scale of resource rents that could be obtained for optimal management of the marine will be derived.

Framework Guiding Derivation of the Value of the Benefits from GCLME

Economic valuation, in order to be relevant, must measure the right thing and in a right way. Thus, based on this guiding principle, the economic valuation process that would be used for the valuation of the Guinea Current Large Marine Ecosystem would involve three stages; namely, defining the problem and assessment approach, defining the scope and limits of the analysis and information required for the chosen assessment approach, and defining data collection methods and valuation techniques required for the economic appraisal, including any analysis of distributional impacts.

The first stage would involve three approaches depending on what is to be valued. The assessment approach could be impact analysis, partial valuation or total valuation.

Impact analysis will be appropriate if the damage inflicted on the marine or coastal area by specific external impact is to be determined, for example, the case of oil pollution in the GCLME. Partial valuation is appropriate if alternative use options are to be considered while total valuation is appropriate when one is interested in knowing the total benefit of the ecosystem to the society especially in terms of developing a conservation strategy and inclusion of value in the national accounts. The total benefit of GCLM ecosystem would be derived besides determining the impact of pollution.

The second stage would involve the definition of the audience, wetland area, and scope and limits of the valuation and information. In this regard, the audience would be determined, the components and attributes of the GCLME will be identified and defined and ranked based on their importance, the attributes will also be categorized based on the type of value, for example, use or non use value, and the information required will be described.

The third stage would involve the description of actual valuation methodologies that will be used for the specific valuation process of the GCLME whether the process is impact analysis, partial valuation or total valuation.

Box 1: Seven steps (in three stages) to conducting a valuation study

Stage 1

1. choose the appropriate assessment approach (impact analysis, partial valuation, total valuation) based on the objective;

State 2

2. define the wetland area and specify the system boundary between this area and the surrounding region;
3. identify the components, functions, attributes of the GCLME and rank them in terms of importance (e.g., high, medium, low);
4. relate the components, functions and attributes to the type of use value (e.g., direct use, indirect use and non-use);
5. identify the information required to assess each form of use (or non-use) which is to be valued and how to obtain the data;

Stage 3

6. use available information to quantify economic values, where possible;
7. implement the appropriate appraisal method, e.g., contingent valuation method (CVM), cost benefit analysis (CBA) etc.

Adapted from Barbier, et al, 1997

Conventional Economic Valuation Methods

***Market Valuation Techniques*:** The market valuation techniques are based on the use of market prices and costs. In this regard, the direct market prices or shadow prices (a reflection of the actual price in relation to the economy) is used. These methods are best adopted when the environmental goods and services are transacted in formal markets.There

are three recognized market valuation techniques, namely, market price approach, appraisal method and resource replacement cost (cost-based approach). The market price approach identifies all elements damaged and assigns a value to their loss by their market value. The appraisal method is designed to determine the difference between "with injury" and "without injury" appraisal for land and apply that difference to the injured resource to measure compensable value. Resource replacement cost is the cost of acquiring comparable natural resources for conservation. Although these methods are observable and seem reliable and easy to measure, they are not capable of accounting for non-use values of natural resource and, therefore, do not reflect the true value of the damaged public natural resource. In fact they underestimate the true willingness to pay as they do not account for the consumer surplus.

Non-market valuation Techniques: Non-market valuation techniques use indirect measures to place an economic value on a natural resource. The non-market technique falls into two types, namely, revealed preference and stated preference techniques. Revealed preference methods identify the underlying preferences for goods and services based upon the market and non-market choices users reveal in their consumption patterns (Grafton, Pendleton and Nelson, 2001). Stated preference techniques ask the willingness of individuals to pay for a particular good in question. Revealed preference techniques include the following: travel cost method, hedonic price method, factor income, while stated preference techniques are contingent valuation method and choice modelling. The travel cost method, hedonic price method and factor income method make use of surrogate markets, that is markets that can be used to infer the value of the good while contingent valuation method and choice modelling uses constructed or hypothetical markets. Contingent valuation method (CVM) has the advantage of measuring use and non-use values.

Participatory Environmental Valuation: Besides the conventional methods, another method that has been developed and used successfully in Kenya is Participatory Environmental Valuation (PEV) (Emerton, 2003). This method combines conventional economic methods and participatory rural appraisal survey techniques. It aims to find a bridge between local economic categories and cash values and to elicit information about forest use and values in the subsistence, non-market level. PEV often uses pictures to refer to different forest products which are manipulated in order to value forest use. Instead of cash, it uses a numeraire for valuation, a commodity that forms part of the local socio-economy, has wide local significance as an item of value, and can easily be translated into a monetary amount. PEV follows a three-stage process. First, ranking of activities/products preferably using picture cards; secondly, values are established by distributing counters such as seeds or stones below the cards to represent the activity or product and the numeraire commodity. This gives an idea of the value of different resource uses relative to each other and to the numeraire. Thirdly, respondents state the purchase price of the numeraire commodity, which provides means for resource to be translated into cash amounts. These can be discounted to give average annual household forest use values at today's prices.
Table 2 shows the breakdown of economic valuation techniques.

Table 2: Valuation Techniques

Price-Based Valuation	**Surrogate Market Valuation**	**Constructed Market Valuation**	**Cost-Based Valuatio**
Market Prices Shadow Prices Related or Substitute Good - **Purpose** For Evaluating Timber and Non-wood Products (food, medicine, handicrafts) Fisheries	Hedonic Prices Travel Cost Change in Productivity – **Purpose** For Evaluating Environmental Amenities Recreation and Ecotourism Regulatory Ecological and Environmental Functions (flood Control, nutrient cycling, carbon sink, micro-climate regulator	Contingent Valuation Choice Modeling – **Purpose** For Evaluating use and on-use values including fisheries, wood and non-wood forest products conservation, Recreation and Eco-tourism Ecological and Environmental Functions Protected areas Cultural and Religious Values	Opportunity Cost Replacement Cost Relocation Cost Preventive Defensive Expenditure Dose Response Function – **Purpose** For Evaluating Damages to protected Areas Losses of ecolo and environmental Functions Health impa

Adapted from Mohd-Shahwahid and McNally, 2001

Livelihood Analysis: Although economic valuation gives adequate information about the economic values of natural resources, adequate management of these resources requires information about people involved and ways in which people use natural resources to sustain livelihoods. Thus to make an appropriate decision regarding the management of a natural resource, one not only needs the economic value obtained through the most comprehensive evaluation framework possible, such as the TEV, one also needs to know the contribution which this resource makes to livelihoods: who uses the resources? When? How? The Sustainable Livelihoods Framework (Scoones, 1998) can help to provide a better understanding of the relationship between human society and natural resources. Thus sustainable livelihood approach (SLA) can be a good complement for the conventional economic valuation approaches. The SLA is a holistic and people-centred approach that attempts to capture and provide a means of understanding people's livelihoods and in particular the factors and processes which affect these livelihoods. The framework consists of five components: (1) the vulnerability context of the environment in which the communities under consideration operate; (2) the livelihood assets of these communities; (3) the policies, institutions and processes (PIPs) which affect their lives and in particular their access to livelihood assets; (4) the livelihood strategies which the communities adopt; and (5) the outcomes they achieve or aspire to. An important aspect of the SLA is its use in helping to understand the role of institutions (e.g. rules which affect resource access).

Empirical Review of Some Marine/Wetland Economic Valuation Studies

Some studies have dealt on valuation of marine ad coastal resources. Costanza et al. (1989) used both WTP and energy analysis-based methodologies to value wetlands in Louisiana. Again focusing on wetlands, Bergstrom et al. (1990) assessed the recreational value of Louisiana coastal wetlands within a total economic value framework which divided components into current use, non-use, and future use values. Their results indicated sizable aggregate economic values (of about $145 million annually) for Louisiana wetlands. Van't Hof (1985) analysed marine parks and protected areas in the Caribbean region and concluded that marine parks have high cost-benefit ratios. Hodgson and Dixon (1988) researched the benefits of fisheries and tourism in Palawan, Philippines. Barbier, Adams and Kimmage (1993) conducted a partial valuation to assess the economic importance of Hadeja-Nguru wetlands, and thus the opportunity costs to Nigeria of its loss. The authors estimated some of the key direct use values the floodplain provides to the local people through the exploitation of the resources (Barbier *et al*, 1997). Day and Mourato (2002) estimated the value of river quality in China using CVM and concluded, among others, that WTP for preventing river quality from deteriorating is positive and amounts to around 1 per cent of household income. Yeo, H. B (2002) conducted a valuation study of the marine park in Malaysia using CVM and found out that 91 per cent of the respondents were willing to pay entrance fees. However this depends on the money being channeled back to build capacity and enhance the management of the marine park.

Mathieu, Langford, and Kenyon (2000) used contingent valuation method (CVM) to determine the willingness of tourists to pay for visits to marine national parks in Seychelles. The findings show that the WTP values are over and above those benefits that are currently realized, as willingness to pay values for visits to the parks are higher than the current 50 Rupees fee (both for people having visited a park and people having not visited any park). Therefore, the entrance fees could be increased without sharp reductions in visitation. Mohd-Shahwahid and McNally (2001) conducted an economic valuation of the terrestrial and marine resources of Samoa. The study made use of several techniques which include market price, CVM, and benefit transfer approach. Two estimates of the total economic value (TEV) of the goods and environmental services of the forest and marine resources of Samoa were computed. The first estimate of ST$21.0 million per annum [about 2.7% of Samoa's GDP] refers to the TEV from the perspective of the citizens of Samoa, by excluding the values generated for the benefit of the rest of the world while incorporating that of the rest of the world, gave the TEV as ST$232.5 million per annum. The study found that the economic rent of the resources where not adequately paid for by the resource users. In addition, the result of a marine valuation in Kenya (Emerton and Tessema, 2001) shows that the Marine Park and Reserve was generating income in excess of US$1.6 million a year in net revenues from tourism, and a further US$39,000 from fisheries. These returns are far in excess of the estimated management and opportunity costs associated with the park of some US$190,000 a year. The economic benefits would have been greater if other economic benefits of the marine protected area, such as its contribution to shoreline protection, marine productivity, wildlife habitat and nursery, cultural and aesthetic values, had also been considered. Moreover, Seenprachawong (2002) conducted an economic valuation of Coastal Ecosystems in Phang Nga Bay, Thailand using choice experiment. The study focused on the willingness of the Thai people to pay for improved environmental quality in Phang Nga Bay and on their attitudes towards environmental protection. Based on the findings, the study recommended, among others, that the government introduce a two-tier basic entrance fee for

marine parks in Phang Nga Bay, with different rates for residents and foreigners. Thais pay an entrance fee of 40 Baht (USD 1) while foreigners pay 400 Baht (USD 10).

Valuing the Guinea Large Current Marine Ecosystem

Constraints in Valuing Marine Ecosystem: The marine environment has some futures which tend to constrain economic valuation. First, a large part of the marine areas are outside the territorial limits of individual countries and are being exploited like a common property resource (in terms of fishing), and also used as a (costless) sink for wastes. Thus there is a tendency of tragedy of open access. Also, the resources are multi-purpose in nature, which have both use and non-use values. For example, besides fish, the marine area serves for recreation, biological support, performs other ecological functions and serves as an important pool of biodiversity. Also coastal resources, especially mangroves produce, among other things, wood (which can be processed into charcoal), medicinal and aromatic plants and serves as breeding grounds for shrimp and fish, and as bird sanctuaries, among others.

In addition, the fact that the species are migratory in nature and not confined to national boundaries makes it more difficult to prepare precise accounts, even for the marine resources within the 200-nautical mile limit of nations. Furthermore, there are significant limitations in knowledge on how pollution physically affects marine output, biodiversity, and the various services. Besides, measuring stocks of fish and that of other organisms and the determination of the sustainable level of exploitation is difficult.

Assessment Approach for GCLME: The assessment approach that will guide the economic valuation of GCLME is the total valuation approach. The total valuation approach will enable the estimation of total benefits derived from the conservation of the marine ecosystem. The information to be obtained will guide the inclusion of benefits in national accounts and in determining resource rents.

Functions and Attributes of the GCLME: The GCLME, serves as a source of resources and performs numerous environmental functions. The resources and functions of the GCLME categorized into use and non use values are presented in Table 3.

Table 3: Functions and attributes of GCLME

Consumptive Use values	**Non-consumptive use values**	**Indirect use values**	**Non-use values**
Captured fish species, non-timber forest products from mangrove locations, medicinal products from mangroves, salt extractions	Recreation for tourists including beach going, novel products, fuel and fiber, water transport (shipping), sand/gravel, other minerals	Detoxification, storm protection, biodiversity regulation, ground water recharge mangrove), nutrient cycling, air quality and climate, flood and flow control, biological support (sea birds and turtles), other ecological functions	Biological diversity, cultural heritage

Major Issues that will Guide the Valuation: The major environmental issue of the GCLME that will guide the valuation study are the issues of resources depletion especially depletion in fish catch and marine pollution and their effect on livelihoods. As earlier noted, the fish stock is rapidly depleting due to over fishing as catches are dominated by juveniles and output of artisanal fishermen are low due to environmental degradation. Pollution issue is very critical that the Guinea Current area places priority on pollution both from land-based sources and oil and gas exploration and production and on coastal processes like erosion (UNEP, 2005). Major sources of pollution include coastal industries, marine mining (especially oil exploration activities), and waste disposal. The other major issue that will guide the valuation study is the tourism aspect of the GCLME including beach going. Although the size of coral reefs in the GCLME is about 4% of the region, valuation study will also be focused on coral reefs in the ecosystem.

Recommended Valuation Techniques: In economic valuation it is often helpful to have value estimates from multiple methods as valuation estimates are mostly sensitive to the valuation method used. Thus, a combination of conventional economic valuation techniques (both market and non- market valuation techniques) and sustainable livelihood approach is recommended for the economic valuation of GCLME.

Market Valuation Approach: In market valuation approach, market prices of products that are traded in the market should be used to estimate the total value of production. The major product that should be considered is fish. Timber products and other mangrove species, especially periwinkle should be considered. Periwinkle is a major non-timber forest product from the mangrove ecosystem. This will assist in deriving the economic rent of the resources. When a good is traded in the market and information exists on the costs of production, this information can be used to derive the economic rent of natural resources (Mohd-Shahwahid and McNally, 2001). The value of output of fish production and cost of production for both artisanal fishermen and that of trawling industries should be obtained. The selling price of the various fish species should also be obtained. The running costs will include payments for fuel, bait, ice, labour man-hours and maintenance of fishing gear. Fixed inputs include man-made fixed assets such as the boat and fishing gear. Other cost of running fishing vessel should be obtained from the trawling companies. Beside the breakdown of cost elements, the output of fish, that is, quantity of fish stocks caught should be obtained. Also, the information would assist in doing a cost benefit analysis (applying discounted measures) for the different intervention scenarios.

A basic model to estimate the economic rent of marine fishery resources: The economic rent from fishing should be obtained by calculating the difference between the selling price and the direct costs of production and other returns to fixed assets. A portion of the total profit margin should be imputed and allocated to the fisherman for his effort and entrepreneurial skill while the rest should be allocated as the rent from the marine resource for producing the stock of fish that is caught. Thus economic rent can be written as:

$$R = FP - ADC - AIC - APM$$

where: R = the resource rent per unit of fish caught;
FP = the price per unit of fish sold to the middlemen;
ADC = the average direct cost of fishing and transporting (not inclusive of a normal profit margin for the fishermen);

AIC = the average indirect cost of fishing; and
APM = equitable profit margin allocated to the fishermen for the effort and risks taken up.

The formula for calculating the resource rent from the fish stock caught will be adapted from the formula for stumpage timber value of Davis (1977), and Mohd Shahwahid and Awang Noor (1998) and given as

$$R = \sum_{i=1}^{n}\sum_{j=1}^{k} Q_{ij}\{(FP_{ij} - ADC_j - AIC_j - APM_j)\}$$

where:
R = the rent from the stock of fish caught per unit;
Qij = the quantity of fish caught by species group i and fishing boat/gear j;
FPij = the selling price of fish species i and grade class j to the middlemen;
ADCj = the average direct fishing cost using fishing boat/gear j (not inclusive of the fisherman's equitable profit margin);
AICj = the average indirect fishing cost using fishing boat/gear j; and
APMj = equitable profit margin allocated to the fishing boat/gear

APM can be estimated as $\pi\sum_{i=1}^{n} Q_{ij}FP_{ij}$

Non-Market Valuation Approach: The non market valuation methods that are recommended for the valuation of GCLME are the travel cost method, contingent valuation method (CVM) and choice experiment. The travel cost method should be used to value recreation and tourism in the ecosystem while the CVM should be applied for estimating the use and non-use value of the ecosystem. The choice experiment should be used to ascertain the people's preference for a given set of marine/coastal environmental service or characteristic at a given cost and another characteristic or service at a different cost. The individuals that should be interviewed would include individuals and households living in the coastal areas, artisanal fishermen (60% of fish harvesters), and other users of the marine resources found in the area e.g. tourists.

The CVM Approach: Two value elicitation formats are recommended for the valuation of GCLME. The value elicitation formats to be used are discrete choice (often referred to as referendum CVM) with open-ended follow-up question and the stochastic payment card approach. The valuation formats will be applied to different samples and later the responses are compared.

Discrete Choice with Open-ended Follow-up Question: Although, the dichotomous choice format is a common elicitation method, the use of an open-ended follow-up question to a binary (close-ended) one has been proposed and used by Mitchell and Carson (1989). In addition, Green et al (1995) argue that a binary question with open-ended follow up question provides far more information on WTP and on plausibility of responses than alternatives such as the double referendum method. Generally, introduction of follow-up questions to the dichotomous choice payment question helps to improve the precision of the WTP estimates (FAO, 2000). Notwithstanding, some disadvantages of open-ended format have been identified in literature, for example, large non-response rates; starting point bias and individuals giving what they would not mind paying instead of their maximum WTP. These problems can be taken care of by improved survey design and administration and use of in-

person interviews. Also, the idea of unfamiliarity with market scenario is not always a problem particularly when open-ended questions are presented as a follow-up to a binary question (Mekonnen, 2000). In fact this type of elicitation format is closer to what the respondents are familiar with as it mimics a bargaining process in which the respondents as buyers of a commodity would first expect the price to be stated by the seller and then after some bargaining would decide on a final amount he or she would pay, as obtained in developing countries. Mekonnen, (2000) applied this elicitation format in the valuation of community forestry in Ethiopia and Kohlin, (2001) applied it in contingent valuation in social forestry in Orissa, India.

Stochastic Payment Card: Stochastic CVM proposed by Wang, (1997) assumes that an individual valuation is a random variable even when there is no obvious uncertainty involved and that there is a valuation distribution. Stochastic payment card will be used to measure individual valuation distribution as regards the good in question in the GCLME. This method will be used in other to reduce some bias in CVM which is normally brought about by uncertainty faced by individuals. In stochastic payment card, uncertainty is somehow resolved by using the concept of an individual's valuation distribution. The notion that an individual's value of a good or service is stochastic, and is best characterized as a random variable with associated valuation distribution, is consistent with daily observations on ways people talk about their willingness to pay for a commodity (Wang and Whittington, 2000). Many people use two ways to express their WTP for a good. One is to say that they are willing to pay X currency, which may be interpreted as a mean of a valuation distribution; the other is giving by a range from Y to Z currency, which can also be interpreted as information about a valuation distribution. In stochastic payment card, an individual will be given a set of prices with probability values under some verbal responses of definitely yes, probably yes, probably no and definitely no. Respondents are asked to select a number as the likelihood or probability that they would agree to pay a specific price. If the respondent answers a series of such questions, a likelihood matrix can be observed. The likelihood matrix obtained with the stochastic payment card is a record of an individual's probabilities of accepting different proffered payments (Wang and Whittington, 2000). By choosing a number/verbal response for each price, the bias brought about by payment card where by the respondent selects one price which may be lower or higher than his WTP is reduced.

Points to Note in Conducting the CVM Study: Before actual field survey, the following should be done:

1. A pilot study should be conducted using open-ended valuation question. The prices that will be used as starting prices for the actual study would be derived from the prices giving in the pilot study.
2. A focus group discussion (FGD) should be organized. The focus group discussion will guide the wording of the market scenario for the CVM question.
3. Field assistants should be trained for use for administering the questionnaire.
4. A random sample of survey population should be selected for administration of the questionnaire. Furthermore;
5. In the actual field survey, care should be taken that the questionnaire is properly designed incorporating the lessons learnt from the pilot study and focus group discussions. Questioning should be done in such a way as to eliminate strategic or compliance bias. The practice to be carried out by field assistants during training

would help in detecting potential sources of bias in questionnaire administration and thus corrected before the actual filed survey.

Analysis of Willingness to Pay Responses: There are three basic ways in which CVM information are typically analyzed. These include:

1. Examination of the frequency distribution of the responses to the valuation question and obtaining the means, median and standard deviation of WTP values.
2. Cross tabulations between WTP and socioeconomic variables are determined
3. Multivariate statistical techniques are used to estimate a valuation function that relates the respondents answer to the socioeconomic characteristics of the respondent.

For estimation of the valuation function for the discreet choice with open-ended follow-up question, the WTP responses should first be checked for valid and invalid responses. Invalid responses will include protest zeros, outliers and cases where the maximum willingness to pay is less than the accepted starting price. Protest zeros will be determined based on response to the follow-up questions to the valuation question while outliers will include those whose WTP will be over a given percentage of their income (or referred to as α trimmed means, Freeman III, 1993) and well above the maximum starting price to be used. Where invalid responses exist, a check should be conducted to ascertain whether there are differences between respondents with valid and invalid responses. T-test can be used to compare their different attributes. If differences are found to exist, respondents with invalid responses should not be discarded since discarding them will make the remaining sample not to be a random one thus leading to inconsistent and biased parameter estimates. However, an estimation technique, precisely, tobit model with selectivity (Green, 1995) should be applied. The model takes the form:

$$Y^* = \beta^1 X + \varepsilon$$

$$Y = 0 \text{ if } Y^* \leq 0 \qquad (1)$$

$$and \ \mathrm{Y} = Y^* \text{otherwise}$$

$$Z^* = \alpha^1 V + U$$

$$Z = 1 \text{ if } Z^* > 0 \qquad (2)$$

$$and \ \mathrm{Z} = 0 \text{ if } Z^* \leq 0$$

where Y is vector of willingness to pay which is censored at 0, X is matrix of explanatory variables that are hypothesized to influence willingness to pay; Z is a vector of a dummy variable which is 1 when the observation has a valid response and 0 other wise; V is a matrix of explanatory variables which may influence the probability of giving a valid or invalid response; α and β are vectors of unknown parameters to be estimated corresponding, respectively, to the matrix of explanatory variables V and X; ε and μ are error terms which could be correlated with correlation coefficient ρ; Y* and Z* are unobserved or latent variables corresponding to Y and Z respectively. Y values are observed when Z equal l.

For the estimation of valuation function from the stochastic payment card, with a set of prices and likelihood ratios, simple regression analysis will be used to determine a household head's mean price and standard variance. Multiple regressions will be used to determine the factors that influence mean and standard variance of individual's valuation distribution. The dependent variables for the multiple regressions include: $Y_1 = \log(\mu)$ mean; $Y_2 = \log(\sigma)$ standard variance and $Y_3 = \log(\mu/\sigma)$. One regression each will be run for the dependent variables.

Fig.1: Example of a stochastic payment card.

(A description of the market scenario)

Monthly/annual cost	Definitely no	Probably no	Not sure	Probably yes	Definitely yes
	vote against		vote for/against		vote for
₦ 0	0%	25%	50%	75%	100%
₦50	0%	25%	50%	75%	100%
₦ 100	0%	25%	50%	75%	100%
₦ 200	0%	25%	50%	75%	100%
₦ 300	0%	25%	50%	75%	100%
₦ 500	0%	25%	50%	75%	100%
₦ 1000	0%	25%	50%	75%	100%
₦ 2000	0%	25%	50%	75%	100%

Travel Cost Method: The first step in such an analysis is to survey participants on a particular recreation about their expenses for example trip for bird watching or viewing of water movement. The expense is the travel cost. The travel cost is given as:

Travel Cost = Travel Time + Transportation Costs + On-site expenditures

Travel time would depend on the motor type; transportation costs would include two-way motor ticket, parking, fuel-cost and user-cost; while on-site expenses would include beach material, food, drink and payment in parks or, for example, for boat ride.

User cost = Fuel cost + Maintenance + Insurance + Capital depreciation.

The second step would examine the relationship between the number of participants and expenses. If this information cannot be obtained, information on the level of use of the resource e.g., historical information on number of users, their location of residence, and frequency of use should be obtained. Other information that can assist in sampling is that on when the resource is most heavily used and by whom. With the above information in addition to site characteristics and attributes of the respondents, the travel cost can be estimated.

Choice Experiment (CE): The goal of CE would be to ascertain the people's preference for a particular marine/coastal area characteristic at a given cost and another at a different cost. This will help to design integrated coastal area management approach and to restore the ecosystem. The advantages of the choice experiment are that values for each attribute as well as marginal rate of substitution between non-monetary attributes can be estimated. The success of the choice experiment depends on the design of the experiment, which is a dynamic process. Thus, in conducting the CE, first, the marine/coastal attributes and their levels and the actual values of the attributes would be defined. Attributes and attribute levels of marine/coastal environment used in previous studies as found in literature and their importance in choice decision should be ascertained. This will guide selection of attributes and levels for the current study. Secondly, focus group discussions should be done to guide the selection of attributes and levels based on the perception of the individuals living in the area under study. The focus group discussion will also guide the inclusion of monetary

attributes and the best way to present a monetary attribute. Next, attribute levels should be combined into profiles of alternatives and profiles into choice sets. Based on the attributes and levels and the combinations, a pilot test would be carried out to check whether the attributes and levels defined are appropriate and whether the people understand the design and to test the appropriateness of the number of choice sets. In carrying out the study, visual aids (maps, texts, and graphics) should be used in communicating information especially on attributes and levels.

After the pilot test, a sample of the population is selected for the actual study. Simple random sampling, multistage sampling or stratified random sampling can be used in selection of respondents depending on the nature of the population. In the field survey, the individuals are asked their preferred choices. After actual data collection, the welfare effects of change in attributes can then be estimated empirically. In empirical analysis, a standard random-utility framework (McFadden, 1974) can be used. The model is based on the assumption that, between two alternatives, A=0, 1, the individual chooses the alternative with highest utility. The actual estimation can be done with a conditional logistic regression or nested logistic regression. Multinomial logistic regression has also been used in previous studies. The marginal rate of substitution between two attributes can be derived as the ratio of their coefficients.

A summary of conventional valuation techniques to be used for specific goods and services in the GCLME is shown in table 4.

Table 4: Valuation techniques to be used for goods and services in GCLME

Goods and Services	Kinds of Value	Economic Valuation Techniques
Fishery	Direct Use Value	Economic rent/contingent valuation/ change in productivity approach
Recreation/tourism	Direct Use	Travel Cost
Ecological functions	Indirect and option	Contingent valuation
Cultural Values	Direct/indirect	Contingent valuation
Biodiversity generally	Direct use/indirect use	Choice experiment/ contingent valuation
Other mangrove resources	Direct use/indirect use and option	Contingent valuation/choice experiment

Source: Recommendations by the authors

These conventional economic valuation techniques will be applied in conjunction with sustainable livelihoods analysis. This combination will help provide

- an analysis of the causes of vulnerability – shocks and stresses in the economic, social and political context, trends, seasonality, fragility of resources from GCLME, etc – which affect the coastal communities;
- an assessment of the assets, at the individual, household or community levels, comprising human, social, economic, physical and GCLME resource assets;
- a description of the context within which livelihoods evolve especially in relation to the resources from GCLME – policies at both micro- and macro-levels; civil, economic and cultural institutions, both formal and informal; the nature of governance and its processes at all levels in society;
- an identification of livelihood strategies of the coastal inhabitants, including, but not restricted to, consumption, production and exchange activities; and

- an evaluation of the resulting livelihood outcome, assessed multi-dimensionally in terms of food and other basic needs security, greater sustainability of the GCLME resource base, reduced vulnerability and increased income.

ESTIMATES OF DIRECT OUTPUT VALUE OF GOODS AND SERVICES OF RELEVANT MARINE SECTORS OF GCLME

Available Methodology for Estimation of Direct Output of Goods and Services of the Relevant Marine Sectors of the GCLME:

Direct Output Impact (DOI) Approach: DOI's are the product of the physical quantities of goods or services flowing from marine activities, namely, fish landings, oil production, salt/sand extraction etc. and their market prices. The DOI for each of the marine activities is normally estimated and added together to get an estimate of the total output of goods for the entire marine sector. DOI does not account for the cost of inputs in production, including the degeneration of the environment or the depreciation of capital or the depletion of natural resource stocks.

Total Economic Value (TEV): This involves estimation of the net benefits from each nation's marine activities and sums all the benefits across all activities. These benefits are then summed for all countries to obtain the aggregate value for the entire marine area. Net benefits are the sum of consumer surpluses (what consumers are willing to pay over and above the market price for good or service) and producer surpluses (what firms, e.g. trawling companies, earn from sale of goods and services over and above their cost of production). Normally, net benefits from environmental goods and services that are not traded in the market are estimated using any of the methods as outlined in Table 4 and then added to TEV. The cost of implementing government policies to help manage the marine environment is subtracted from TEV (as resource rents). The TEV could be obtained for each county of the GCLME and then aggregated for the entire GCLME.

Estimation of Direct Output of Goods and Services of GCLME: The DOI methodology described above was applied in the estimation as the consumer surplus and producer surplus for most of the goods and services could not be obtained. The main products covered in this estimate of value of goods and services of GCLME are marine fisheries, offshore oil production, Non Timber Forest Products (NTFP), mining (Sand and Salt products), international tourism and timber. Data was also obtained from secondary sources which include, FAO, World Bank (World development Indicators, 2004), US Department of the Interior (2005), Oil and Gas Journal Databook (2004), Federal Department of Fisheries (in case of Nigeria) and Committee for Inland Fisheries in Africa.

Landing Value for Marine Fisheries of GCLME Countries

The value of landings for marine fish for GCLME countries was estimated using the DOI approach as indicated using average market prices for marine fisheries. The average landing for last five years (1999-2003) where data is available was obtained and used for estimating value of landing. The landing (in metric tones) was obtained from FAO statistics. The result is presented in Table 5.

Table 5: Value of Marine Fish Landing for GCLME countries (2003)

Country	**Landings (metric tonnes)**	**Value of Landings in millions ($)**
Cameroon	56339	681.7
Congo Democratic	4569	55.3
Congo, Republic of	22044.2	266.7
Angola	213799	2,586.9
Benin	11997	145.12
Gabon	32135.8	388.8
Ghana	347048.2	4,199.3
Guinea	94465.6	1,143.0
Guinea-Bissau	3867	70.8
Nigeria	270476.6	3,272.8
Equatorial Guinea	2,500	30.3
Sao Tome and Principe	3403	41.2
Liberia	7806.6	94.5
Togo	17843.2	215.9
Sierra Leone	48200	583.2
Côte d'Ivoire	56400	682.4
Total	**1,221,934.4**	**14,458.0**
Illegal Unreported Unregulated (IUU) Fishing (30%) of landing value	**366,580.32**	**4,337.4**
Total landing +IUU	**1,588,514.72**	**$18,795.4**

Source: FAOSTAT (2006) and calculations with market price data

The result in Table 5 shows that the average overall value of marine fish capture from GCLME for 1999-2003 is $14,458.0 million. This total value of landing including that due to illegal, unreported and unregulated (IUU) fishing in the area is $18,795.4 million.

Offshore Oil Production: The direct output value for offshore oil production for each country involved in offshore oil production and for the entire GCLME is shown in Table 6.

Table 6: Value of offshore Oil Production for GCLME countries (2004)

Country	Offshore oil production (bbl/day)	Value of Production ($)
Cameroon	-	-
Congo Democratic	16,169	413,117,950
Congo, Republic of	-	-
Angola	653,233	16,690,103,150
Benin	-	-
Gabon	15,000	383,250,000
Ghana	6,000	153,300,000
Guinea	-	-
Guinea-Bissau	-	-
Nigeria	278,360	7,112,098,000
Equatorial Guinea	200,000	5,110,000,000
Sao Tome and Principe	-	-
Liberia	-	-
Togo	-	-
Sierra Leone	-	-
Côte d'Ivoire	-	-
Total/day	**1,168,762**	**81,813,340**
Total/year	**426,598,130**	**29,861,869,100**

Source: Oil and Gas journal (2004), US Department of Interior (2005) and calculations using current world market price

The result shows that the total annual value of offshore oil production for GCLM based on 2004 data was $29,861,869,100.

Value of Non-Timber Forest Products Resources of GCLME

Non-Timber Forest Products (NTFPs) are one of the major resources obtained from the GCLME. These resources are mainly obtained from the mangrove areas. NTFP activity is a major employer in the mangrove areas especially in the rural areas where they serve as source of food, medicine, income, for crafts and entertainment. A reconnaissance survey of the mangrove areas show that the common products collected are periwinkle, mudskipper and *Rhizophora* spp. Periwinkle and mudskipper are consumed while *Rhizophora* spp is used for crafts, fencing, making fishing gear etc. Among them, periwinkle is the mostly collected and used NTFP.

The data for estimation was obtained during the reconnaissance visit of some communities in the Niger Delta mangroves. The Niger Delta mangrove has been noted as the largest mangrove in Africa and the third largest in the world (Ukwe, Isebor, and Alo, 2001). The respondents indicated their annual returns from periwinkle activity. This, for these individuals, does not include household consumption of the product.

Based on the average value obtained from households, the value of the major NTFP species for some countries of the GCLME with mangrove areas was estimated. The estimation was based on the assumption that five percent of the populations in the coastal countries with mangrove areas are involved in the activity. Periwinkle was the only product considered. The result is shown in Table 7.

Table 7: Value of periwinkle NTFP to some countries of GCLME

Country	Coastal Population in million (2003)	5% of Coastal Population	Value of Periwinkle Collected ($)
Benin 728.98	2.49	0.1245	90,758,010
Cameroon	11.88	0.594	433,014,120
Côte d'Ivoire	5	0.25	182,245,000
Equatorial Guinea	0.26	0.013	9,476,740
Gabon	0.87	0.0435	31,710,630
Ghana	7.34	0.367	267,535,660
Nigeria	25.86	1.263	920,701,740
Sao Tome	0.16	0.008	5,831,840
Total			**1,941,273,740**

Source: Data on population is from TDA while the values are calculation from field data

Considering that 5% of the costal population is involved in periwinkle collection activity, the result shows that the total value of the product annually for the countries with mangrove areas and indeed for the GCLME is $1,941,273,740. This is a conservative estimate considering the fact that the individual dealers who supplied the information did not include their household consumption of the product. Besides, some households collect only for own consumption.

Mining

Mining is a major activity in the coastal areas of some of the GCLME countries although this activity sometimes are illegal and become source of coastal area degradation. Data on mining in the coastal area is fragmented and not well documented. Products include sand, salt, granite, phosphate and limestone. In Angola, 60-70 vehicles of 10-12 tons each of sand are filled daily. This is equivalent to $6720 a day and $2,016,000 (two million and sixteen thousand dollars) for a year (300 days). In Benin, beach sand is mined at Fielnon II area and Mariell beach and on several other coastal sites in Cotonou. In Guinea, there are seven authorized sites for sand mining with annual extraction of 89,000 tonnes. This amounts to $8,544,000 (eight million, five hundred and forty four thousand dollars) annually. In Cameroon, sand and gravel extraction are major economic activities. Sand extraction from the beach is also a major activity in Nigeria although the annual quantity extracted is not documented.

On salt production, in Angola, about 20 tons of salt is produced per month. This amounts to $12,127.2 annually. In Ghana, eight large to medium and 16 small scale salt production companies operate; current production is about 200,000 metric tones per annum and average export earnings of US$2,648,533.37 from 52,419.17 tonnes of salt has been realized (Armah, 2005). Guinea has six quarries with annual production of granite of

121,000 tonnes amounting to $98,362,110. Phosphate and lime mining is carried out in Togo; 3.5 million tons are mined giving rise to 40% of export earnings. Coastal mining is equally carried out in about four sites in Congo Democratic. Based on available data as indicated, the value of output from mining is summarized in Table 8.

Table 8: Summary of returns from different mining activities in some countries of GCLME

Product from Mining	**Amount ($)**
Sand	10,560,000
Salt	2,660,660
Granite	98,362,110
Phosphate/Lime	243,200,000
Total	**354,782,770**

Source: Calculations by the authors.

Tourism

Tourism is also a major activity in the coastal areas of some countries of GCLME. However, exact tourist flows in the coastal towns are not well documented thus could not be extracted. In Benin, there are 20 hotels ranging from four stars to two stars in the single city of Cotonou. In Congo Democratic, the number of tourists per year is averagely 16,949 with 252 hotels of all categories and bed occupancy of 42.72%. In Sao Tome, the Archipelago offers excellent condition for sports and leisure. In Ghana, five types of tourism have been recognized, namely, cultural and heritage tourism, eco-tourism, beach tourism, conference and business tourism and urban tourism. Table 9 shows international tourist flows in GCLME countries in 2004.

Table 9: International tourism indication number of arrivals per country of GCLME in 2004

Country	**Number of Visitor in 2004**
Cameroon	223,400
Congo Democratic	169,800
Congo, Republic of	15,187
Angola	101,200
Benin	36,800
Gabon	192,000
Ghana	542,800
Guinea	53,200
Guinea-Bissau	0
Nigeria	970,800
Equatorial Guinea	0
Sao Tome and Principe	9,900
Liberia	0
Togo	36,700
Sierra Leone	35,600
Côte d'Ivoire	0
Total/year	**2,386,987**

Source: World Development Indicators, 2004 (World Bank, 2004)

Timber Production

Timber cutting is one of the major activities in the coastal areas of the GCLME especially in the coast of Cameroon, Nigeria and Gabon, although actual quantity cut from the area is not well documented. Figure 2 shows a timber processing factory near a beach in Nigeria.

Figure 2: Timber processing near a beach in Nigeria

Table 10: Summary of Value of Some Outputs from GCLME

Item	**Value ($) in million**
Marine Fishery	18,795.4
Offshore Oil Production	29,861.9
NTFP (One Major)	1,941.3
Mining	354.8
Total	**50,953.3**

The result in Table 18 shows that the total value of output in GCLME when some outputs namely, marine fishery, offshore oil production, NTFP (periwinkle) and mining, are considered is $50,953.3 million.

CASE STUDIES OF POTENTIAL ECONOMIC EFFECTS OF PROSPECTIVE GEF FUNDING FOR THE GCLME

Recap of the Development Objective of the GCLME Project: As indicated in the project document, the overall development goals of this project are to: recover depleted fish stocks; restore degraded habitat; reduce land and ship-based pollution; and create an ecosystem-wide assessment and management framework for sustainable use of living and non-living resources in the GCLME. The document indicates that the priority action areas rely heavily on regional capacity building. Thus, sustainability will derive from this improved capacity, strengthening of national and regional institutions and improvements in policy/legislative frameworks.

Fisheries Management Functions and Activities for Recovery of Depleted Fisheries of GCLME

Generally, the overall objective of the GCLME is to improve the immediate livelihood of the coastal dwellers and hence the entire economy of the GCLME countries. Although several benefits are derived from the GCLME area, the major one impacting mostly on the livelihood of the coastal inhabitants are the resources derived from the area especially the fish resource. Thus the whole activities geared towards solving the problems of the area, which are built into five components, will directly or indirectly lead to the recovery of the environment, especially the resources, mostly fish. Therefore, notwithstanding that pollution reduction, habitat destruction, biodiversity restoration among others would be achieved, the impact will mostly be felt directly by the coastal inhabitants and other stakeholders through increase and sustainability of fish resources. Fish management functions ordinarily consist of three main processes. These include stock assessment, that is, the scientific assessment of the stock size and age distribution of the given fishery; setting total allowable catches (TACs), preparing rules and regulations related to the TACs, licensing vessels and fishermen, and disseminating the rules and procedures for the coming years fishery; and third, monitoring, control and surveillance (MCS), that is, enforcement and policing functions (Sumaila, Munro and Keith, 2005). It is expected that these management functions will be achieved by the GEF project.

Already as outlined in the project document, the specific activities for restoration of fish resources, which are built under component two of the project, are:

1. Demonstrate regional stock assessment methods including regional surveys (Regional Demonstration Project on Fisheries)

2. Develop methods and estimates for maximum sustainable yields for dominant commercially important fisheries species

3. Evaluate productivity with regards to its carrying capacity for living marine resources of the ecosystem (Regional Demonstration Project on Productivity)

4. Develop Regional Agreements and Regional Fisheries Commission

5. Assess and draft modifications to the National Legal Frameworks to achieve sustainable fisheries

6. Develop Fisheries Management Plans for at least three fisheries

7. Assess existing coastal aquaculture and mariculture and determine environmentally sustainable capacity for future development, including identification of investments and legislation for SAP

The effect of the habitat restoration will be felt more by the major stakeholders that exploit the fish resources of the marine area. These include the artisanal fishermen, semi-industrial fishermen and trawling companies. Thus the potential effect of GEF funding was on these stakeholders were considered.

In order to estimate the potential effect on these stakeholders, the current cost and return of fishing activity for each group was considered, and then this was used to project the effect with GEF funding. In this regard, the average cost and returns of artisanal fishermen using hooks, nets, semi-industrial fishing, and that for trawling companies in the GCLME are included. Data used for the calculations were obtained from the artisanal fishermen and trawling companies at a point in time during a reconnaissance survey in the coastal and fishing ports of Nigeria section of GCLME. The data from the trawling companies were summary of previous year record.

Cost and Returns from Fishing and Other Marine Resources in GLCME

***Summary of Cost and Return of Artisanal Fishing with Hooks*:**

Materials used: Hooks (No 8 and No 12 hooks), ropes (No 36 and 45), boat. Paddle and stones and bait. The cost detail is shown in Table 11.

Table 11: Cost of material for artisanal fishing with hooks

Materials Used	Unit Costs ($)	Quantity	Total Cost ($)
Canoe	120	1	120
Paddle	16	3	48
Basin with hooks	64	2	128
Total			296

Source: calculations from field survey data

Labour Cost: The estimated cost of labour per man day based on information from the fishermen is $8/day. An average of two fishermen work in one boat per day. This gives $16/day. Considering that they fish for an average five days in a week, the total labour cost for a month is derived thus:
$16 x 5days/week x 4weeks/month = $320.

The useful life of a set of fishing material is three months. Thus for three months, the estimated labour cost will be derived thus: $32/month x 3 months = $96
Total Cost: Total Cost = cost of material + labour cost = $296 + $960 = $1256
Average Returns: Average daily return per boat/material shown above according to the fishermen is $40. Thus total return for three months = $40 x 5 days/week x 4 weeks/month x 3 months = $2400.

Average Net Return: Average Net Return/cycle of three months is obtained thus:
Average Return – Total Cost = $2,400 - $1,256 = $1,144

Therefore, the net return for artisanal fishermen using one boat with fishermen in a boat, fishing with hooks and working for three months, five days per week is one hundred and forty three thousand naira ($1,1444).

***Summary of Cost and Return of Artisanal Fishing with Nets*:**

Materials used: Nets (No 1 and No 2 nets - 4 fingers and 3.5 fingers respectively or 1 and 1,5fingers respectively for dry season), ropes (No 36 and 45), boat. Paddle and stones, and bait. The cost detail is shown in Table 12.

Table 12: Cost of material for artisanal fishing with nets

Materials Used	Quantity	Unit Costs ($)	Total Cost ($)
Boat	1	120	120
Paddle	3	16	48
Net with accessories (4 bundles of net)	1	122.08	122.08
Total			290.08

Note: $1 exchanges for ₦125

Labour Cost: The estimated cost of labour per man day based on information from the fishermen is $8/day. The fishermen indicated that an average of two fishermen work in one boat per day. This gives $16/day. Considering that they fish for an average of five days in a week, the total labour cost for a month is derived thus:$16 x 5days/week x 4weeks/month = $320.

The useful life of a set of fishing material is three months. Thus for three months, the estimated labour cost will be derived thus: $320/month x 3 months = $960

Total Cost: Total Cost = cost of material + labour cost = $290.08+ $960 = $1,250.08

Average Returns: Average daily return per boat/material shown above according to the fishermen is $24. Thus total return for three months = $24 x 5 days/week x 4 weeks/month x 3 months = $1,440

Average Net Return: Average Net Return/cycle of three months is obtained thus:
Average Return – Total Cost = $1,440 – $1250.08 = $189.92

Therefore, the net return for artisanal fishermen using one boat with two fishermen in a boat, fishing with net and working for three months, five days per week is twenty three thousand seven hundred and forty naira.

Semi-industrial Fishing

The average cost and return for semi-industrial fishing is shown in Tables 13 and 14.

Table 13: Average unit cost and return of material and other expenses for semi-industrial fishing

Materials Used	Quantity	Unit Costs ($)	Total Cost ($)
Wooden Boat and nets	1	15,200	15,200
Engine (40Hp)	1	4,000	4,000
Petrol	1 drum/day/boat		208
Engine oil	20 litres/day/boat		
Feeding for cruise	18 members/day/boat	1.6	12.8
Labour cost	18 member cruise/day/boat	8	144
Average income/day/boat			800

Source: Calculations from field survey data

Table 14: Net income statement for a unit of semi-industrial fishing

Items	Amount/month ($)	Annual amount ($)
Income	16,000	192,000
Less		
Expenses		
Depreciation *	800	9,600
Fuel	4,160	49,920
Feeding	256	3,072
Labour	2,880	34,560
Total	8,096	97,152
Net Income	7,904.02	94,848

Source: Calculations from field survey data

*straight line depreciation for 2 years useful life with no salvage value

The result in Table 11 shows that the average annual net return per unit of industrial fishing is $94,848.

Trawling Companies

Based on the data collected from trawling companies, the summary cost of production (running costs) and return for a trawler is presented in Table 15. Initial cost of providing physical facilities and machinery including trawlers were not included. The companies were reluctant in providing detailed cost and returns of the trawling business. The direct costs covers the cost of fuel, diesel and labour cost while the indirect cost of production include rent for buildings, salaries of ancillary staff, maintenance charges, electricity, duties and quality control etc. Table 15 shows the summary cost and return of a unit of fish trawling activity.

Table 15: Average summary cost and return of a unit of Fish trawling activity annually

Items	Quantity (tons)	Amount ($)
Direct costs		371,560
Indirect costs		89,784
Total Costs		461,344
Production (shrimps/prawns)	41.34	500,214
Production (Fish)	6.45	66,306
Total Production/Income	47.79	566,520
Net Income		105,176

Note: an average trawler measures 24.2m
Source: Calculations from field data

As can be seen in Table 15, the average net income for a unit of trawler is $24,092.34. Direct costs dominated the cost of fishing. The trawling companies, during the reconnaissance field survey, indicated that fuel cost was the major direct cost they experienced.

Summary of Case Studies of Economic Effects of GEF Funding

Case 1: Assuming Management Plan of GCLME Project Increases Catch/Landing by Ten Percent (10%)

The first scenario here is to assume that the management plan proposed in the GEF funding for the GCLME will increase fish catch/landing from the marine area by 10% but the cost expended for fish catch will not be changed. Hence based on this assumption, the previous estimates for the artisanal fishermen, semi-industrial companies, trawling companies and overall value of marine fish of GCLME will the increased by 10%. The effect is presented in Table 16.

Table 16: Effect of a ten percent increase in output/return due to GEF funding on the net returns of different categories of stakeholders involved in fishing

Items	Artisanal (with hooks)	Artisanal (with nets)	Semi-Industrial (Annual)	Trawli compa
Previous cost ($)	1,256.00	1,250.08	97,152.00	461,34
Previous return ($)	2,400.00	1,440.00	192,000.00	566,52(
Previous Net returns ($)	1,144.00	189.92	94,848.00	105,17(
Current cost ($)	1,256.00	1,250.08	97,152.00	461,34
Current return (10% increase) ($)	2,640.00	1,584.00	211,200.00	623,17
Current net return ($)	1,384.00	333.92	114,040	161,82
Difference between current and previous net return ($)	240.00	144.00	19,200	56,652.
Percentage increase in net return due to 10% increase in returns due to GEF	21.00	75.82	20.24	53.86

Source: Calculations by the Authors

The calculations in Table 16 show that a 10% increase in returns in fish landing value without an increase in the cost of fishing due to GEF funding and subsequent restoration of

the GCLME will lead to 21%, 75.82%, 20.24% and 53.86% increase in net returns for artisanal fishermen with hooks, artisanal fishermen with nets, semi-industrial outfits and trawling companies respectively.

Case 2: Assuming Management Plan of GCLME Project Reduces Effort/Direct Cost Per Catch by Ten Percent (10%)

The second scenario is to assume that the economically optimal management of GCLME due to GEF funding will reduce effort/direct cost per catch by 10% but the returns from fish catch will remain unchanged. Hence based on this assumption, the previous direct cost estimates for the artisanal fishermen, semi-industrial companies, trawling companies and overall value of marine fish of GCLME will the increased by 10%. The effect on their net returns from fishing is presented in Table 17.

Table 17: Effect of a ten percent decrease in cost/effort per catch due to GEF funding on the net returns of different categories of stakeholders involved in fishing

Items	**Artisanal (with hooks)**	**Artisanal (with nets)**	**Semi-Industrial (Annual)**	**Trawling companies**
Previous cost ($)	1,256.00	1,250.08	97,152.00	461,344.00
Previous return ($)	2,400.00	1,440.00	192,000.00	566,520.00
Previous Net returns ($)	1,144.00	189.92	94,848.00	105,176.00
Current cost (10% reduction in direct costs ($)	1,160.00	1154.08	88,366.80	424,188.00
Current return	2,400.00	1,440.00	192,000.00	566,520.00
Current net return ($)	1,240	285.92	103,633.2	142,332.00
Difference between current and previous net return ($)	96.00	96.00	8,785.20	37,156.00
Percentage increase in net return due to 10% increase in returns due to GEF	8.39	50.55	9.26	35.33

Source: Calculations by the Authors

The calculations in Table 17 shows that a 10% decrease in direct cost for without an increase in the returns from fishing due economic optimal management of GCLME due to GEF funding will lead to 8.39%, 50.55%, 9.26% and 35.33% increase in net returns for artisanal fishermen with hooks, artisanal fishermen with nets, semi-industrial outfits and trawling companies respectively.

ESTIMATES OF RESOURCE RENT AND EFFECT ON FISH RESOURCE

The scale of resource rents that could be obtained from the economically optimal management of the marine resources due to GEF funding was estimated. Resource rent was estimated for artisanal, semi-industrial and industrial fishing (trawling companies). The estimation was done using Lange (2003) estimation procedure which estimated resource rents as total revenues minus average cost assuming a normal profit of 30 percent as one element of average cost. Based on the earlier estimates of cost and returns of fishing for different marine fishing activity, the result was obtained and presented in Table 18.

Table 18: Scale of resource rents without and with GEF funding

Items	Artisanal (with hooks)	Artisanal (with nets)	Semi-Industrial (Annual)	Trawling companies (Annual/trawler)	Landing value for GCLME
Average Total Revenue ($)	2,400	1440	192,000	566,520	14,458,000,054
Average Cost	1,256	1250	97,152	461,344	11,492,276,807
Net revenue	1,144	190	94,848	105,176	2,965,723,250
Normal profit ($) (30% of net revenue)	343.2	57	28,454.4	31,552.8	889,716,975
Annual Rent without GEF ($)	800.8	133	66,393.6	73,623.2	2,076,006,275
Average total revenue (Due to 10% increase in revenue due to GEF funding) ($)	2,640	1584	211,200	623,172	15,903,800,060
Average cost	1,256	1250	97,152	461,344	11,492,276,807
Net revenue	1,384	334	114,048	170,828	4,411,523,260
Normal Profit($) (30% of net revenue)	415.2	100.2	34,214.4	51,248.4	1,323,456,978
Annual Rent with GEF funding ($)	968.8	233.8	79,833.6	119,579.6	3,088,066,282

Source: Calculation by the authors.

Note: The cost for landing value of GCLME was obtained using cost data from trawling companies

The result of the estimations shows that, with 10% increase in returns to the fishermen and in the landing value of GCLME (case 1), the amount of rent to be obtained from the landing value of GCLME annually ($3,088,066,282) will be over hundred times higher than the total GEF funding ($20,814,404.00). Thus investing ten percent of this amount annually into the proposed management that GEF funding will put in place will ensure the sustainability of the GCLME.

PROPOSAL FOR MAINSTREAMING ECOSYSTEM VALUE ESTIMATES INTO THE SYSTEM OF NATIONAL ACCOUNTING IN GCLME COUNTRIES

The System of National Accounts

The System of National Accounts (SNA) consists of a coherent, consistent and integrated set of macroeconomic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules. It provides a comprehensive framework within which economic data can be compiled and presented in a format designed for purposes of economic analysis, decision taking and policy making (Manraj, 2001). It is the set of accounts which national governments compile routinely to track the activity of their economies. SNA data are used to calculate major economic indicators including gross domestic product (GDP), gross national product (GNP), savings rates, and trade balance figures. These economic accounts are calculated by all countries in a standard format, using a framework developed, supported, and disseminated by the United Nations Statistical Division (UNSTAT). Thus almost all countries make the calculations the same way. Normally, the economic activity of a country in question which includes production, consumption, and accumulation is measured in the national accounts. Activities that fall within the production boundary, according to Manraj, (2001) are: Production of all goods; Production of all services delivered to another unit; and Imputed rent of owner occupied dwellings.

A fundamental identity in national accounts is:
Production + Imports = Final consumption + Intermediate consumption + Capital formation + Exports. Also, the gross Domestic Product (GDP) identity is represented by the equation: GDP = Sum of Value added = Production – Intermediate Consumption or GDP = Final Consumption + Capital Formation + Exports – Imports. Capital goods are valued as productive capital, and are written off against the value of production as they depreciate. This practice recognizes that the consumption level maintained by depleting the capital stock exceeds the sustainable level of income.

The System of National Accounts (SNA) statistics, for example, is a balance sheet of the most significant economic transactions among the major participants in the economy during a reference period. The System of National Accounts in many of the GCLME countries has evolved in the last four decades from a simple system of two tables on GDP at current and constant basic costs to a structure consisting of 21 tables with sectoral decomposition of cost components of value-added by all kinds economic activities in addition to current and real GDP series as well as capital finance, capital formation and external transactions. In the Anglophone countries, this was largely achieved by re-classification of industry groups in accordance with International Standard Industrial Classification (ISIC) Rev.2 recommended by 1993 SNA. The 1993 SNA recognizes that a Supply and Use table (SUT) which describes for each product, all the sources of supply and all the uses to which that product can be put, and for each industry, all the inputs and outputs, provides the most reliable possible estimate of gross domestic product (GDP) at current or constant prices. The GDP is the basic measure of the output arising from economic activities. The economic activities included in the compilation of the SNA are market activities, non-market activities of government and private non-profit institutions and non-market activities resulting in outputs whose values can be imputed from those of parallel market activities.

Flaws in the System of National Accounts and the Need for Environmental Accounting in the GCLME

The national income accounts have a number of well known shortcomings regarding the treatment of the environment. In the SNA, goods like machinery, tools, and equipment are valued as productive capital, and are written off against the value of production as they depreciate. This practice recognizes that a consumption level maintained by drawing down on the stock of capital exceeds the sustainable level of income (Repetto et al 1989). Natural resources, however, are not so valued. For example, from the coding system of the Nigeria national accounts statistics, environmental degradation and productive role of natural resources are not accounted for in the GDP calculations. While the income from harvesting timber is recorded in the national accounts, the simultaneous depletion of natural forest assets is not; perhaps more importantly, essential life-support services provided by forest ecosystems are not recognized at all. In fact, a country could fell all its forests, erode its soils, deplete its oil reserves, harvest all its fish and marine resources, exhaust its mineral resources and yet measured income would not be affected though such losses which would clearly decrease potential output in the future just as the depreciation of man-made capital would (Baytas and Rezvani, 1993). This can result in quite misleading economic signals about economic growth and development. In fact according to Lange (2003), none of the GCLME system countries has environmental accounting programs. Sachs, Lange, Heal and Small, (2005) observes that in developing countries, the stated objective of the widely adopted PRSPs (Poverty Reduction Strategy Programs) is to promote sustainable economic growth and poverty reduction, however, PRSPs use GDP as a primary macroeconomic indicator in their monitoring framework; consequently, policy makers receive information about only half of the objective, short-term economic growth, but not sustainability of that growth.

Some of the elements missing from the accounts according to IUCN (1997) include:

- Environmental expenditures which include expenditures to protect the environment from harm, or to mitigate that harm, for example, the costs incurred to prevent environmental harm (pollution control equipment purchased by factories or catalytic converters in cars) and the costs of remedying that harm (medical expenses, replacement of property destroyed in landslides caused by deforestation, or drinking water filtration required because intake water is highly sedimented). Although some of these expenditures are already included in the income accounts, along with all other intermediate or final consumption they are not disaggregated to highlight the costs incurred to prevent or mitigate environmental degradation.
- Non-marketed goods (for example, some non-timber forest products). Some countries do include these in their national income accounts by estimating total consumption, and then using market prices for comparable products as a proxy to calculate the value of non-marketed goods. However, such estimation is incomplete, and cannot always be disaggregated from products which are sold.
- Non-marketed services which include unsold services, such as watershed protection by forests or water filtration by submerged vegetation, or ground water recharge by mangrove ecosystems are not included in the SNA.

- Consumption of natural capital - the SNA treats the gradual depletion of physical capital (machines and other equipment) as depletion rather than income, in accordance with conventional business accounting principles. However, the depletion of natural capital - forests, in particular - is accounted for as income. Thus the accounts of a country which harvests trees very quickly will show quite high income for a few years, but nothing will reflect the destruction of a productive asset, the forest.

Considering the fact that most of Africa, especially the countries in the GCLM, depend mostly on natural resources even as the continent is often referred to as "a continent on the brink" (Timberlake 1985), it will be meaningless for the GCLME countries to ignore a system that can account for the ecosystem resources. Furthermore, African countries and indeed most developing countries contain most of the world's biodiversity; biodiversity protection services benefit not only local communities but also the global community. Ecosystem services, such as water and soil protection, are often under greatest threat in developing countries, but these countries often have fewer resources to cope with loss of ecosystem services (flood control, water purification, increased health care, etc.) (Sachs, *et al,* 2005). Besides, the rate of resource depletion in the GCLME as noted in the TDA makes a good case for an accounting framework that will help maintain the resources in a sustainable manner. Therefore, to rephrase Repetto et al (1989), how could a country like Ghana, Nigeria or Gabon, which depend largely on natural resources for employment and income, use a system for national income accounting that ignores their principle assets (Baytas and Rezvani, 1993). In fact, not accounting for the ecosystem resources also contradicts the most widely accepted Hicksian definition of income as the amount one could consume in a given period without reducing the amount of possible consumption in some future period (Lutz and Munasinghe 1991). Thus ecosystem accounting enables policy makers to ascertain whether they are laying foundation for long term economic growth or not. Environmental accounts provide the basis for answering questions such as:

- How much resource rent is being generated, and would different policies increase rent?
- How much resource rent is recovered through taxes and non-tax instruments?
- How much of the recovered rent is invested in other assets, providing the basis for sustainable long-term growth (Sachs, *el al* 2005).

Environmental Accounting

Overview: Environmental accounting sometimes referred to as "green accounting", "resource accounting" or "integrated economic and environmental accounting" - refers to modification of the System of National Accounts to incorporate the use or depletion of natural resources. Natural resource accounts provide a valuable picture of a nation's wealth at different points in time and enhance the evaluation of a nation's future potential for sustained income generation (Repetto et al 1989). Environmental accounting is an important tool to implement sustainable development at the national level and provides a more comprehensive GDP. The underlying principle to environmental accounting is the concept of sustainability. The notion of sustainable management was coined by reference to sustainable development which became popularized in the Brundtland report (World Commission on Environment and Development, 1987). The notion implies that when a production activity is performed using a stock of renewable natural resources which can be irreversibly destroyed, it must be restricted to the generation capacity of that resource, to

avoid jeopardizing its vitality (FAO, 2000). To ensure sustainability, all assets need to be included in the calculation of national accounts. However, only manufactured capital has been included in the past while ignoring natural capital. Thus the need to ensure that the principle of sustainable development is maintained led to the initiation of environmental accounting. Integration of sustainability and ecosystem valuation into economic growth has increasingly focused on 'greening' the national income accounts (Sachs *et al*, 2005).

*Approaches to Environmental Accounting***:** Considering the fact that environmental resources often are not marketed, it has been difficult to evolve a standardized system like the SNA, incorporating environmental concerns. Some of the most important debates concern the way some issue raised should be treated. These include whether physical or monetary accounts should be used (Physical accounts include information about natural characteristics of the environment and its use; the size of forests or mineral reserves, the quality of water or air, the depth of topsoil, etc. while monetary accounts place an economic value on those characteristics or their use); whether integrated or satellite account be used (integrated accounts change the calculation of GNP, GDP, and other key national indicators while satellite accounts - of which physical accounts are one example- do not change either the calculation of key indicators or the central framework of the accounts); whether net benefit or user cost should be used in calculating depletion of natural capital; and whether maintenance cost of environment and outcomes of valuation of non-marketed resources should be included. However, besides these debates and shortcomings, an important step towards evolving a common method that can be applied like the SNA was the development of the System of Environmental and Economic Accounting (SEEA) under the aegis of the UN's Statistical Commission. The SEEA provides a comprehensive and broadly accepted framework for incorporating the role of the environment and natural capital into the conventional system of national income accounts through a system of satellite accounts for the environment (Sachs *et al*, 2005).

According to Lange (2003) environmental accounts, especially as it relates to the revised SEEA, have four components:

- Natural resource asset accounts, which deal mainly with stocks of natural resources and focus on revising the Balance Sheets of the System of National Accounts (SNA);
- Pollutant and material (energy and resources) flow accounts, which provide information at the industry level about the use of energy and materials as inputs to production and final demand, and the generation of pollutants and solid waste. These accounts are linked to the Supply and Use Tables of the SNA, which are used to construct input-output (IO) tables;
- Environmental protection and resource management expenditures, which identifies expenditures in the conventional SNA incurred by industry, government and households to protect the environment or manage resources;
- Environmentally-adjusted macroeconomic aggregates, which include indicators of sustainability such as environmentally adjusted Net Domestic Product (eaNDP).

The asset account in the SEEA like that of SNA covers the opening account, closing account and changes during the year. The changes during the year include those due to economic activity and those due to natural processes like birth and death. The problem in asset account is normally on the issue of what to measure and how to measure it. There is also some controversy over how to treat new discoveries of minerals whether as an economic change

or as part of other volume changes. Certain resources, like marine capture fisheries are not observed directly and require biological models to estimate stocks and changes in stocks. The two methods used in valuing assets are the Net Present Value (NPV) method and net price method. The NPV which is a discounting technique involves the discounting of future income stream while the net price method is calculated as price minus the average costs of extraction because information about marginal costs are unavailable. The NPV method of valuation requires assumptions about future prices and costs of extraction, about the rate of extraction, and about the discount rate. The NPV method is recommended by the revised SEEA. The measurement of depreciation and appreciation of assets is another area of asset account calculation that is still controversial. The revised SEEA proposes a measure of depletion cost more consistent with economic depreciation: the change in the asset value from one period to the next (Lange, 2003). However, several alternative ways to measure this cost have been proposed and no consensus has yet been reached (Ryan 2000).

The pollutant and material flow accounts takes care of the use of material and energy and the generation of pollution. It accounts for emissions especially of those of fossil fuels. Physical quantities of emissions are often calculated. Assigning monetary value to the emission have been controversial. However, two methods of valuation used in this regard are maintenance, or avoidance, cost approach, which measures the cost of measures to reduce pollution to a given standard and damage cost approach, which measures the actual damage caused by pollution, in terms of, for example, damage to marine resources due to oil spill, or damage to human health from water pollution. In addition, the willingness-to-pay methodology can be applied to environmental degradation, however, this is not commonly used yet.

Environmental protection and resource management account recognizes expenses that are related to environmental protection and management. The aim is to make the expenses more explicit and easily used for policy analysis (Lange, 2003). It has three components, namely; expenditures for environmental protection and resource management, by public and private sectors; the activities of industries that provide environmental protection services; and environmental and resource taxes/subsidies.

Major Problems in Including Marine Area in Environment Account

Including marine area (resources, pollution, and protection) in environmental account pose some problems. First, the calculation of physical assets of marine sector is a major problem as the stocks are not observed directly. The resources, for example fisheries, are migratory in nature and is not confined to specific location. As a result of this too, the calculation of marine resource depletion is equally a problem as it is difficult to capture the actual rate of depletion. Often resolving it requires the use of biological models to estimate stocks and changes in stocks. The marine area also serve multiple functions for example ecosystem services. Even the treatment of ecosystem services is still a major issue that has not been resolved by the SEEA.

Calculating damages due to pollution is even more difficult. Transboundary flows of atmospheric pollutants, pollution due to oil spills and burning of fossil fuels including gas flaring, pollution from poor sanitation arrangement and agricultural activities in the coastal areas are very difficult to measure and quantify thus making their inclusion in national accounting difficult.

Generation of Ecosystem Value Estimates to be Used for National Accounting in GCLME Countries

Considerations in Generating Ecosystem Value Estimates for GCLME: To facilitate the conservation of the GCLME the inclusion of ecosystem value estimates in national accounting is imperative. Although some of the countries already include environmental account issues as satellite accounts in their national accounts, it is important to integrate environmental accounts in the national accounts especially for GCLME countries as these countries depend largely on natural resources for their survival. It is important to note that successful work on environmental accounting depends on two crucial factors. Firstly, it must be focused on answering important policy questions so as to ensure that the accounting work responds to a real demand for policy guidance, and not driven simply by a desire to build databases. Secondly, it must bring in the major players in the areas of environmental policy, economic policy, national income accounting, and the development of information systems on the environment, the economy, and the population. This ensures that people who could either use or provide the data required will cooperate with and support the project.

Policy issues that are of utmost importance in the GCLME and which have to be considered in environmental accounting include the issues of resource depletion especially fisheries resources, pollution of the GCLME environment and coastal area degradation, deterioration of water quality, deforestation, environmental sanitation, and natural resource conservation for sustainable development. To achieve environmental accounting and inclusion in the national accounts, the major stakeholders should be incorporated in the process. A GCLME commission would help to ensure that the individual countries statistical office, planning commissions, ministries of environment, fishing companies, oil exploration companies, bankers, academics and researchers and other stakeholders are incorporated from the onset in the derivation of the accounting framework.

The recommended GCLME commission in initiating environmental accounting can take the following steps:

- Organize a workshop for the major stakeholders in order to sensitize them on the need for environmental accounting and their roles in achieving it in the GCLME. Further decisions about the accounting project should be made by the stakeholders as a group after the workshops.
- In collaboration with the stakeholder groups confirm, further identify and become sensitized on the pressing policy questions facing the GCLME which the environmental accounting must take care of. In line with this, the sectoral focus of the accounting process will be clearly defined
- Choose a methodological approach (or approaches) which will be practical and will also enable the accounts to answer the key policy questions. The methodology of the revised SEEA (indicated above), would serve as a guide. Also, the ongoing work of global initiative on environmental accounting which is an effort by World Bank and Earth Institute to update the SEEA and generate a unified environmental accounting system would serve as a guide for individual countries and for resolving transboundary issues in generating

environmental accounts for GCLME. The objective of the global initiative is presented in Box 3 below.

Box 3: The Global Initiative in Environmental Accounting

The overall objective of the Global Initiative in Environmental Accounting is to promote sustainable development worldwide through the implementation of environmental accounts. The specific objectives are:

- Support implementation of environmental accounts, and the indicators and policy analyses based on environmental accounts that are comparable across countries. Technical support and capacity building for the developing countries will also be provided in the Global Initiative. Developed countries are expected to fund their own activities.
- An interdisciplinary policy research program to address critical issues in the SEEA. Initially, the Global Initiative will focus on components of the SEEA that are most relevant to the policy issues, mainly the monetary accounts. It will address issues related to asset valuation and particularly accounting for ecosystem goods and services. The Global Initiative will develop a collaborative team of economists, statisticians and others to resolve these issues.
- Build sufficient awareness and support for environmental accounting so that it is accepted, as it should be, simply as a more thorough way to compile national accounts. A major focus will be to influence multinational and national agencies to mainstream environmental accounting in their programs

Adapted from Sachs, Lange, Heal and Small, 2005

- Select an institution to carry out the initial accounting work. Considering the fact that some countries have already incorporated some environment accounts as satellite accounts in their national accounts, the government agency responsible for national accounting can kick start the accounting work while a unified team for the GCLME will supervise and harmonize. However, it is important the key players agree on an institution to take charge of this activity and how the entire GCLME countries will be involved and how issues will be harmonized. This is pertinent in order to ensure that the support and cooperation that the work requires is received.
- A team to compile the accounts should be formed. It is likely to include staff of the institution leading the effort, staff detailed from other key institutions, and consultants to provide technical expertise on environmental accounting or on specific issues related to the environment. Team members should have a strong grounding in economics and environmental issues.

- Lastly, the team should build and disseminate the first set of accounts for the countries and the entire GCLME. This fist effort should form the basis for future work.

Some Accounts to be Considered in Generating Environment Accounts for the GCLME:

In generating environmental accounts for the GCLME, the following accounts and issues should be considered.

1. *Physical Accounts*: This will include stocks of resources and annual changes in their stocks. In this regard, all resources of the GCLME should be considered. For example, for fish resources, the basic accounting identity is that opening stocks plus all natural growth and restocking of fish species less total catch by both artisanal fishermen and trawling companies, losses due to pollution and use of chemicals in fishing, losses due to Illegal Unregulated Unlicensed (IUU) fishing, equals closing stocks. Often, as noted earlier, marine capture fisheries are not observed directly and require biological models to estimate stocks and changes in stocks. The fish catch in the area would serve as a guide.

Monetary Accounts: Monetary accounts for resources can be developed directly form physical accounts by assigning appropriate values to resource stock levels and changes in these levels. The net present value (NPV) method which will involve discounting should be used in calculating income and cost of extraction.

Pollutant and Material Flow Account: Considering the fact that pollution and material (including energy and resource) flow accounts track the use of materials and energy and the generation of pollution by each industry and final demand sector, the use of material and energy by industries and homes, especially using the data on demand for energy and materials, and a detailed identification of industries and firms that generate pollutants should be carried out. The volume of the flows should me measured and incorporated in the national accounts.

ANALYTICAL TECHNIQUES FOR ANALYSIS/PROJECTION OF SOCIOECONOMIC IMPACTS OF DEVELOPING THE GCLME AREA

Introduction

Elements of Impact Analysis

Socioeconomic impact analysis focuses on impact of policy change. Impact analysis could be anticipatory or empirical. Anticipatory ascertains the socioeconomic/cultural impact of a project before they occur while empirical involves the analysis of impacts experienced after the project has been implemented, that is, a periodic assessment of a project to find out whether the stated objectives have been achieved. Mosley (1997) used impact assessment and impact evaluation interchangeably to mean an attempt to find out the effect of an intervention after it has occurred. It involves tracking outcome such as gains in environmental management programs, for example, restocking of coastal area resources or implementing community forestry initiatives. Determining what made things work or not work in such project will assist in designing better intervention approach and in sporting "lame ducks" in project/policy initiatives. With the growing use of result-based management by governments and development agencies, determining whether goals have been attained and convincingly linking changes to specific programs has become increasingly critical (Rawlings and Schady, 2002).

Formal impact assessment is more problematic, and thus the most difficult of the evaluation process to undertake. It involves not only the reactions of the beneficiaries and the outputs generated by them, but also measurement of the change which has come about, and, even more difficult, the proportion of this change that is attributable to the project (Bellamy, 2000). On the other hand Barrow (1997) argues that if impact assessment is to become an integral part of planning it must be applied before development decisions are made although retrospective impact assessments are critical in development process. Some of the key elements of socioeconomic impact evaluation include identifying reforms that will be subject to analysis, identifying stakeholders, understanding transmission channels, assessing institutions, gathering data and information, analyzing impacts and monitoring and evaluation of impacts (World Bank, 2003). Mosley (1997) argues that there are three questions which the authors of impact assessment need to answer:

1. what was the net benefit conferred by the intervention (or project), i.e., the difference between the with-project and without project situation?
2. How did that benefit divide up between the different parties affected by the intervention?
3. By what causal process did the benefits and costs revealed by (1) and (2) materialise?
4. What are the lessons for designers of future interventions of this type.

Two major purposes are defined by Mosley (1997), both of which are valid in the context of GCLME projects, namely; assessment of impact in a precise manner as possible, taking into account indirect, long term and unintended effects of an intervention (project) that can then be used for purposes of institutional development and public relations (typically this is valued more strongly by researchers, policy makers and planning and public relations staff of development agencies); and Learning lessons that can be fed back into subsequent phases of the same intervention in the field (valued by field workers/project managers).

Recap of the Problems of the GCLME

The four major transboundary environmental problems/issues identified in the GCLME TDA are:

- decline in GCLME fish stocks and unsustainable harvesting of living resources (Declines in Catch per Unit Effort (CPUE) indicate that catch is exceeding sustainable yields in some resources (Ajayi,1994) while species diversity and average body total lengths of the most important fish assemblages have declined (FAO,2000);
- uncertainty regarding ecosystem status, integrity (changes in community composition, vulnerable species and biodiversity, introduction of alien species) and yields in a highly variable environment including effects of global climate change;
- deterioration in water quality (chronic and catastrophic) from land and sea-based activities, eutrophication and harmful algal blooms;
- habitat destruction and alteration including *inter-alia* modification of seabed and coastal zone, degradation of coastscapes, coastline erosion.
- Lack of environmental policy and institutional coordination among countries in the region.

Expected Interventions and Outputs of the GCLME Project

The major expected results from the successful implementation of the GCLME project which will serve as a guide post for any impact analysis include:

- improved institutional structure to address priority regional issues, including a Guinea Current Commission and other regional and national bodies for conducting effective regional interventions for fisheries and biodiversity conservation and pollution prevention;
- improved legal/management structure for addressing the priority regional issues, including a Protocol on Land Based Activities for the Abidjan Convention, a regional Biodiversity Action Plan, as well as legislative reforms for fisheries, land-based activities, and biodiversity;
- nine successful demonstration projects will serve as a basis for replication in the region and outside the region, as concrete steps towards achieving agreed environmental quality objectives;
- nationally endorsed Strategic Action Program and National Action Programmes (NAPs) with accompanying sustainable financing plan will lead the way towards continued incremental improvement to the GCLME based on a solid foundation of regional commitment and consensus;
- realization of the pertinent WSSD JPOI Targets related to Oceans and Coasts.

Socioeconomic Impact Methodologies

Considerations in Choosing Impact methods:

One of the most important common conclusions to emerge is that impact assessment relies on both formal and informal methodologies, and is a mix of objective and subjective analysis (Bellamy, 2000). There is also a common consensus that the methodology and the process must be established from the outset of the project, not introduced post hoc. Mosley (1997) observed that impact assessment is split between two polar alternatives, the rigorous and the subjective. Subjective approach focuses on testimonies of various groups without necessarily making any quantitative measurement.

He argues that the form of impact assessment to be adopted depends on the users of impact assessment and the purpose for which they require it. Both formal and informal methods

have a place; there is a case for having both treatment (i.e. those who have received the intervention), and control groups (those who have not).

Menou (1994) provided some useful checklist for anyone designing impact studies, for example, types of impact: those that are both measurable and quantifiable, such as cost and time savings; those that are measurable but not quantifiable, such as increased quality; those that are neither measurable nor quantifiable such as new insights, learning, etc. In general, four factors will condition the choice of approach to be used in socioeconomic impact analysis, namely; the importance of indirect impacts; data availability; time availability; and capacity (World Bank, 2003). In determining choice of impact method, it is always important to ascertain whether the reform under consideration will make a direct or an indirect impact. Reforms with indirect impact will include those reforms that will have several transmission channels and markets, leads to behavioural changes at the household level, and/or has multiple round effects that may take time to actualise (World Bank, 2003). Based on considerations of direct/indirect impact and data/time/capacity, Table 19 shows the impact analysis methods.

Table 19: Socioeconomic impact analysis methods in relation to different considerations

Date/Time/Local Capacity availability →			
Low	Low	Medium	High
Indirect impact ↓	Beneficiary assessment Cost benefit analysis	Social impact assessment Participatory poverty assessment Benefit incidence analysis Social capital assessment tool Demand/supply analysis Household models Behavioural incidence analysis (ex-post and ex-ante marginal incidence analysis and ex-post evaluation of assigned programs)	Poverty mapping
High	Social impact analysis	Multi-market analysis Reduced form	Social accounting matrices Input/output models Computable general equilibrium Macro-model + micro simulation

Adapted from World Bank, 2003

Note: the tools presented along the dimension of data/time/capacity availability are additive across rows. That is to say, any tool that can be used in the context of lower data/time/capacity can also be used with higher data/time/capacity and certain tools such as social impact assessment can be applied to examine higher indirect impacts.

Social Analysis: these consist of techniques that ascertain how people are likely to be affected by reforms, how the impact will differ among groups, (for example, based on gender and ethnicity), coping mechanisms are available for people to deal with changes after the reforms and who is most likely to be vulnerable to a particular reform. Social analysis

methods include social impact assessment, participatory poverty assessment and social capital assessment tool.

Direct Impact Analysis

Direct impact assessment is a simple assessment of who is directly affected by a policy reform and by how much. It assumes no behavioural responses from affected households or groups, that is if prices change, quantities do not change. Example is incidence analysis. Incidence analysis or accounting approach does not measure second round effects attributable to behavioural responses but finds out who pays what to the State and who receives what. The policies with some directly observable or easily conjectured impact at the household or personal level are typically tax, transfer, and more generally public spending policies (Bourguignon and Pereira, 2003). There are two main types of incidence analysis relevant to direct impact analysis: simple incidence analysis and marginal incidence analysis (World Bank, 2003). The first measures the incidence of average expenditures on education, health or a tax, that is, it considers all expenditures, while the second focuses on the distributional incidence of the last or the next unit of expenditure or tax.

Behavioural Analysis: this includes economic tools that go beyond direct impact analysis to account for second round effects attributable to behavioural responses. These responses may modify receipts or payments by the unit under consideration, say a household. Some behavioural models include ex-post behavioural marginal incidence analysis, ex-ante behavioural marginal evaluation of policy reforms, ex-post impact methods for assigned programs (randomization, double difference, propensity score matching technique), demand analysis, supply analysis and household models.

General Equilibrium Analysis: General equilibrium analysis is different from partial equilibrium in that it considers the entire economy. General equilibrium theory is a formalization of the simple but fundamental observation that markets in real world economies are mutually interdependent. Although it can be used in the analysis of most type of policy reforms, it is most relevant to reforms with multiple and significant indirect impacts on the economy through a number of transmission channels (World Bank, 2003). Special tools for general equilibrium analysis are social accounting matrices and computable general equilibrium models.

Impact methods to be used in GCLME

Overview: Considering the proposed interventions and output of the GCLME project, a mix of impact assessment methodologies will be used. Using different approaches is recommended because one method will not automatically capture the expected impact of the interventions. In many instances, using one technique alone allows only a partial evaluation of the poverty impact of a particular policy; a more comprehensive view may be obtained by using various techniques at the same time (Bourguignon and Pereira da Silva, 2003). Secondly, anticipatory or ex-ante (before the projects) and analysis or ex-post (after the

projects) procedure will be adopted in the assessment of the GCLME projects. In fact the assessment cannot be self-contained, isolated and one time exercise, but an ongoing process, built into project formulation, not added as an afterthought, and should be beneficiary/user driven (Bellamy, 2000).

Stakeholder Analysis: Basically, the coastal area inhabitants, who exploit and depend on the resources and who are the immediate people that bear the brunt of the degradation of GCLME are the major stakeholders. The rich living marine resources of the GCLME provide livelihood and employment for thousands of fishermen who operate in the area, foreign exchange for governments and food security for the peoples in and out of the region. Approximately 40% of the region's 300 million people (more than 1/2 of the population of the African continent) live in the coastal areas of the GCLME, many of whom are dependent on the lagoons, estuaries, creeks and inshore waters surrounding them for their food security and well being (Ukwe 2003). Considering that the underlying cause of over-exploitation by artisanal fishermen is poverty, any improvement on the GCLME will be first lead to increase in income of the people and reduction in poverty. Other stakeholders include government institutions, trawling companies, oil companies, and private companies involved in tourism, other companies and individuals involved in extractive industries e.g. mining in the GCLME.

Expected intervention and results of the GCLME projects and proposed socioeconomic impact approaches to be applied: The expected intervention and results of the GCLME project as indicated in the project document and proposed techniques for analysis and projection of socioeconomic impacts are summarized in Table 20.

Table 20: Expected intervention and results of the GCLME project and proposed Socioeconomic impact approaches to be adopted

S/ No	Intervention/Results	Nature of Impact	Proposed Technique Before project	Proposed Techniques After project
1	Recovery and sustainability of depleted fisheries and living marine resources	Direct/indirect	Social impact assessment (SIA), cost benefit analysis	SIA, propensity score matching/instrumental variable technique (IV) and other methods for ex-post analysis of assigned programs
2	Reduce land and sea –based pollution and improve water quality	Direct and Indirect	Social Impact Assessment (SIA)	SIA, Computable General Equilibrium (CGE)
3	Planning for biodiversity conservation, restoration of degraded habitats and develop strategies for reducing coastal erosion	Direct/indirect	SIA	
4	Improved institutional structure for conducting effective regional interventions for fisheries, biodiversity conservation and pollution prevention (emission payments and tradable permits issues may be involved)	Direct/indirect		SIA, CGE
5	Improved legal/management structure and legislative reforms including rent and tax reforms for fisheries, land based activity and biodiversity	Direct/indirect		SIA, Ex-post behavioural marginal incidence analysis
6	Nine successful demonstration projects	Direct/indirect		SIA, Propensity Score Matching Technique, Double Difference, IV

Source: Recommendations by the authors

Checklist for Social Impact Assessment of the GCLME:

Checklists are used in the process of undertaking an SIA to determine whether or not there are some significant socio-cultural impacts that should be assessed, as well as to highlight those issues which are of particular importance (Nwafor, 2006). Based on the adaptation of that of oil and gas industry by Health, Safety and Environment Manual (1996), the following checklist for SIA is proposed for the GCLME.

- *Description of development activity*: this will include activities for the restoration of the GCLME. Activities will include recovery of fisheries resources; removal of *Nypa* and other invasive species; reduction of pollution to the marine area; putting in place integrated coastal area management framework; institution of legal framework for effective management of the GCLME; setting up of regional commission and other national bodies for effective regional intervention in the management of GCLME. This section will also indicate the time line for activities.
- *General context of the affected area*: this will include settlement patterns in the coastal areas including population pressure; land uses; size of the area affected by the pollution, *Nypa* and other invasive species; political situation locally, nationally and regionally; socioeconomic status of the coastal inhabitants including a description of major occupation and resource exploitation, poverty level threats to livelihood; infrastructure situation etc.
- *Baseline Information*: this will cover such issues as methods and techniques of data collection including timing and suitability of approach used; data reliability and sufficiency; indication of uncertainty and assumptions; identification of social trends; indication of size and make-up of populations according to the range of characteristics; fertility, mortality and migration processes; social infrastructure potentially affected by the proposed activities; sites and areas of cultural significance; existing uses of land and marine areas; patterns of resources use and exploitation; relevant institutions (locally, nationally and regionally) and patterns of leadership; sensitivity of the coastal inhabitants; national, regional and local policies affecting the project area; presence of endemic disease especially due to the location of the area e.g. coastal area related ailments; accessibility of community infrastructure; and perceptions of quality of life including wealth definitions by the coastal inhabitants.
- *Scoping and Consultation*: this will cover issues such as stakeholders consulted e.g. government officials, Non Governmental Organization working in the area, fishermen, trawling companies, other coastal inhabitants and representatives of disadvantaged groups; consultation methods e.g. informal meetings with communities and community leaders, meetings with residents and stakeholders; impact identification method, e.g. use of past experience of similar project activities and professional judgment; logic of impact identification; social impacts proposed and reasons; values and perceptions of the various stakeholder groups affected; and use of informal data sources, e.g. local historical accounts.
- *Assessment of Impacts (Magnitude and Significance)*: this will cover issues such as methods and techniques of prediction; use of learning and appraisal methods; cross checking information by triangulation; qualitative and quantitative approaches, e.g. use of professional judgment and experience to predict impacts on lifestyles and

multipliers to predict indirect employment, household surveys can also be applied; dimensions of impact, e.g. positive and negative effects; project's impact on natural resources especially fisheries and other marine resources social changes affecting resource use and impacts on resources resulting in socials effects; health risk for local communities if any; demographic changes, or example, changes in migration pattern, movement of people to areas where there is increased fishing and marine environment activity; socioeconomic changes e.g. number of locals employed.

- *Monitoring*: The last step of SIA is development of a monitoring programme. The strategic objective of monitoring and evaluation of activities is to measure the extent to which the objectives of the project are being achieved and identification of any important unanticipated impacts. Thus the monitoring programme should be able to identify potential pitfalls, track project development and compare actual impacts with projected ones. The monitoring aspect will indicate the monitoring programme, e.g. parameters to be monitored, use of data, responsibility, frequency and time periods; community involvement; how the use of monitoring information will be used for corrective action and in future SIA. An example of monitoring programme which can be used in the SIA is to make monitoring a continuous process instead of putting it at the end of implementation. Fig 1 below depicts the continuous process form of monitoring.

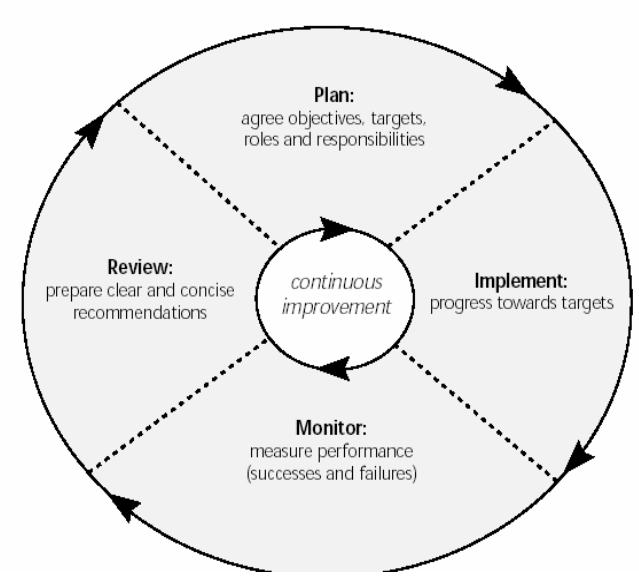

Figure 1: Conceptual Model (Adapted from National Biodiversity Strategy and Action Plan (NBSAP), 2004)

Thus, based on measurable indicators, the progress of the project will be assessed. This will involve a thorough comparison of projected activities with actual achievements based on the work plan and the log framework. Details of reasons for variances will always be determined and adequate corrective measures taken. Data collection in then monitoring stage will involve key informant interviews, focus group discussions, and direct observations. The recommended monitoring approach will help assess the progress of implementation and make timely decisions to ensure that progress is maintained.

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