

## ANNEX P

### Summary of Demonstration Projects

- 1. Fisheries: introduction and maintenance of an assessment and management system to achieve and support the long-term sustainability of the Fish and Fisheries of this ecosystem: regional execution**

ASSESSMENT AND MANAGEMENT OF FISHERIES RESOURCES FOR  
SUSTAINABILITY AND BIODIVERSITY CONSERVATION IN THE GCLME  
REGIONAL PROJECT PROPOSALS

*BY*

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## SUMMARY

The Guinea Current Large Marine Ecosystem (GCLME) Project involving sixteen countries and these are Guinea Bissau, Guinea, Sierra Leone, Liberia, Cote d' Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon, Sao Tome and Principe, Equatorial Guinea, Gabon, Congo Republic, Congo Democratic Republic and Angola is an offshoot and an expansion of the six-country Gulf of Guinea Large Marine Ecosystem (GOGLME) Project.. The Guinea Current which determines the coverage of the GCLME Project is a continuum of coastal waters associated with innumerable and expansive nearshore watersheds and offshore waters, all characterized by a unique blend of physical, chemical and other environmental factors predisposing biological productivity and fisheries. Ranked among the most productive marine waters in the world, GCLME represents a distinct economic and food fish security disposition.

The Fisheries Component of the GCLME Project "Assessment and Management Of Fisheries Resources For Sustainability And Biodiversity Conservation proposes to address environmental factors predisposing fisheries resource health, production zone, production decline, shared stocks, transboundary issues, management framework and options, stakeholders participation and implementation arrangements.

The major outcome of the regional fisheries demonstration project anticipated is the establishment of Guinea Current Fisheries Management Commission, serviced by appropriate science coupled subsets including Regional Fisheries Data And Network Centre, Regional Fisheries Museum as depository of prototypes and artifacts, the Regional Centre For Pollution Finger Printing And Habitat Protection and Restoration for pollutant source identification and quantification to facilitate mitigation and clean-up remediation.

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## LIST OF ACRONYMS AND ABBREVIATIONS

1.	CECAF	Committee for East Central Atlantic Fisheries
2.	ECC	Equatorial Counter Current
3.	EEZ	Exclusive Economic Zone
4.	E-mail	Electronic Mail
5.	FAO	Food and Agriculture Organization
6.	GC	Guinea Current
7.	GCLME	Guinea Current Large Marine Ecosystem
8.	GEF	Global Environmental Facility
9.	GIS	Geographical Information System
10.	GONGLME	Gulf of Guinea Large Marine Ecosystem
11.	GTS	Guinea Trawl Survey
12.	ICAM	Integrated Coastal Area Management
13.	IOC	Intergovernmental Oceanographic Commission
14.	ITCZ	Inter Tropical Convergence Zone
15.	IUCN	World Conservation Council
16.	LME	Large Marine Ecosystem
17.	LOA	Length Over All
18.	MSY	Maximum Sustainable Yield
19.	NECC	North Equatorial Counter Current
20.	NGO	Non Governmental Organization
21.	OAU	Organization of African Unit
22.	STRC	Science Technology and Research Commission
23.	TED	Turtle Excluder Device
24.	UK	United Kingdom
25.	UNIDO	United Nations Industrial Development Organization
26.	US	United States

## 1.0. BACKGROUND AND CONTEXT

The Guinea Current (GC) is essentially a warm, superficial and eastward flowing saline water system lying between Bissagos Island, Guinea Bissau (Latitude 11°N, Longitude 16°W) and Cape Lopez, Gabon (Latitude 0° 41' S, Longitude 8° 45' E) (Binet and Marchel, 1993) in the east central Atlantic. It derives from the North Equatorial Counter Current (NECC), and overlays the westward flowing Equatorial Counter Current (ECC). The Guinea Current transits or influences coastal waters and EEZ of 16 countries (Figure 1) namely Guinea Bissau, Guinea, Sierra Leone, Liberia, Cote d' Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon, Sao Tome and Principe, Equatorial Guinea, Gabon, Congo Republic, Congo Democratic Republic and Angola. A total of 7,600 Km coastline (Table 1) serviced by lagoons, over 100 Km<sup>2</sup> in area, innumerable rivers (Table 1) and three sedimentary coastal basins off Cote d' Ivoire, the Niger, and Gabon to Angola are part of the GC water system.

Characterized by a unique blend of physical, chemical and other environmental factors predisposing biological productivity and fisheries, the Guinea Current System represents a Large Marine Ecosystem (LME) ranked among the most productive marine waters in the world. Remarkable for its rich continuum offshore waters and coastal waters, serviced by extensive near shore water sheds the Guinea Current represents a distinct economic and food fish security disposition.

### 1. 1. FISHERIES PREDISPOSING FACTORS

Several environmental factors predispose the Guinea Current Large Marine Ecosystem (GCLME) to fisheries resource abundance and selective species composition and assemblages. These factors include hydrography, especially temperature, salinity and other water quality parameters; tidal ranges; upwelling and thermocline regimes; topography, nature of bottom and trawlability; primary and secondary productivity; benthos; associated wet lands, lagoons and their estuarine products and services especially terrigenous flush; climate change and climate variabilities; Inter Tropical Convergence Zone (ITCZ) oscillations, and wind forcing; as well as rainfall and drought cycles. Marine debris, oil spillage and other sources of marine pollution, nutrient enrichment and eutrophication are major among the anthropogenic factors (Ajayi 2001).

The intermix of the warm, surface waters of the Guinea Current with cold fronts create thermocline regimes as well as the upwelling systems in the GCLME area, giving varying nutrient profiles in sections of the water. (Gulland 1971). Koranteng and McGlade (2002) “time blocked” 30-year in the central GCLME area ocean temperature, salinity and thermocline depth fluctuations as productivity variables confirming that the local upwelling system governs the biological capacity off Ghana and Cote d' Ivoire. Intensification of the December – January minor upwelling in the area, over the years (Koranteng 1988), has been documented, and GOGLE Continuous Plankton Recorder samples confirmed a “new” upwelling location as far east as Benin and Nigeria. Incontrovertible linkages have been established between these environmental parameters and their variabilities, as factors of the upwelling phenomenon and its cyclic interspecifications on one hand, and the natural fluctuations of target fish abundance on the other.

Around river mouths, especially off Sierra Leone, Cote d' Ivoire, Nigeria, Cameroon and the Congo, significant reductions in salinities are seasonally associated with the rains. Folorunsho et

al (1998) estimated sediment discharge as 90 million tonnes annually. This terrigenous flush into nursery grounds in the estuaries and mangroves, contributes significantly to the replenishment of blue mud critical to the penaeid shrimp fishery. They determine the fisheries production zones and their productivity levels.

## 1.2. FISHERIES PRODUCTION ZONE

Factored by a combination of environmental variables especially temperature and salinity ranges dictated by the thermocline movements and upwelling regimes and estuarine nourishment in general terms, the Guinea Current Large Marine Ecosystem (GCLME) has several ecological subsets. As such, the main fisheries production zones in the Guinea Current Large Marine Ecosystem area are

- a) Sherbro zone – Guinea Bissau, Guinea, Liberia and Sierra Leone;
- b) Gulf of Guinea West – Ghana, Cote d' Ivoire, Togo and Benin;
- c) Gulf of Guinea Central - Nigeria, Cameroon, Gabon, Sao Tome and Principe and Equatorial Guinea; and
- d) Gulf of Guinea South – Congo DR, Congo and Angola

Each of these production zones has distinct commercial fish species composition and assemblages.

## 1.3. FISHERIES EXPLOITED AND SPECIES COMPOSITION

The main fisheries resources exploited in each of these zones are Small Coastal Pelagics, Large Offshore Pelagics, Demersal Fin Fish Stocks, Shrimp Fishery and Molluscs. The small pelagics consist of

- a) Clupeidae principally Sardinella aurita, round sardinella ; Sardinella maderensis, flat sardinella ; and Ethmalosa fimbriata, bonga;
  - b) Carangidae including Caranx rhoncus, yellow horse mackerel; and Trachurus trachurus, horse mackerel;
  - c) Scombridae especially Scomber japonicus, Spanish mackerel; and
  - d) Engraulididae represented by Engraulis encrasicolus, anchovy.
- ii) Large offshore pelagics on the other hand are essentially the tuna fish stocks represented by
- Thunnidae mainly Katsuwonus pelamis, skipjack Thunnus albacares, yellowfin tuna, and tuna like fishes.
- iii) Demersal fin fishes consist of an inshore component dominated by the Sciaenid Community principally
- (a) Sciaenidae  
Pseudotolithus elongatus, estuarine croaker; Pseudotolithus senegalensis, short croaker; and Pseudotolithus typus, long croaker;
  - (b) Pomadasysidae  
Pomadasys jubiline, grunt;

Pomadasys suillus, grunt and

- (c) Polynemidae  
Polydactylus quadrifilis, shinynose ; and  
Galeoides decadactylus, thread fin..

The deeper water component of demersal finishes is represented by the Sparid Community particularly

Pagellus bellotti, sea bream; and  
Sparus caeruleosticus, porgies;

- iv) The shrimp fishery in the GCLME area exploits Inshore penaeids especially Penaeus notialis, pink shrimp; and Parapeneopsis atlantica, brown shrimp. Offshore penaeids, on the other hand, consist of Parapenaeus longirostris, deep water rose shrimp.
- (v) Molluscs, consisting of squids, cuttlefish and octopus are still an emerging fishery highly localised.

In summary the Guinea Current Large Marine Ecosystem (GCLME) covers, coastal and ocean space together with nearshore watershed, accommodating a variety of production subsystems, marked by seasonal upwelling, and deltas seasonally dominated by river outputs. As such, the GCLME is characterized by season driven production cycles, typified by the Senegal upwelling influence to the west, the Benguela upwelling influence to the south and the central Ghana-Ivorio upwelling system, rather classic for its two-time minor and major nutrient nourishment occurrences, separated by a period of relative thermal stability. Delta dominated systems take up the interspaces.

## 2.0. RATIONALE AND OBJECTIVES

Having regards to the main objective of the GCLME project – the restoration and sustenance of the health of the Guinea Current and its natural resources - particularly as it concerns the conservation of biological diversity, the status of the fisheries resources vis – a – vis exploitation is very relevant and indeed important for its economic value and long term sustainability.

### EXPLOITATION PREREQUISTE

First and foremost, a pre-exploitation evaluation of the capacity of fisheries resources to support commercial operations – an exploratory fisheries survey is cost conscious sine qua non prerequisite. The survey should target the species composition, abundance and distribution of the fisheries resource in time and space. Usually in that framework, the survey is structured to investigate the zones of resource concentrations and the pathway to sustainable development together with initial management options and their appropriateness. It guides the selection of technologies and intensity of fishing (effort) sets the initial limits of investments, while indicating the resource rent (rate of returns).

Subsequent to the initiation of commercial exploitation, fisheries resources must be continuously monitored and assessed regularly. Such periodic monitoring focuses as a matter of priority spatial

and temporal variabilities among other fishing pressure induced changes and environmental forcing, often cyclic. Taking all these factors into consideration, the interval between the monitoring surveys should be long enough for stock level changes to manifest perceptibly enough, but short enough for the negative changes to be reversible.

The very first region-wide Fisheries Resource Survey was the Guinea Trawl Survey (GTS) conducted under the auspices of the Science and Technology Research Commission – STRC - of the Organization of African Unity (OAU) (African Union) in 1963 – 64. Unfortunately, the GTS remains the one and only comprehensive regional fisheries survey in the GCLME area to date.

All follow up monitoring surveys which should have been GCLME-wide were limited in scope, time-spread and coverage. In addition, they should have been simultaneously season referenced, location specific and fishery prioritized for reliability. Indeed, in the GCLME area, the regional survey should be repeated at 5 – 10 year intervals, no more, no less.

In the circumstance, 40 long years after the one and only, regional appraisal, another fisheries resource survey is long overdue, not just to update the data and records, but also to re-establish and re-validate the baseline for resource management for sustainable exploitation, in the wake of several ocean related global environmental refractions including EL NINOs.

The long 40year inter survey interreguauum has been characterized by massive and wide-spread changes in the resource level, exploitation systems, governance regimes, ownership stakes bilateral fishing rights agreement negotiations, fisheries products trade and equity, as well as environmental parameters. First of all Annual marine and inland fish catches by the local fleets of the 16 GCLME countries range between 1.15 and 1.46 million tonnes (FAO, 2000). Marine fish alone accounts for 0.69 and 0.86 million tonnes annually. Such is the tremendous value of the GCLME fisheries resources. The catch records even show an increasing trend for several countries but that simply masks the real position of the resources.

While the export ranged between 0.040 and 0.103 million tones valued at US\$ 43 – 173 million annually (FAO, 2000), fishery products import averaged 0.611 – 0.900 million tones mainly pelagic (often rancidity prone poor quality mackerels) valued at US\$ 0.376 and 0.592 million, more than 300 percent the value of export. It is indeed a paradox that in the GCLME area, without doubt among the most productive waters in the world, many countries are net importers of fisheries products and some of these “imports” might be fish caught in GCLME waters, packed at sea, labeled as catches of non coastal country and then promptly landed in the region as exports for hard currency. The poverty implication of GCLME countries paying scare hard currency to foreign flag vessels for GCLME owned fish is doubly consequential on the pocket and psyche. Indeed a densely populated GCLME country is the largest importer of frozen fish in the whole wide world, among the largest for canned fish, and at one time among the largest for stockfish. Without doubt, intra regional trade among GCLME countries, to be addressed by the fisheries assessment and management project will assuage matters.

Beyond the skewed export-import balance, fisheries exploitation has actually resulted in stocks decline in the GCLME area. In Equatorial Guinea for example, artisanal fisheries annual catches declined from 1,500 – 2,000 tonnes prior to the 70’s (FAO, 1970; Lagoin and Salmon, 1967) to 1,000 tonnes in the 80’s.

The number of fishing canoes, 7,350, 8,650 and 200,000 in Cameroon, Ghana and Nigeria respectively and the number of fishermen, 2,400 Cameroon and 7,600 Cote d’ Ivoire further substantiate over capacity. In Sao Tome and Principe, artisanal landings decreased from 1,800



tonnes in 1967 to 1,500 tonnes in 1979 (SCEY, 1980). Artisanal fisheries may be the lowest level of organization and fisheries livelihood in the GCLME area, its technologies even if least cost may be complex and no less environment compromising. For example, the dragnets and beam trawls of the small scale fisheries tunnel the soft substrate and disturbs the benthos impacting fauna biodiversity.

The biomass of small pelagics in the western and central Gulf of Guinea was estimated as 392,000 tonnes (CECAF, 1994) suggesting that catches of 257,000 tonnes greater than 0.60 of biomass is over exploitation (Mensah and Queatey, 2002). Off Guinea, (CECAF, 1991) biomass estimates of 180,000 tonnes for demersal fish in 1990 decreased by 50% between 1991 and 1994 due to effort increases.

In the industrial and semi industrial fisheries in the region, enforcement of effort control has been difficult. In Cameroon, the number of licensed vessels rose from 1 to 39 between 1951 and 1979 (Laurce, 1969; 1972; FAO, 1987) and that landings fluctuated between 15,736 tonnes in 1974 and 12,500 tonnes in 1984 (FAO, 1987). Industrial fin fish and shell fish fisheries and their shrimp by catch of juvenile fish off Nigeria are responsible for much more damage. Shrimp catches increased from 942 tonnes in 1970 through 15,736 tonnes in 1974; 20,397 tonnes in 1976 declined to 268 tonnes in 1980 and 859 tonnes in 1987.

Off Nigeria, licensed semi industrial vessels numbers grew from 13, 29 and 52 in 1971, 1976 and 1983 respectively to 440 in 1984 (Federal Department of Fisheries Nigeria) totally at variance with the maximum number of inshore trawlers - 100 vessels - for Nigeria (Ajayi and Anyanwu, 1997). Considering that most of these vessels actually shrimp trawl with 44mm cod-end mesh or less, and that 75% of the catches of shrimpers is fish and that 44% of that fish by catch is undersize juveniles, so much damage is traceable to over capacity. Indeed, in the Nigeria trawl fishery, croakers Pseudotolithus typus categorized as medium is now regarded as extra large (TL 50cm). According to FAO, 1995, (Tables 2 – 6 ) most of the pelagics, demersal, crustaceans and mollusc resources in the GCLME are either over exploited, or very close to it leaving very little room for expansion.

Over capacity and associated fisheries returns decline were linked with coastal community poverty in Sub-Sahara Africa and biodiversity loss persuading the World Summit on Sustainable Development to time schedule ecosystem-predicated international remedial action. The restoration of fisheries stocks to maximum sustainable yield levels is anticipated by year 2015. This sense of can only be translated into appropriate programme of action in consonance with the fisheries and environmental audit to result from the fisheries survey.

Furthermore, Nigeria has over 90 active oil fields about 6,200km of flow lines and pipelines spread over 30,000km<sup>2</sup> in the Niger Delta (Shell, 1998). Oil spills average about 7,500 barrels a year off Nigeria. Cameroon also produces 6.25 million tones of crude oil in the Rio del Rey Basin annually. Gabon, Equatorial Guinea, Sao Tome and Principe and Angola are also active in petroleum oil sector. In addition, a third of the petroleum in the GCLME area is on the coast with all these potent for effluent discharge. The same zone harbours 60% of all industries in the GCLME (UNDP / GEF, 1993) discharging untreated effluents directly into the waterways all ending on the coast. Innumerable marine pollution incidents resulting from crude oil spillages and untreated effluent discharges are a major factor negative to fisheries resource sustainability. Sand mining prevalent on the beaches in the region also compromise the food web and coastline integrity. Agricultural run-off and raw sewage discharges contribute to eutrophication leading to various reports of harmful algal blooms.

The overall impact of pollution on coastal resources has to be investigated and documented as baseline information for future ecological reference especially as more changes are anticipated at least from 16 gas pipeline linking Nigeria, Benin, Togo and Ghana. The exploration and exploitation of gas in the GCLME region should benefit from substantial data base records for amelioration of adverse consequences. Marine pollution records in the GCLME region make the proposed fisheries survey especially important.

Nothing justifies the need for regularized fisheries resource survey more poignantly in the GCLME area than the records of fisheries changes or species succession in some of the subsystems of the region. In the early 1973 Sardinella aurita fishery and catches of grunts, Pomadasys species in Ghana-Ivory upwelling area suffered sharp decline, table 2. At about the same time 1973 trigger fish Basistes capriscus which hitherto was hardly noticeable in the landings, suddenly assumed prominence and dominated the landings over 250,000 tonnes in 1981. By 1985, just after a fleet of vessels to exploit the “new” resource, had been built with a loan facility, Balistes vanished totally from the landings. The disappearance also coincided with the re-emergence of Sardinella species aurita the dominant pelagic stocks. The economic consequences of such massive scale of species flip were immense. The fishing industry and the financial institutions would have been saved the harrowing experience and embarrassment had monitoring survey records been long term enough to accurately predict and forestall the species succession.

This is especially the case as preliminary analyses are putting cyclic weather changes and perhaps environmental forcing in some of the GCLME area at 10 year and 30 year minor and major cycles respectively. Region-wide collection of relevant information and the creation of a database to facilitate environmental predictability as it moderates fisheries resource abundance are doubly urgent now than before in view of global warming, together with climate change and their marine resource impact.

For example, tiger prawn, Penaeus monodon, hitherto unknown in the Central Gulf of Guinea subset suddenly appeared as 1 or 2 pieces in 35 – 40 day shrimping cruises in the late ‘90s. Tiger prawn catches have since grown to commercial levels. Presently, landings of 700kg per trip by shrimpers are significant contributions to variability. Such large scale change has to be rigorously investigated for explanations vis-à-vis management options amply justifying regularized surveys.

The regional fisheries assessment and management project here proposed focuses the relationship between the living marine resources and the environment, monitoring the quality and quantity of fisheries harvests, seasonalities and variabilities in upwelling and non upwelling locations.

At the core of the project is a comprehensive fisheries monitoring survey, targeting the major stocks in the Guinea Current system. The survey is to elucidate the changes in the fish stocks (catch variabilities and trends) attributable to environmental conditions. Impact of fishing technology changes and socio-economics have also to be examined as baseline for the short and long term status and trends assessment and for the prediction of the future of GCLME fish stocks.

Work details include measurements of abundance, bio-diversity and stock levels, fish age and growth analyses, predator – prey interactions and gross pathology observations all leading to current biomass estimates and species composition change assessments. Measurements of temperature, salinity, and other environmental parameters and macrobenthos abundance will provide comprehensive information backdrop to the changes and physical health of the Guinea Current Large Marine Ecosystem.

The survey will among other things

- (a) identify the different fish stocks prevalent in the Guinea Current Ecosystem and their boundaries;
- (b) determine the present structure and species composition of fish assemblages in each fishery for comparison with earlier records;
- (c) document the spatial and temporal changes of the fish stocks;
- (d) investigate the variability and trends attributable to environmental forcing conditions;
- (e) assess the impact of fishing technology changes;
- (f) predict the short and long term status, potentials and socio-economics of fish stocks; and socio-economics of exploitation
- (g) locate breeding and feeding grounds of the finfish and shellfish stocks;
- (h) determine the seasonal migration patterns of economic species; and
- (i) demarcate the sensitive areas in the Guinea Current Ecosystem and identify vulnerable species.

Survey records will provide data for projections of fish yields, fishing levels and exploitation pattern as baseline for recommendations of optimal fishing strategies, all of resource abundance predictability and long term which are essential for fisheries management. The project should positively impact food fish security, fisheries exports and economics and marine biodiversity in the GCLME region.

Survey planning meetings proposed are to review previous effort principally the Guinea Trawling Survey (GTS) and the Gulf of Guinea Large Marine Ecosystem Fisheries Survey (GOGLME) to harmonize the methodologies in order to facilitate comparison. The planning meetings are to serve as training grounds for young scientists in the Region and are therefore to prioritise the participation of experienced researchers in the GCLME Region as Resource Persons for ownership significance. Resource personnel from GCLME partners are to complement regional capacities.

### 3. 0. PROJECT ACTIVITIES / COMPONENTS AND EXPECTED RESULTS

#### 3. 1. GCLME FISHERIES ISSUES AND CONCERNS

Having regard to the foregoing, the fisheries production challenges and fisheries exploitation concerns in the GCLME area, to be addressed by the Regional Fisheries Assessment Project are

- Mangroves and River Mouth Ecologies and Closures;
- Destructive Fishing Methods;
- Habitat and Nursery Ground Degradation;
- Ecosystem uncertainties and loss of biota integrity;
- FAO Code of Conduct for Responsible Fisheries and compliance;
- Biological diversity loss;

- Ornamental fish survey for exports;
- Exotic species introduction;
- Human dependence on coastal areas and Population Migration;
- Conflicts between User Groups;
- Integrated coastal area management;
- Coastal erosion;
- Coastal Industry Waste Discharge and Management;
- Untreated effluents and raw sewage discharge;
- Petroleum Oil Spillage and Marine Pollution;
- Water Quality;
- Anthropogenic Nutrient Enrichment;
- Terrigenous flush;
- Climate change and Climatic Variabilities;
- Upwelling;
- Periodic Environmental Audit and Environmental Forcing;
- Current dynamics, Fronts, and Subecologies;
- Guinea Current Changes;
- Over exploitation;
- Fisheries Production decline;
- Large Scale Changes in stock abundance
- Fishing effort control;
- Shrimp Trawl By Catch;
- Sea Turtles and other Endangered Species;
- Ship Board Measurements and Ship Time Availability;
- Straddling Stocks, Shared stocks - Migratory species;
- Stocks delineation;
- Biomass flip and species succession;
- Under - Exploited Stocks;
- Production Increases;
- Employment, Fisheries Livelihoods and Socio-economics;
- Loss of Income from fisheries products sales and Poverty level;
- Resource Level Predictability;
- Exploitation Levels;
- Over capacity;
- Non-Sustainable Technologies and Alternatives;
- Food Fish Security;
- Poverty Reduction;
- Import - Export Balance;
- Import Substitution;
- Intra Regional Fisheries Products Trade among GCLME Countries;
- Long Term Resource Sustainability;
- Data Gaps and Inadequate Understanding;
- Resource Monitoring Surveys;
- Fisheries Management Protocols and their appropriateness
- Enforcement and Monitoring, Control and Surveillance;
- Policies – Regional and National Harmonization;
- Critical Mass of Skilled Operatives;
- Communication Gap and Awareness;

- Stakeholder Involvement and Networking;
- Capacity Building and Staff Upgrade;

Details of Project activities and Components addressing these issues and concerns and the expected results are as outlined below.

### 3.14. LENGTH BASED MANAGEMENT PROTOCOL

Techniques for biological data collection at national level and research especially length frequency measurements and analyses as well as age determination have to be standardized by the GCLME resource survey to facilitate the co-management of shared stocks and other resources.

Thereafter, fishery-wide records of length and age at first maturity, and in relation to length and age at first capture and mean length in the fishery will be researched, as they are meaningful parameters for management.

### 3.15. MANAGEMENT FRAMEWORK AND OPTIONS

Reinforced by minimal age readings for reliability, length based fisheries management, is no less accurate than the other sophistication's in use, and is relatively less data demanding.

GCLME fishery survey is to promote and prioritise length based fisheries resource management options, for cost effectiveness.

### 3.11. ENVIRONMENTAL FORCING AND BIOMASS FLIP

Management frameworks have to accommodate environmental forcing and limits. The sudden collapse of the Ghana-Ivory sardinella fishery from 95,000 t (over and above 40,000 t predicted MSY) to 2,000t a year and its seeming substitution by Balistes spp., trigger fish recording 200,000 tonnes a year up from nothing at all are on record for GCLME. Off Nigeria, tiger prawns, Penaeus monodon hitherto unknown have become commercial whereas Parapeneopsis atlantica, brown shrimp; diminished in abundance. GOGLME survey cruise found Chlamys sp in quantities hitherto unrecorded. First indications suggest that changes in the environment are at least partly contributory.

Without doubt environmental and climatic forcing (Koranteng and McGlade 2002) causative of biomass flips or species succession have to be researched and factored into management strategies (Ajayi 2001) as appropriate.

### 3.16. PENAEID SHRIMPS

Penaeid shrimps which are major exports of the GCLME are amphibiotic - juveniles in lagoons and adults at sea. Estuaries and their organic matter load are primary ecological factors. Closure of lagoons and river mouth have compromised some shrimp fishery in the GCLME and damage to the mangroves as nurseries have had similar impacts.

Penaeid life expectancies have to be researched for their management implications. Size at juvenile migration from the lagoons, heavily dependent on inter-annual fluctuations of the onset of the rains and salinity variabilities contingent has to be studied as well. The negative impact of tropical shrimp fishery bycatch receiving attention elsewhere GEF / FAO Shrimp fishery by catch reduction project has also to be kept in mind.

### 3.17. SEA TURTLES AS SHRIMP BYCATCH

Tropical shrimp trawl fisheries by catch and impact sea turtle abundance negatively. This was the basis for US Law 102 which conditioned exports of marine shrimps to the United States on the use of Turtle Excluder Device (TED) in shrimp trawls. Selected GCLME countries were on the prohibition list and indeed Tundi (1989) found Turtle nesting grounds in Bissagos Island off Guinea Bissau but the prevalence of sea turtles in the entire GCLME area has not been documented.

A full survey of the entire GCLME to establish sea turtles species composition, abundance, distribution, migration route and depth preferences vis-à-vis shrimp trawling depth ranges is urgent to couple science to management and governance.

An Inventory of nesting grounds in the GCLME area, as a real first step to conservation of sea Turtles on the IUCN endangered list is also urgent.

### 3.18. CANYONS AND BIODIVERSITY

The survey should investigate the canyons in the GCLME area hitherto unfished and document their pristine scientific repositories as baseline records for future comparison.

### 3.19. CORALS AND BIODIVERSITY

As far as is known, a belt of corals runs through the GCLME area around the 70 – 140 metre isobath, all presumed to be dead. But white exudates from fresh broken pieces off Nigeria suggest otherwise and videos of wrecks show luxuriant coral growth with positive implications for biodiversity.

The corals in the GCLME region will be reassessed for life status and biodiversity records by the fisheries survey.

### 3.12. WEATHER CYCLES AND PREDICTION

Analyses of historical time series rainfall and drought records and satellite correlates by the GCLME fisheries project may accurately predict cyclic variabilities, and associated climate change to fore warn weather induced natural variabilities in recruitment and stock levels especially of pelagic fisheries as well as coastal perturbation and disasters. The predictions will guide ICAM decisions and fishing infrastructure location and reinforcements.

### 3.21. BIO-ECONOMICS AND EFFORT CONTROL

Assessments of the bio-economics, addressing the carrying capacity and effort levels of each fishery will guide vessel licensing and gear rationalisation for optimum economic benefits and resource conservation.

### 3.20. PROTECTED AREAS AND CLOSURES

GCLME fisheries survey and follow up research should focus inshore areas to “finger print” the recruitment of yearlings to the fishery for purposes of situating season “closure” as desirable. In the same way, coastal waters and wetlands dominated by undersized fish, far smaller than mean length at first capture, could be candidates for "closed area" or protected area legislation. Detailed mapping and inventory of Mangroves and nursery grounds by the fisheries project are vital to these developments.

### 3.22. FISHERIES COMMISSION FINANCING

The fisheries Import-export profile in GCLME, suggestive of a negative balance calls for a full assessment of regional fisheries export and import requirements in order to put a value on the regional fisheries net benefit. Thereafter, appropriate level annual surcharge (1.0% of export earnings and 1.0% of imports value) should seed the establishment and sustenance of the GCLME Regional Fisheries Commission.

### 3.3. ARTISANAL FISHERIES INVENTORISATION

Artisanal fisheries support domestic food fish supply and coastal livelihoods in the GCLME region, but information sharing and technology exchange and networking are bedeviled by poor records, insufficient statistics collection and data standardization. A comprehensive GCLME-wide Inventorisation of the artisanal fisheries, prioritising canoe distribution, gear type, numbers and gear selectivity, target species, yield and biodiversity loss urgent to baseline for further action.

### 3.13. UNDER EXPLOITED STOCKS

For trawl fisheries, conservation conscious pre-exploitation baseline biological studies are to be undertaken as prelude to further exploitation of under exploited stocks including bigeye, Brachydeuterus auritus and drift fishes Ariomma spp. which are suitable for canning, and therefore import substitution. Some countries in the GCLME region are among the largest importers of canned fish in the world.

### 3. 2.3. HUMAN RESOURCE DEVELOPMENT

More than anything else, capacity building, especially human resource development, must be accorded appropriate priority and capital investments for ownership stakes in the future, and sustainability awareness.

The creation of a nucleus of (doctoral degree level) LME scientists in each GCLME country and persistent increase in the number to achieve the critical mass level, will ultimately lead to fisheries skill self sufficiency for GCLME management and governance purposes.

### 3.2. EXPLOITATION LEVELS

Although the terminologies still need to be standardised GCLME-wide, fisheries exploitation is at artisanal, semi-industrial and large scale industrial levels. Artisanal level fisheries exploitation, typically small scale commercial, works passive or active gear from wooden canoes, sometimes motorized. Artisanal fisheries predominate particularly in Sierra Leone, Ghana and Nigeria generating well over 50% of domestic production. However, scattered landing sites bedevil the collection and reliability of statistical data, constraining management and sustainable development.

### 3.3. SMALL SCALE

GCLME fisheries survey is to focus the determination of the potential yield of small scale fisheries in each country as baseline for the sustenance of livelihoods. Assessment of the operations of small scale coastal fisheries for impact on biodiversity and resources conservation is crucial.

### 3.4 SEMI INDUSTRIAL FISHERIES

Semi-Industrial fisheries exploitation level deploys 13 to 32m (LOA) wooden or non wood coastal trawlers for fin fish and penaeid shrimps and purse seiners. Driven by market demands, export pricing and dollar earnings, the targets of the penaeid fishery changed from time to time from pink shrimp *Penaeus notialis* to brown shrimp *Parapenaeopsis atlantica* and back, resulting in over capitalization. GCLME fisheries survey is to analyse and document the species specific economics of exploitation for viability and profit levels in order to re-direct investment appropriately.

### 3.5. FOREIGN FLEETS AND IMPORT -EXPORT BALANCE

Large scale industrial fisheries consist typically of larger steel vessels, often flying foreign flags. Historical records of fish landings and the import - export balance shown in Tables 1 and 2 substantiate the near dominance of foreign fleet in the exploitation of the fisheries resources of the GCLME. Some of the GCLME catches are processed at sea labeled as products of the fishing nation and are then promptly sold to countries in the GCLME Region as their IMPORTS, and for hard currency. Often, the clearing house for these economic transactions and trade with or more appropriate still, within the GCLME region, is located elsewhere. Some of the GC coastal countries, are fishery products net exporters, and some others are net importers.

Clearly, there are issues of resource ownership, resource rent, socio economics and equity alleviation in the GCLME region to be courageously resolved, without confrontation for common good and poverty reduction.



### 3.6. TRANSBOUNDARY STOCKS (SHARED STOCKS)

The trans-boundary nature of many of the resources (shared stocks) especially the migratory coastal and offshore pelagics, crossing national jurisdictions seasonally with the front in annual cycles, throws up issues of governance.

Time and location reference documented details of fisheries migration patterns by the GCLME fisheries survey will facilitate resource sharing and catch quota allocations. Research into and harmonisation of the methods of catch and effort statistics collection will also facilitate joint management.

### 3.7. STOCK DELINEATION

The separation of over-lapping fisheries, into discrete unit stocks, is rather indispensable for management purposes. The delineation of unit fish stocks especially of migratory species using molecular techniques to set stocks distribution boundaries is one of the targets of the survey but real quantifications are hard to come by in the GCLME region.

### 3.8. GUINEA CURRENT DYNAMICS AND SUB UNITS

The fisheries survey will investigate the details of the dynamics of the Guinea Current, identifying fronts, sub- ecologies and other sub units, together with their inter annual and intra annual variabilities and correlate with fish migration, distribution and abundance to facilitate GCLME governance.

### 3.9. FLUVIAL NOURISHMENT

Fluvial nourishment of coastal waters is inexorably linked with productivity. Assessment of deltas, river mouths and estuaries for sediment load and fluvial nourishment and C-14 productivity assessment in comparison with upwelling areas should be very instructive (Ajayi 1994 and 2002).

### 3.10. CRUDE OIL FINGER PRINT

In addition to migratory species riding the fronts, currents also carry and broadcast marine pollution especially oil spillages, increasing the areas degraded often times far away from source. Sooner or later the GCLME area with its oil reserve everywhere will have to contend with increasing incidents of oil pollution and their transboundary consequences. The fisheries survey will also Finger print crude oil from various source locations in the GCLME region in order to pin point and identify the source of transboundary oil pollution to facilitate the implementation of the polluter- pay – principle's implementation.

## 4.0. OUTCOMES

#### 4.1. ESTABLISHMENT OF GUINEA CURRENT FISHERIES MANAGEMENT COMMISSION

For now, the FAO/ Committee for the East Central Atlantic Fisheries (FAO / CECAF ) is the one and only regional body with responsibility for fisheries management. However, it is purely advisory and has no power of enforcement and its recommendations are not mandatory and are not binding on member States. As such the recommendations are hardly reflected. CECAF too has been attempting to restructure but lacks the will and cohesiveness. All other instruments are smaller in coverage and are hardly effective.

The real challenge therefore is the development and institutionalization of an arrangement or structure fully reflective of the variabilities, fragile nature and vulnerabilities of the GCLME environment and natural resources continuously pressured by anthropogenic and natural forces. In that context, the establishment of a Fisheries Commission with enforcement powers should be the ultimate outcome of the regional fisheries assessment and management project. The commission will be a coordinating secretariat with responsibilities for organization, consultation and regional cooperation and harmonization of all activities and institutional arrangement and policy framework. The Commission will have more chances of success serviced by appropriate units including

- (1). Fisheries Data and Network Centre
- (2). Fish Age and Growth Unit
- (3). Centre for Pollution Finger Printing, and Habitat Protection and Restoration
- (4). Natural History Museum

All the Centre or Service Units created will come under the full purview and control of the GCLME Fisheries Commission as its component ancillaries.

#### 4.2. REGIONAL FISHERIES DATA AND NETWORK CENTRE

A data repository is sine-qua-non to the regional fisheries management framework. Creation of a Regional Fisheries Data and GIS Centre and the logging of survey data into the regional data base will therefore receive attention. Subsequent improvement of net-working of GCLME researchers, as well as the management and conservation of marine resources should improve productivity and lead to sustainability and improvements in the livelihood of fishing communities.

The Centre will pivot the organization of working group meetings to distil and develop from research results recommendations mechanisms frameworks and other mandatory protocols to be synthesized after extensive consultation by the Commission into policies for adoption and implementation by governments for resources management, conservation of biological diversity and coastline protection.

#### 4.3. REGIONAL UNIT FOR FISH AGE GROWTH STUDIES

Investigations of fish age and growth are crucial to facilitate fish population dynamics studies providing least cost validation justification or validation of management decisions. A regional unit or centre for Fish Age and Growth Studies will therefore be established to process regional and national survey otolith samples as a second opinion on management decisions. Appropriate human resource development and infrastructural capacity building will facilitate matters.

#### 4.4. REGIONAL CENTRE FOR POLLUTION FINGER PRINTING AND HABITAT PROTECTION AND RESTORATION

The polluter-pay-principle earlier proposed is a potent deterrent provided the home source of pollutant can be located without controversy. A unit for finger-printing pollutants for source identification, quantification and clean-up programme decisions and cost elements would facilitate prompt remediation and mitigation to be paid by the polluters. The Unit will be in charge of vulnerable or fragile habitat for purposes of their identification, mapping, inventorization, protection and restoration.

#### 4.5. REGIONAL MUSEUM OF NATURAL HISTORY

The Creation of a Regional Museum of Natural History as repository of marine science prototypes and artefact will be prioritized. The Museum will be responsible for the inventory, collection, preservation of specimens of all marine organisms. The collection will be augmented by molecular genetic studies to “road-map” and quantify biodiversity. Later on a gene bank facility may be added, if all goes well.

#### 5.0. RISKS AND SUSTAINABILITY

In the course of sustainable resource exploitation, fisheries practitioners are subjected to risks traceable to environmental degradation arising from anthropogenic activities such as oil spillage, dredging, canalization, construction of hydro-electric dams, and the use of explosives and other obnoxious fishing methods. Risks can also arise from multiple-user conflict resulting in loss of inputs and, in extreme cases, loss of life. A case in point is trawler menace in coastal communities. More often than not, shrimp and fish trawling in estuaries and shallow inshore water off coastal fishing villages compromise set or drift gill nets of artisanal fishermen generating conflicts between the small scale practitioners and industrial trawl fisheries. Unfavorable macro-economic policies resulting in high input cost are also economic risks. Storm surge and other Forces of nature increase in virulence particularly between June and September annually resulting in loss of life in the artisanal fishery due to the types of craft used. The prevalence of water hyacinth in the coastal and estuarine waters pose high risk to fishing, they clog the nets and could also entangle the propellers of out board engines leading to damages and accidents. These risks have to be managed for sustainability. The results of the fisheries survey will point in the right direction.

#### 6.0. STAKEHOLDER PARTICIPATION AND IMPLEMENTATION ARRANGEMENTS

The Fisheries Survey will be undertaken by research institutions in the region specialized in fish biology and ecology. They will be supported and augmented by the provision of necessary equipment and relevant practical training as appropriate.

The survey field trips will last approximately 60 days each quarter of the year, over the life span of the project, and experimental fishing will concentrate on nearshore waters, including deltas and

estuaries. The quarterly research vessel cruises will prioritise the following implementation agenda:

1. bottom trawl and pelagic fishing: to determine stock levels, changes in species composition, biodiversity loss and fish tissue contaminant loading;
2. towed bioacoustics survey: to estimate the biomass of pelagic stocks;
3. improvement of catch and effort data collection for artisanal and industrial fisheries through capacity building;
4. analyses of catch and effort statistics of target species or groups;
5. identification and examination of specific fragile habitats for sustainability and management;
6. articulation and fine tuning of management strategies;
7. assessment of GCLME drainage basins in relation to nutrient loading, biodiversity status and associated fisheries;
8. assessment of the effect of oil spills on the productivity of nearshore wetlands and inshore waters;
9. assessment of impact of water hyacinth and other floating aquatic weeds on fisheries resources, productivity and potential;
10. improvement of the forecast, timing and intensity of upwelling events and assessment of their impact on fish stocks;
11. investment in capacity building and human resource development of GCLME community of researchers and managers;
12. promotion of regional cooperation and including exchange of scientific and technical information, technologies, and expertise; and
13. community education and ecosystem awareness
14. investigation of canyons and coral belt for biodiversity

#### 6.1. VESSEL AVAILABILITY

GCLME has to build on the successes of GOGLEME. In that respect, a sea worthy vessel, even a refitted “fairly used” trawler, fully owned by the Project or shared so that its availability at all times is guaranteed will be desirable for cost effectiveness. Sale of the catch will offset the cost of operations – crew salaries. Vessel hire is the alternative but the US dollar cost per day are exorbitant and prohibitive. As such the offer by the Government of Guinea to place a vessel at the disposal of the GCLME is good news for co-financing, speaking loud and clear in unambiguous terms the regional commitment to GCLME Project.

#### 6.2. GOVERNMENT INPUTS

Participating Governments hosting training programmes, will provide suitable conference facilities as well as trainees accommodation gratis. Trainees and Project personnel entry and movement within the host country will be facilitated.

#### 6.3. STAKEHOLDERS INVOLVEMENT

Stakeholders especially fishermen, researchers (gear technologists, biologists, environmentalists), fishery managers, coastal-zone managers, fish traders, fish processors and NGOs will be involved in the design, planning and execution of the regional fisheries survey.

#### 7.0. MONITORING, EVALUATION AND DISSEMINATION OF RESULTS

The lead Institution(s) for the Fisheries Assessment project and the National Coordinator shall submit quarterly progress reports to GEF using a standard format for project activities to facilitate monitoring and review.

The Steering Committee will have responsibility for regional level review of the project's activities and results at its formal meetings and through intersessional exchanges and E-mail conferencing. Such evaluation will be made against milestones to facilitate decisions regarding the implementation of subsequent activities, and work plan changes as desirable.

## **2. Environmental Information Management: regional execution**

04 June 2003 Draft

REGIONAL DEMONSTRATION PROJECT ON THE DEVELOPMENT OF AN  
ENVIRONMENTAL INFORMATION MANAGEMENT SYSTEM (EIMS)

GUINEA CURRENT LARGE MARINE ECOSYSTEM REGION

## <sup>1</sup>ABBREVIATIONS

UNIDO	United Nations Industrial and Development Organisation
GCLME	Guinea Current Large Marine Ecosystem
EIMS	Environmental Information Management System
TDA	Transboundary Activities
IT	Information Technology
ICT	Information and Communications Technology
GEF	Global Environmental Facility
IW	International Waters
IW:LEARN	International Waters Learning Exchange and Resource Network
ICS	International Centre for Science and High Technology

## <sup>2</sup>1. INTRODUCTION

Collection of data and information on the environment is part of the national environmental action plan in each of the countries of the guinea current large marine ecosystem. This activity, which is aimed at improving decision-making in environmental management, implementation of appropriate programs and projects, and harnessing of local know-how, often fails to take full advantage of regional similarities in conditions and experience. The impact of such data collection and processing efforts is constrained by:

- Limited distribution of the data collected and processed;
- Limited use of results, in terms of informing subsequent action and decision-making processes related to the management of natural resources and the environment;
- Limited access by those who would otherwise need the information and knowledge generated;
- Limited utility because of language incompatibility among countries of the Gulf of Guinea.

Yet the data collected and processed in each country of the GCLME region represent rich resources for decision-making on management of ecosystem, as well as significant prospects for generating new knowledge through data mining. However, to achieve any of these benefits, the data collected must be compatible, the processing homogeneous, and the dissemination of results comprehensive and exhaustive.

Several developmental activities take place along the Atlantic Coast of Africa from Guinea Bissau to Angola. These have huge environmental effects on land and sea ecosystems of the region. They include deforestation, oil and gas exploration and exploitation, urbanisation, coastal erosion and industrialisation. All these cause serious pollution within the region's environment. Over the past 40 years, rapid increase in population and migration from the interior have led to a population density of 250-300 persons per square kilometre along the Atlantic Coast. Added to this is the inability of these fast growing cities to provide the requisite sanitation, in some cases only 1.3 per cent of households have access to sewerage, while in others there are no facilities for waste treatment. These factors have contributed to significant degradation of the natural resources and biodiversity of the coastal and international waters of the Guinea Current LME region and adjacent freshwater catchment areas. The region faces problems of fisheries depletion, water pollution, public health and sanitation, loss of habitat and biodiversity, land-use and planning and Coastal erosion. Over-fishing, for example, has caused degradation of critical breeding, while over-cutting of mangroves, for firewood for cooking, building and salt drying, have affected the natural habitats.

For instance, deforestation caused by logging companies and for agricultural purposes affect the biodiversity, inland water resources, land use and the lives of indigenous populations. Apart from these specific negative effects, logging in such industrial scales does seem to affect the climatic cycles of the region and of the world. In-land water channels are also being silted up by the erosion of large tracts of land that have been denuded of their trees. This silting of rivers and streams has direct impact on power generation and also pollutes water used by rural inhabitants. Rivers are polluted as they flow through as they flow through urban and industrialised areas. There are many more ways in which this affects human, animal life on land and in water that need to be investigated and documented and remediation taken to reverse



change. Oil exploration and exploitation have led to a deteriorating coastal and sea ecosystems. These activities have adversely affected lives on land and sea.

It is recognised that as long as deforestation, growth of industrial and domestic wastes, exploration and exploitation for oil and other activities that lead to pollution continue to increase, environmental degradation shall continue. It is also a known fact that environmental problems do not obey national boundaries. For example an oil spill that occurs on the Republic of Benin Coast can move into the Nigeria Coast. There is therefore a need to develop regional strategies for addressing environmental problems in the West and Central African Region. One of the ways of achieving this is the development of an Environmental Information Management System (EIMS) for the Region. This system has the ability to store, manage and interpret large volumes of data associated with the environment.

The project will build on a regional environmental information management system set up during the Pilot Phase Project and which included a Geographical Information System (GIS) serving primary functions of compilation, analysis and communication of data collected, systematised and archived using a common architecture. The GIS data base, to be devolved to national level, will serve as a management decision-support tool for national coastal and marine resources management and planning, selection of sites for industrial facilities, delineation of critical environmentally sensitive areas, identification of other sources of environmental degradation, and designation of particular living resources and human populations at risk. The data pertinent to fish, fisheries, productivity, habitats and pollution will be made available to the GCLME Scientific and Technical Advisory Committees.

The clarification and understanding of environmental and resource management issues obtained from GIS analysis will aid decision makers in setting priorities and in implementing effective actions on both national and regional levels. In a region where effective and efficient management has been vitiated for a long time by lack of credible data and information, it was little wonder that the Stocktaking Workshop placed a particular priority on this Demonstration Project. Hopefully, decision making in the region, at least as it concerns environmental and living resources management and planning, would no longer be a stab in the dark.

This Demonstration Project would thus strengthen environmental and living resources management capacity in the Guinea Current LME by setting up decision making support tools which link all relevant socio-economic sectors. The goal of the proposed EIMS will be to store, organise, and maintain environmental data in a central location with the possibility for users to interpret the data through a user-friendly interface. The proposed EIMS must be able to address the various goals and needs of users. In order to determine these goals, a needs assessment would be carried out to understand user requirements and develop an implementation plan that leads to that meets user objectives. Since the system shall be developed from scratch, the computer data infrastructure has to consider user objectives and needs. Through this demonstration project, a single integrated regional environmental information system for observing changes in the ocean, in the atmosphere and on land caused by inadvertent modification of natural processes as a result of human activities would be created for the GCLME region. Apparently, we now know some of the risks of the changes brought by these inadvertent changes. It would also be necessary to measure the net effect of the concerted action being taken world wide to reverse these negative changes. The GCLME project goal is to provide a coherent plan that integrates space and on site observations of the environment (ocean, atmosphere, and land) in the region.

In order to complete this project, the way it is envisaged, developers of the system need to work together with governments and the different stakeholders within the region. This is a necessary requirement if the database must be designed to integrate the fields necessary to meet the

functional requirements defined in the needs assessment phase. Graphical user interfaces are required to allow users to have a visual impression of the data from the database. Obviously direct contact with users shall be beneficial in meeting the goals of the project.

## RATIONALE AND OBJECTIVES

### RATIONALE

<sup>3</sup> National governments and the various stakeholders within the region have a need to monitor and control environmental change. This action is necessary in order that along with other regions of the world, the Region could in the long run keep reliable data on human activities that alter the environment. With such data, the Region could participate effectively on the on the scientific and societal challenge of managing and sustaining human activities on this planet. Some countries in the region possibly have developed environmental awareness programmes and do have records of their monitoring and remediation activities. Others may have not for lack of the expertise or financial resources or both.

Given the growing awareness of the risk to humanity of environmental degradation, the Guinea Current Large Marine Ecosystem Region project should help the countries involved to pool resources and information on the one hand and to help those without the resources and/or know how to benefit from common efforts in the region and globally. Because the effects of degradation are felt across national boundaries, it makes sense to take account of national programmes in a centrally located database to be used for understanding and improvement of environmental issues regionally. In the end, the project should fit comfortably within the global effort to preserve our environment. The regional programme shall be part of a chain of regional programmes for monitoring and taking remedial action of activities that negatively the environment.

### OBJECTIVES

The GCLME project addresses transboundary environmental problems with implications exceeding the immediate territorial limits/boundaries of each of the participating sixteen countries. In order for this unified approach to managing the environmental and living marine resource problems to achieve its goal, the information collected and processed under the various components/activities of the project in all participating countries should be compatible in nature and format, and be exchanged among the countries. This calls for a regional information network with a common information-handling environment, one, which allows seamless transfer throughout the project area of coverage. This regional demonstration project aims to assist countries of the GCLME region with the development and operationalization of an information management systems facilitating decision-making, which meet the above criteria. The proposed system will consist of national GIS databases and experts, which take advantage of existing information and communications infrastructure to interconnect the national databases and network the experts linking them to a regional central node.

This overall objective of this demonstration Project is to strengthen environmental and living resources management capacity in the Guinea Current LME through the provision of a reliable and efficient environmental information management and decision making support system.

The specific projects objectives are:

- To establish an integrated GIS database for the Guinea Current LME, including collection of existing data as well as data generated through the various activities of the GCLME project.
- To make arrangements for networking and exchange of data electronically among the various institutions participating in the project
- To establish links to relevant international information resources via the Internet
- To strengthen capacities users and providers of environmentally related information for countries in the region through strengthening of the scientific and technical capabilities of countries in the region to use computerized EIMS in order to monitor, store and manage environmental change information
- Develop and/or enhance communications and connectivity between users within countries. The goal is to enhance communications and connectivity between the users and providers of information related to environmental change, risks and remediation activities required to reverse change in the GCLME countries.

## PROJECT COMPONENTS/ACTIVITIES

The project would focus on the collection and integration of data from various components of the GCLME project and other relevant activities into the national and regional GIS databases. It will also facilitate the organization of service agreements, for sustainable long-term access to electronic network services (Internet) at participating institutions, in order to enable e-mail discussion groups of project participants and general exchange of information within the scope of the project.

### COMPONENTS 1: Strengthening Institutional Capacities, Policy and Legal Frameworks:

Activity 1.1 Conduct Needs assessment in capacity building required in the various aspects including scientific work of measuring environmental change, risks and effects, developing country servers and nodes etc;

Activity 1.2: Conduct Needs assessment in defining the functional routines of the information management system. This involves a workshop or workshops with project stakeholders. It should be followed by a conceptual planning session to develop recommendation that would meet user needs within the limits of client operating systems. The involvement of all users in the conception of a system that meets the goals of the authorities concerned with environmental change reversal. IT experts and institutions are expected to be involved in determining system components that are easily made part of <sup>4</sup>the existing computer infrastructure if any. Where it does not exist, to develop one from scratch;

Activity 1.3: Identify and develop products and services, based on the needs assessment carried out earlier, to meet the needs of users and of key stakeholders of the EIMS for GCLME and beyond using computer based communications;

Activity 1.4: Identify existing training activities and organisations with which to collaborate in providing training and Develop training modules;

Activity 1.5: Conduct training workshops on application of Geographic Information System to Coastal Zone Management; Data collection, storage, archiving and retrieval for experts in the different Modules of the GCLME. Enable countries to train and support information and knowledge providers on environmental issues (network of training and research on environment);

Activity 1.6: Identify equipment needs and provide supplementary equipment to national coastal and marine environmental data management institutions.

Activity 1.7: Formulate appropriate policies, legal and regulatory frameworks supporting environmental information management systems.

Activity 1.8: Assist institutions of higher learning and research to develop educational, research and/or training programmes on environmental monitoring and protection on the one hand and on computer mediated communications and networking on the other hand;

Component 2: Establishment of Regional and National Environmental Information Management Systems:

Activity 2.1: Development of an implementation plan based on a GIS- system, that is custom designed to take into account the interpretative routines required by users;

Activity 2.1: Development of a high band-width dedicated Internet connection through land lines, wireless radio access or using very small aperture terminals (VSAT) satellite technology;

Activity 2.3: Create a register of EIMS linked users in sites in GCLME and connect them through country servers to develop a regional, continental and world-wide compatible network;

Activity 2.4: Establish and test dial-in, serial line Internet protocol or point-to-point protocol and leased line connections to the EIMS country Internet servers. Enhance and/or develop capacity to use Internet applications on the EIMS server, including, email, electronic conferencing (news groups), electronic mailing list, logging in to remote CPUs, file transfer (FTP), Gopher, various retrieval applications and the World Wide Web (WWW);

Activity 2.5: Link users and providers of information and knowledge resources on the environment through the EIMS network and Develop and support local user groups. Enable users and providers of information and knowledge to load information on EIMS computer server and to use Internet applications to shares this information;

Component 3: Strengthening Information Dissemination to Stakeholders

Activity 3.1: Undertake an awareness campaign to educate governments and stakeholders on the need to monitor environmental change and on the importance of taking remediation actions;

Activity 3.2: Establish a Website for exchange of information

Activity 3.3: Updating of Data on the EIMS server on an ongoing basis

Activity 3.4: Monitoring and Evaluation of project activities.

Expected project outcomes, with underlying assumptions and context:

The project should lead to better coordination of the regional environmental problems, which are indispensable to the success of the GCLME project. It should result in the creation, where they currently do not exist, or strengthening elsewhere, of databases of geo-referenced information on the environment. The availability of these databases will, in turn, result in informed decision making on all aspects of national environmental planning and management, by Government institutions and private sector actors.

Electronic networking of experts and compatibility of the data bases, should lead to improved exchange of information on common problems among the sixteen participating countries, better sharing of experiences, and significant leveraging of available expertise in the region, to address national issues.

Use of modern information and communication technologies (ICTs) to provide for the information and communication needs of the GCLME project in an effective and efficient manner leading to significant advantages to all aspects of project implementation. Internet chat and video-conferencing are possibilities offered by the Internet, for use in virtual conferences to supplement, and in some cases replace, future conferences undertaken within the project.

Rather than assembling people in a specific area, people remain where they are - leading to significant gains in travel costs, convenience, and reduction of risk. However, such virtual meetings are not expected to replace conventional meetings, which provide an opportunity for human interaction and face-to-face communications. But they serve as a complement to regular meetings. A case in point is any activity which requires holding a series of meetings, such as the development of a strategic action plan - which could take up to six meetings – where the use of both formats could result in savings in finances and time.

Maintenance of equipment is important to proper implementation of the GCLME project. Local capacity to properly manage and maintain equipment is insufficient in some areas. However, formal sharing and the information support provided by the network, will permit leveraging of capacity available in some areas, to resolve maintenance problems in areas with limited capacity. This is facilitated by the similarity of problems of equipment maintenance throughout the project catchment area.

To realize this vision, a number of changes will be required, both in behaviour and in institutional arrangements. These barriers are not uni-dimensional, focusing on technical knowledge (the most obvious challenge), but rather a multi-dimensional construct, encompassing technical knowledge, economic viability, organizational support and behavior modification.

At the institutional level, capacity needs to be developed for the implementation of environmental information management tools, and to support various stakeholders involved in the management of the environment in sharing their experiences and information. This requires the establishment of a coherent and efficient institutional framework and the development of adequate training programs to produce the required human resources.

At the technical level, one of the key challenges is the fragmentation problem - many pieces of information, in many formats, on many platforms, in many stakeholder environments, and in many geographic locations. The data sets are thus heterogeneous both physically (stored in

different locations) and logically (not organized in the same fashion). This accentuates issues of interoperability which are raised by lack of compatibility of systems and equipment.

The project involves collaboration with other organizations, both within the UN system and outside. These include: UN Food and Agriculture Organization (FAO) in the fishery component UN Environment Programme (UNEP) in industrial pollution survey, International Maritime Organization in oil spill preparedness UN Educational, Scientific and Cultural Organization/Intergovernmental Oceanographic Commission (UNESCO/IOC) in marine debris and solid waste minimization; US National Oceanic and Atmospheric Administration (NOAA) in provision of scientific and technical advice and guidance; International Union for Conservation of Nature in environmental studies. This multi-agency collaboration underscores the need for GCLME data to be accessible not only to these other agencies, but to visitors to their web sites on the Internet. Links should be available from these web sites to the project web site.

Specific project outcomes include:

1. Availability of courses of studies and capabilities in research and protection of the environment in local and/or regional institutions;
2. Established reliable and functional EIMS that is updated on a continuous basis (access to information on biogeochemistry (small rivers and their potential, wind and tidal possibilities, biomass etc.) that could aid small entrepreneurs and individuals to use sustainable sources for energy production
3. Long-term development of an adequate pool of trained technicians and scientists in environmental research and protection and data collection, storage, archiving and retrieval;
4. Strengthened Institutional capacities (pool of trained users and information providers in the use of computer database on the one hand and of computer based and Internet communications on the other hand);
5. Enhanced levels of awareness/appreciation of the risks of environmental change and remediation efforts required to reverse negative change;
6. Established user community spread throughout the region with an enthusiasm for exploiting information in the system;

## RISKS AND SUSTAINABILITY

### RISKS

This project is the result of consultation with stakeholders in participating countries. Various consultations have focused on building consensus on the broad outline of the proposal.

There is a risk that some of the countries may not have the financial resources to train professionals and scientists in the environmental sciences on the one hand and in the setting up of a reliable environmental monitoring programme on the other hand. Consequently, some of the countries may not be able to participate or if they do, their participation may not be effective or reliable. This is somehow mitigated by the fact the most of the participating countries have

significant expertise and capacity for fulfilling the objectives of this project. Among them are the Comité National pour la Télédétection et de l'Information Géographique (CNTIG), the Remote Sensing Applications Unit (RSAU), University of Ghana, Legon - Accra, the Centre National de Teledetection (CENATEL) in Cotonou, Benin, the Department of Surveying & Geoinformatics and the Department of Geography, both at the University of Lagos, Lagos – Nigeria and Regional Centre for Training in Aerospace Surveys (RECTAS), Ile – Ife, Nigeria. Degree programmes are offered at the Department of Surveying & Geoinformatics, University of Lagos, as in the other universities above at Bachelors level, Masters level and M.Phil and PH.D levels in Surveying and Geoinformatics. There are also professional Masters programmes in Geoinformatics at the Department of Surveying & Geoinformatics; and GIS at the Department of Geography, University of Lagos. The Department of Surveying & Geoinformatics recently attracted seven licences of ARCGIS 8.2 from ESRI and Compaq Computers from CheveroTexaco, Nigeria Limited.

The possibility also exists that the manpower may not exist or that if it exists, the Regional EIMS may not be able to compete in the job market for the skills of these people. Too often in Africa, we have seen government organisations being unable to hire and keep skilled technicians. The result has been the inability to maintain infrastructure in government institutions that house delicate and other technical equipment. Uncompetitive salary structures have been a major contributory factor. In these days of global competition for skilled individuals in the IT sector, the project runs the risk of not finding the people to run the system. The major risk to the project remains financial sustainability in terms of recurrent costs for the following:

- Subscription for Internet services;
- Maintenance of databases - updating information in the data bases and ensuring upkeep of the associated software
- Maintenance of equipment – availability of technical knowledge, skills, tools facilities and spare parts. This can be greatly facilitated by proper user training as user abuse accounts for roughly 50% of all equipment failure.

Subscription for Internet services: The risk of discontinuity in availability of Internet services to project national GIS institutions is mitigated by the decreasing cost of Internet connectivity in Africa, the increased participation by national institutions driven by government policy and based on the recognition that ICTs are a major instrument for sustainable development. Projects such as the New Partnership for African Development (NEPAD) could significantly increase the availability and affordability of Internet services by countries participating in the project. Even so, Government in each project country is urged to support the project through financial contribution of their share of project expenses. The effectiveness of such pleas could be positively affected by the availability of information to policy and decision makers in government. This is equally true for donors.

The fear is that in some countries, the participation levels may be low and perhaps unsustainable in the long run. Literacy rates of many of the countries are low and already there is such difficulty in finding the financial resources to improve literacy. On the issue of environmental change and remediation not only do we require skilled personal, we do also need to educate the populations on what must and what must not be done. The point is, are these governments in a position, financially and technically speaking, ready to meet the demands of participating and producing reliable information needed by the EIMS?

## SUSTAINABILITY

Although the completed project is expected to generate income from marketing information stored in the EIMS, governments are expected to support it financially since the international conventions on the environment have been signed by them and of course the project will assist the participating nations in managing their environment. Managers of the system must be required to develop products and services to be marketed to users. These activities are expected to generate incomes support subventions from governments. The RSAU is a telling example. Plans call for it to become a legal entity of its own, with a Board of Directors. The new entity will fall somewhere between a non-profit government service with cost recovery and a limited liability company (PLC). A business plan has been approved for this entity. As of now, various projects enable the Unit to operate fairly close to financial self-sufficiency. The training facility (buildings and equipment), for example, is being built at no cost to the University. There is a coordination unit for promoting the use and development of remote sensing technology in Ghana. It includes the five institutions in Ghana which are involved in remote sensing. There is thus potential for LME project activities to benefit from the capacity available at these other institutions. Eventually, a regulatory body could be created to oversee the growth of remote sensing technology, and the associated GIS technology, in Ghana.

The EIM system must be seen as one of those aspects of national concern that borders on national security for members of the GCLME. The use of natural resources not only sustains national economies, but governments are of necessity interested in the long-term sustainability of their national economic activities. Seen from this angle, some financial involvement is required, even if it were to support only the local nodes of the EIMS. This is quite possible given that various taxes exist for exploiting forests, rivers and the sea for its products. Companies, organisations and individuals who pollute the environment in significant ways must be penalised. Some of the proceeds of these taxes and penalties must be ploughed back to sustain the EIMS.

## STAKEHOLDER PARTICIPATION

In order to define stakeholder participation, it shall be necessary to identify who the stakeholders are, the interactions between them and their relationships with the different components (atmospheric, sea and land) of the ecosystems. Clearly, the information related to the existing roles and opportunities for various stakeholders to participate in the decision-making process and in the management of the EIMS is required. The knowledge so obtained shall together with available information on legislations, and defined management policies of the proposed project will provide a basis for discussion on operational procedures and institutional arrangements that might be useful for the development of EIMS management plan.

Different stakeholders' interests on the different subsystems of the global ecosystem extend beyond commercial, recreational, industrial and other activities with any kind of impact on the environment. It is probably easy to state who these stakeholder groups are but it is rather difficult to evaluate their importance to the environment and its ecosystems. We need to know their dependency and reliance on the various components of the ecosystem and the level of environmental and socio-economic impacts on the <sup>5</sup>ecosystems caused by stakeholder activities. This and the fact that it is difficult to determine the interactions and relationship between the different stakeholder groups mean that a way must be found to indicate the importance of each stakeholder group to the various components of the ecosystem. Without this, it shall be difficult to determine stakeholder participation in the project conceptualisation, implementation and management.



Workshops shall be organised at regional and national levels to find answers to the questions raised on stakeholder participation. The objective is to come out with a clear plan of participation for stakeholders at different levels of project development through to implementation and management.

#### Social and participation issues

Grassroots participation in the development of the regionally compatible national environmental information system, will be a major component of the first phase. Stakeholder involvement can occur in three basic ways namely:

project design, project implementation, and project outcomes or benefits. All three aspects are part of the action plan for this project. The needs of the communities that depend on the coastal resources are in integral part of the inputs to the determination of what types of data should be collected. The report generation and dissemination of information from the information system will cater to requirements imposed by various categories of stakeholder. This will be through policy briefs from government; technical briefs for decision-makers in relevant technical ministries and institutions, "how to" and other basic information for daily management of coastal resources by those living or working in coastal area. There will also be awareness raising bulletins and stories for the general public and scientific reports for the scientific community of experts.

#### INCREMENTAL COSTS AND PROJECT FINANCING

An incremental costs analysis is very necessary given the number of countries involved. A wide number of activities in these countries with negative impacts on the environment and ecosystems could be replaced with other beneficial activities with little or no known degradation of the environment. A major component therefore is to cost national activities with known effects on the environment and balance these costs with the cost and benefits of substitute activities that shall guarantee sustainable development and exploitation of natural resources. It is recognized that some of the participating countries have invested in national data bases as part of their national environmental action plans. Regional compatibility will leverage this capacity as well as building synergy among these stand-alone systems by making them compatible.

The above studies shall be conducted on a country by country basis. Where environmental impact is a trans-national affair such as in. oil pollution of coast lines, industrial scale logging, power production from thermal plants and/or large hydro electric projects rather than for small renewable and sustainable energy sources, intra-country studies shall be conducted. This aspect of the project shall be considered in a second phase of the project after these incremental costs shall have been determined for the region and specific remediation actions determined to reverse specific changes of known degradation effects.

Since most countries have committed themselves to sustainable development and given political consensus at the highest levels, some of the funding for this project has to come from governments of the GCLME region. These countries are expected to have actions to achieve sustainable development at national levels in place. This is not only necessary, but in the national interests of the countries. However, these actions are insufficient to maintain sustainability at a global level. It is evident that many national activities have detrimental global environmental effects. Consequently, it is but rational that each country of the region participates in the financing of the project.

<sup>6</sup> Another source of financing is the Global Environmental Facility (GEF). The GCLME project is a regional project that should in the end fit in the network of global environmental action plans to monitor and correct changes to the environment. Its *raison d'être* is to provide new and additional resources for the "agreed incremental costs of measures to achieve agreed global environmental benefits".

Additional funding could come from UNEP, The World Bank, the African Development Bank, WWF, USAID, GTZ, CIDA, Japanese Overseas Development Agency, French Co-operation, and the ODA of Britain. The major oil companies of the world, particularly those active in the region, should also be approached to contribute to determining remediation actions required to reverse changes to the ecosystems. It is also logical to seek some funding from major logging companies in the tropical forest areas of the region. After all, they like the oil companies or large industries within national borders are also part of the problem.

The first phase of this project deals with developing the EIMS and undertaking all the studies connected to it as well as those necessary to start the second phase which is long-term in scope. The project document as presented here does not include activities that shall make up components of the incremental costs analysis. These activities shall be determined and their costs evaluated in the phase. Evidently, the budget presented here covers only the first phase of the project.

## PROJECT IMPLEMENTATION AND MONITORING

The phase of the project is planned to be implemented over a three-year period. In this phase, activities will begin in all countries and at a central location, to be chosen, to house the heart of the EIMS. As described above, efforts will be devoted to helping countries create nodes of the EIMS network, training stakeholders on using/contributing to building the database, training stakeholders in how to participate, strengthening stakeholders and institutions by building their capacities so that they may participate effectively and willingly.

The project will be implemented mainly by participating countries with support from UNIDO and other agencies providing analytical support services and guidelines on field work and data collection. Local and regional training on specific field studies, measurements, sampling techniques, data handling and interpretation and modelling will also be organised in various workshops. Review of educational programs in the area of environment shall be conducted and where they do not exist, introduced. University and research institutions' capacities to teach and undertake research in the domain shall be strengthened. A technical expert is required to undertake co-ordination, of activities of the EIMS. A network experts and an administration assistant is also required to help run the network and manage the centre housing the heart of the EIMS.

<sup>7</sup>Annual meetings will be held for project participants from recipient and stakeholder organisations, representatives of agencies and donor organisations to monitor implementation and progress of the project. Annual progress reports will be discussed and before being sent to stakeholders. Problems of implementation and detailed plans for the coming year shall also be discussed. Progress reports will have to include the main achievements, the impact, the problems and follow-up actions required for further progress to be made. At the end of the first phase, a conference will be held at an appropriate venue to evaluate the project activities and the main

results achieved. This is needed for purposes of analysing the quantitative assessment of the projects socio-economic effects and its role in supporting sustainable development and to make recommendations for future actions. A model project final report will be prepared by the controlling Agency, UNIDO in this case, on the basis of the seminar papers.

The commitment of participating countries was mentioned earlier. Based on this commitment, the countries are expected to put scientific and support staff, laboratory facilities where available, host workshops and training activities when required.

#### Social and participation issues

Grassroots participation in the development of the regionally compatible national environmental information system, will be a major component of the first phase. Stakeholder involvement can occur in three basic ways namely: project design, project implementation, and project outcomes or benefits. All three aspects are part of the action plan for this project. The needs of the communities that depend on the coastal resources are in integral part of the inputs to the determination of what types of data should be collected. The report generation and dissemination of information from the information system will cater to requirements imposed by various categories of stakeholder. This will be through policy briefs from government; technical briefs for decision-makers in relevant technical ministries and institutions, “how to” and other basic information for daily management of coastal resources by those living or working in coastal area. There will also be awareness raising bulletins and stories for the general public and scientific reports for the scientific community of experts.

#### Monitoring and evaluation plan

##### *Indicators*

Monitoring and evaluation are an essential aspect of any project. However, to be of use in improving goal attainment for the project, indicators should be identified, which give a clear picture of the project in three main domains, inputs, process and outcomes. Indicators, however, should not constitute an unnecessary burden on project resources. A balance should be struck between the need to obtain as much information as possible from the monitoring and evaluation exercise and negatively impacting project goal attainment because too many of the project’s resources are consumed by the exercise. The usual compromise is to define a parsimonious set of indicators which, ideally, act as tracers for many aspects of project implementation and achievement. Performance indicators identified for this project are as described below.

##### *Collecting and reporting of data on performance indicators:*

This will be carried out through automatic data collection through monitoring of traffic at sites (hits). This will be supplemented by surveys of stakeholders using questionnaires and structured interview

##### *Schedule of mid-term reviews, self-evaluations, and/or end-of-project evaluations*

Monitoring and evaluation activity	Approximate date
Self evaluation	Months 6, 12, 24 and 30
Mid-term review	Month 19
End-of-project evaluation	Month 36

Project participants and stakeholders will be involved in monitoring and evaluation, as the data collected for this purpose will come directly from the GIS national experts, domain experts, and

automatic data and traffic monitoring on data base access activities and transactions among the domain expert.

*Resources for monitoring and evaluation*

Resources for monitoring and evaluation are included in the project budget. Even so, much of the data collection will be automated in the software, and thus results in greater reliability, (no recall bias)

Use of monitoring and evaluation results in project management.

The results of the monitoring and evaluation activity will be used to close the feedback loop on data from project implementation in a continuous and cyclic process of data collection and measurement to determine gaps in project achievement, identifying policies and strategies to improve achievement, implementing the strategies and measuring project indicators anew.

### **3. Marine productivity assessment: regional execution**

**Determination Of New And Emerging Productivity Patterns  
In The Guinea Current Large Marine Ecosystem With Regard To Its Carrying Capacity For  
Living Resources**

## **List of Acronyms/Abbreviations**

CPR: Continuous Plankton Recorders  
FAO: Food and Agricultural Organisation  
GCLME: Guinea Current Large Marine Ecosystem  
GEF: Global Environment Facility  
GIS: Geographic Information System  
GLOBEC-IGBP: Global Ocean Ecosystem Dynamics of International Geosphere-Biosphere Programme  
GOGLME: Gulf of Guinea Large Marine Ecosystem  
HAB: Harmful Algal Bloom  
IOC: Intergovernmental Oceanographic Commission  
IUCN: International Union for the Conservation of Nature  
LOICZ: Land Ocean Interaction in Coastal Zones  
LME: Large Marine Ecosystem  
MFRD: Marine Fisheries Research Division  
NA/WG: Nutrient Activity/Working Group  
NEAP: National Environmental Action Plans  
QA/QC: Quality Assurance/Quality Control  
SAHFOS: Sir Alister Hardy Foundation for Ocean Science  
SOP: Ship of Opportunity  
UNEP: United Nations Environment Programme  
US-NOAA: United States National Oceanic Atmospheric Administration

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### Background/Introduction

The Guinea Current Large Marine Ecosystem (GCLME) is recognised as one of sixty-four Large Marine Ecosystems (LME) of the world, based on its distinctive bathymetry, hydrography, productivity and trophic dynamics. It owes its unity to the eastward flowing Guinea Current, which stretches from Guinea-Bissau (11°N, 16°W) to Gabon (0° 41'S, 8° 45'E). The hydrographic regime is also influenced by the Canary and Benguela Currents which borders on the northern and southern margins of the Guinea Current, respectively. In addition, the Equatorial and Equatorial Counter Currents also contribute to oceanographic changes in the GCLME.

The northern subsystem of the GCLME is thermally unstable and is characterised by intensive seasonal upwelling while the southern half, which is generally thermally stable, depends on nutrient input originating from land drainage, river flood and turbulent diffusion, although less intensive and periodic upwellings have been reported. Data obtained from satellite observation of chlorophyll distribution, SeaWiFS has classified the GCLME region as a highly productive system (i.e. >300 gC/m<sup>2</sup>-yr). The Food and Agricultural Organisation of the United Nations (FAO) estimates the fishery potential in the region to be about 7.8 million tons/year.

The coastal and marine areas of the GCLME are richly endowed with abundant but rapidly depleting marine resources, especially of commercially valuable fish, as well as other living and non-living resources on which the economies of the countries are largely dependent. These coastal and marine areas are repositories of rich and unique biodiversity of global importance and also contribute significantly to the world's annual catches of fish and fisheries. The fishery resources comprise of both locally important resident stocks that support artisanal fisheries, and transboundary straddling and migratory stocks that attract large commercial offshore foreign fleets from Europe and the far East. Fishing is an important economic activity that provides livelihood for many coastal communities in the region and it is imperative that measures are put in place to forestall the decline in living resources so as to protect the livelihood of the over 280 million inhabitants in the region.

The GCLME region has also witnessed a substantial increase in industrial development mostly in its coastal cities. Massive rural-urban migration of populations to the industrial cities take available infrastructure unawares, water supplies and sewage systems readily breakdown; urban run-off carry much of the spills, with its load of nutrient, into water bodies which ultimately end up at the coastal waters. Nutrient inputs to coastal and marine areas from human activities thus lead to eutrophication, anoxia, and subsequent 'death' of water bodies. In consequence this often gives rise to the decimation of the near-shore and estuarine fisheries of the region and exerts negative impacts on the productivity patterns and economy of the region.

Over the years the use of chemical fertilizers (nitrate and phosphate based) and synthetic pesticides has increased with the advent of commercial agriculture. While this has contributed immensely to food production and protection of human health against insect borne diseases, it has, inadvertently, led to pollution of the waters. Pollution from these nutrients, coupled with sewage pollution, poses a serious threat to coastal waters.

Furthermore, a number of major river systems (Niger, Volta, Wouri, Comoe, Bandama Sangana and Congo) drain into the GCLME. There are also a great number of smaller rivers discharging to the estuarine and shelf areas via lagoon systems principally Ebrie (Cote d'Ivoire), Korle (Ghana), Lagos (Nigeria), Nokoue (Benin). Most of the rivers as they empty into the GCLME bring with them the nutrient loads, thus putting the common coastal and marine waters of the region under severe stress. Issues of continuous depletion of living marine resources and loss of biodiversity, degradation, modification and destruction of critical marine habitats, and decline in water quality with its associated problems of eutrophication, anoxia, and algal blooms are of transboundary in nature and require regional effort in addressing them. These concerns, thus, culminated in a successful implementation of



a six country<sup>8</sup> Pilot Phase GEF-sponsored project from 1995 to 1999. The main goal of the Project was to monitor and assess the health and biodiversity of the Gulf of Guinea Large Marine Ecosystem (GOGLME). The results obtained over the four year period provided evidence that the health of the West African coastal and marine environment is under severe stress.

## Rationale And Objectives

### Rationale

Productivity surveys were carried out in the Pilot Phase Project using continuous plankton recorders (CPR) attached to ships of opportunity (SOP). The results showed new and emerging patterns of productivity that contain both cheering and worrying signals. The hopeful signs come from the discovery of new areas of upwelling (i.e. off Benin and Nigeria) besides those already known (i.e. Côte d'Ivoire and Ghana), which has led already to upward revisions of potentially available fish stocks in the Gulf of Guinea. The distressing signs arise from the increasing occurrence of harmful algal blooms indicating intense eutrophication and, therefore, excessive nutrient loading in the GCLME from anthropogenic sources.

At the Stocktaking Workshop that followed the presentation of the results of the Pilot Phase Project, the countries and other stakeholders present at the meeting stressed the necessity to continue with the plankton survey and water quality monitoring in the Gulf of Guinea to build upon the already acquired results but underscored the imperativeness of extending the activities to correspond with the natural limits of the GCLME, in order to build a comprehensive picture of these new and emerging productivity patterns on an ecosystem wide level. This is based on the fact that projections on present and future availability of living marine resources in the GCLME region for economic and food security purposes will depend on knowledge of the productivity patterns of the Ecosystem with regard to its carrying capacity for living resources.

**The basis for merging Nutrient Activity, which was under the Pollution Module in the Pilot Phase Project, with Productivity in this Regional Demonstration Project is because nutrient loading/eutrophication has direct impact on productivity and fisheries and is central to the general ecological functioning of the coastal ecosystem. In addition, the increasing problem of harmful algal bloom worldwide, with its transboundary impact needs to be adequately addressed for the region, where there is paucity of information.**

**The foregoing position derives from the backdrop that eutrophication and HABs occur in most of the sixteen countries of the GCLME Project and these face similar problems in terms of impacts and management, and which require collective regional action to address.**

Furthermore, UNEP Regional Seas Programme in the West and Central Africa region (WACAF) identified Nutrient pollution as the most pressing issue in the region necessitating urgent actions on the part of Governments. The various countries' National Environmental Action Plans (NEAP) and the preliminary TDA conducted by the pilot GOGLME project identified nutrient loading of coastal and marine waters as a major concern requiring common regional actions for its control and reversal.

### Objectives

The objectives of this project is to assess productivity patterns, nutrient levels and water quality regimes in the Guinea Current LME in order to determine its carrying capacity for living resources. The approach is to assess plankton amount and type through monitoring with Continuous Plankton Recorder (CPR) using Ships of Opportunity (SOP). This will be accompanied by collection of hydrological data using aquapacks attached to the CPRs which will help provide information on water dynamics (currents, upwellings), as well as its characteristics (temperature, salinity, fluorescence).

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<sup>8</sup> Benin, Cameroon, Côte d'Ivoire, Ghana, Nigeria and Togo

The assessment of nutrient loads and monitoring of water quality, which underpin the issue of eutrophication and Harmful Algal Bloom in the region form a critical aspect of this Project. The lack of comprehensive data and information on nutrient fluxes and interactions between coastal ecosystems are limited and often lacking in the region. At best independent, uncoordinated efforts are being made by the countries to generate information on these fluxes, build capacity and initiate scientific study of the ecosystems. This project will consolidate these efforts and provide the much needed platform for a regional transboundary assessment of the nutrient fluxes and enhance the strengthening of capacity to sustain the programmes and undertake common management actions.

Pertinent Scientific/Technical Advisory Committees to the GCLME Compact (mainly on Productivity and Fisheries Management) will meet periodically to analyse and integrate the collected data and assessments of the subsystems of the GCLME to develop and apply indices of diagnostics (e.g. biological diversity, productivity, resilience) of the status of the GCLME and to translate the results of this Demonstration Project into a usable form for living resources managers and planners.

The project will also support the regional implementation of the Global Programme of Action for Protection of the Marine Environment from Land Based Activities, and will develop close linkages with mechanisms developed to address land and water related environmental issues in the major river basins draining to the LME (Volta, Niger) as well as the neighboring GEF International Waters Projects (Canary Current, Benguela Current).

The Project is formulated in such a manner that capacity to be built in terms of human, institutional, and infrastructural will be sustained after completion of the Project in order to continue with the monitoring programme for the region. Since the marine environment is highly variable in terms of ecosystem status and yields, it is pertinent to put in place a mechanism that will provide continuous and reliable information for efficient management of the resources. The alternative will be one-time surveys which has an inherent poor ability for prediction of events and changes in the ecosystem, and limits the capacity for effective management.

There is already in existence some level of human and institutional capacity from the Pilot Gulf of Guinea project. This Project will have the added value of building on those successes achieved in the GOGLME Project through strengthening and enlargement of the base. This project is also complementary and incremental to the existing programmes and activities within the region that focus on the conservation of living resources and health of the ecosystem of the GCLME region.

This Demonstration Project would, create such an opportunity for joint actions and cooperation in sharing knowledge, provide common benchmarks and provide a shift from short-term sectoral development objectives to longer-term multi-sectoral and integrated systems-based planning and management. Knowledge gained from this project would underpin the further development of appropriate guidelines, policies, investment strategies and natural resources management plans to guide coastal development in the region.

The specific objectives include:

1. Strengthening existing institutional and infrastructural capacity to carry out plankton survey and nutrients and water quality monitoring, at the Tema Laboratory in Ghana and Imo State Laboratory in Nigeria, respectively. These Laboratories will be centres of excellence for the region.
2. Strengthening existing human capacity and building further capacity with regard to newly participating countries.
3. Inter-calibration exercise for harmonization of procedures for nutrient sampling, analysis and data processing in all participating countries.
4. Quantitative and qualitative surveys of coastal communities to assess nutrient loading and productivity patterns and changes in diversity, abundance and distribution of organisms.
5. Creation of a Global Information System (GIS) format marine plankton database, complemented by remote sensing imageries for decision making.

6. Establishment of efficient network system to facilitate communication and electronic data transfer
7. Strengthening implementation capacities for nutrient reduction and transboundary co-operation
8. Programme to mitigate the negative effects of eutrophication and harmful algal blooms (HABS).
9. Mechanism for periodic review of adaptive management objectives
10. Sensitization of Governments for formulation of appropriate policies on Land Based Activities including treatment of municipal/industrial wastes and adoption of best agricultural practices for reduction of nutrient inputs into water bodies.
11. Development of a regional-decision making support system and clearinghouse mechanism for joint prioritization of actions and investments in nutrient reduction schemes

#### Components of Project

The Regional Demonstration Project will be implemented over a four-year period and the major components of the Project under which various activities will be undertaken are as listed below:

Component I. Preparatory Consultation and Regional Workshop:

Component II: Strengthening institutional and infrastructural capacity for effective monitoring and co-ordination.

Component III: Human capacity development through training and consultation workshop

Component IV: Establishment of comprehensive programme for monitoring and assessment of productivity indicators

Component V: Data collections, analyses, interpretation, dissemination and archival

Component VI: Preparation of regional action programmes for nutrient reductions for municipal, industrial and agricultural pollution control including trading/market-based schemes

Component VII: Regional stakeholders' workshop for discussion and dissemination of results.

Activities to be undertaken under each Components

#### **Component I. Preparatory Consultation and Regional Workshop:**

1. Inventory of available equipment and materials and identification of critical gaps
2. Appointment of essential support staff.
3. Establishment of transects for ships of opportunity to cover the full extent of the GCLME region
4. Identification of national experts from the other ten participating countries who will serve as contacts for the in-country coordination essential for effective regional coordination and monitoring. Each of the six national experts, with regard to Plankton and Nutrient activities, identified under the Pilot Phase project will add to this number to form the complete regional team.
5. Harmonization and adoption of country reports on nutrient pollution and review of strategies for the integrated management of nutrient pollution in the region
6. Identification and selection of Baseline Stations for water quality monitoring in the participating countries appropriate to the GCLME region
7. Design of regional programme for monitoring HAB toxins/species

#### **Component II: Strengthening institutional and infrastructural capacity for effective monitoring and co-ordination. (Tema Laboratory in Ghana for Plankton Survey and Imo State Laboratory in Nigeria for Nutrients and Water Quality Monitoring).**

1. Procurement of additional equipment and consumables for the two laboratories.
2. Establishment of efficient network system to facilitate communication and electronic data transfer.
3. Engagement of and contractual agreement with shipping lines to carry out CPR tows and fitting of necessary infrastructure on vessel.
4. Transfer of Pilot Phase Project samples and equipment from SAHFOS to Tema Laboratory.

5. Consolidation of arrangements with the Fish and Fisheries Project for outboard water sampling trips.

**Component III: Human capacity development through training and consultation workshop**

1. Training of national experts in plankton analysis, nutrient budgeting and water quality analysis
2. Training of support staff to be engaged in the two laboratories during the Project period.
3. Upgrading and production of existing plankton identification manual and the nutrient manuals generated in the GOGLME and Darwin Project.
4. Establishment of Fund for individual Fellowship for tertiary students to carry out analysis for thesis or dissertations.

**Component IV: Establishment of comprehensive programme for monitoring and assessment of productivity indicators**

1. Carry out plankton sampling using CPR with aquapacks towed by SOP.
2. Acquisition and processing of satellite imageries to complement in situ plankton and hydrological data.
3. Carry out nutrient assessment and water quality monitoring
4. Establishment of QA/QC procedures for monitoring activities.

**Component V: Data collections, analyses, interpretation, dissemination and archival**

1. Entry of collected data into GIS format for analyses, interpretation and archival.
2. Creation of GIS format for marine plankton database and nutrients budgets for the GCLME region
3. Definition and adoption of detailed procedures for laboratory analysis of collected samples and harmonization of nutrients and water quality standards and QA/QC.
4. Establishment of Nutrient Budget Models for the GCLME region.
5. Establishment of a HAB regional reporting network for early warning, detection and prediction of blooms

**Component VI: Preparation of regional action programmes for nutrient reductions for municipal, industrial and agricultural pollution control including trading/market-based schemes**

1. Development of pro-active management strategies and regional contingency programme towards nutrient control and management
2. Mechanism for periodic review of adaptive management objectives
3. Preparation of a Regional Action Programme and adoption of strategies for nutrient reduction for municipal, industrial and agricultural pollution control including trading/market-based schemes
4. Strengthening the implementation capacities for nutrient reduction and transboundary cooperation

**Component VII: Regional stakeholders' workshop for discussion and dissemination of results.**

1. Regional Stakeholders Workshop to be held in order to present the results of the Productivity Project and pursue strategies for sustainability of monitoring programmes.
2. Opportunity to define stakeholder responsibility and secure grounds for commitment Plankton monitoring and nutrient reduction strategies in the GCLME region.

**Expected Outputs**

This Project is expected to lay firm foundation for sustainable monitoring of GCLME region in order to provide necessary information for its management. Thus, emphasis has been laid on capacity strengthening, both human and institutional. A project of this nature in the long term translates to sustainable utilisation of living marine resources within a healthy environment. Nevertheless, there are several immediate benefits that would accrue from the project, and these include:

1. Information update on oceanographic conditions, plankton diversity and dynamics, nutrient loading regimes and overall productivity pattern.

2. Establishment of competent centres with scientific and technical capabilities to carry out sustained monitoring of marine productivity in the GCLME
3. Awareness creation on matters pertaining to HAB
4. Provision of reliable and updated database to provide decision makers with necessary information to help formulate appropriate policies and legal instruments to manage the marine living resources of the region
5. Establishment of a network among scientists and researches in the region to tackle transboundary issues pertaining to nutrient pollution
6. Building human capacity in the region for long term support of marine research
7. Provision of information which will support global research in collaboration with GLOBEC and GOOS-Africa, and ODIN-Africa.
8. Production of updated user-friendly identification guide for plankton and a manual for nutrient analysis
9. Distribution of findings to stakeholders
10. Training of students at the Laboratories which will become centers of excellence
11. Strengthening of Nutrient Activity/Working Group and Plankton Analysis Team
12. Nutrient budget models developed for specific coastal waters of the GCLME region
13. Productivity patterns established in the GCLME region
14. Continuous update of information on productivity patterns in the GCLME

#### Stakeholder Involvement Plan

The consideration and formulation of this Project has been in a pro-active manner and the same will carry on during its implementation. The success of the Pilot Project was mainly due to involvement of participating Governments at the highest level. The same approach has been adopted in this Demonstration Project and, as it was done in the Pilot Project, countries' financial contribution will be in-kind. In terms of Project financing, the Global Environment Facility (GEF) will be approached to underwrite the incremental cost.

The project would tap from the goodwill already generated by the pilot Gulf of Guinea Large Marine Ecosystem project in the region and would greatly benefit from UNIDO expertise in implementation and the enthusiasm of the countries to host regional projects. Overall guidance and supervision of project activities will be provided by the Regional Secretariat while the Industrial Development Officer (International Waters) UNIDO will be the Project Manager (Backstopping Officer). The various country experts for Nutrient/Water Quality Activity will ensure that project activities in-country are carried out in consonance with the overall project objectives. The countries Ministries of Environment will be lead agencies for project execution in-country while guidance will be provided by a full time Regional Project Coordinator to be recruited by UNIDO.

The nature of the Plankton Survey is such that activities will be coordinated by an Operations Manager from the Tema Laboratory, without the need to call at each country during the monitoring programme. However, with regard to the Water Quality/Nutrient, a Consultant will be engaged by UNIDO to undertake a Monitoring Mission to the Participating Countries to ground-truth with the national experts to develop an effective regional approach to address the problem of pollution of waters and degradation of associated critical habitat in the GCLME region.

Research and tertiary education institutions, recognised as principal stakeholders will be brought on board right from the planning stages. This is the best way to ensure the needed commitment, dedication, support and understanding on the part of all players. Local scientists and research institutions will participate and play key roles in order to develop and supervise the appropriate technologies.

This phase of the project has a fundamental bias towards strengthening existing capacity to carry out productivity assessment in the GCLME. The institutions already chosen, following the Pilot Phase Project will be strengthened and a support staff will be created to carry out day to day activities

towards the achievement of outlined objectives. There will be a Coordinator for the Project who will liaise who will supervise all survey/monitoring activities and liaise with the overall GCLME Project Co-ordinator.

Opportunity will be provided for researchers and graduate students to carry out plankton analysis and nutrient analysis through provision of Fellowships. The necessary training will be provided at the Tema Laboratory in Ghana and Imo State Laboratory in Nigeria. Furthermore, national experts will be encouraged to source funds from other Agencies to visit the Centres of Excellence to carry out analyses.

For region-wide implementation of the strategies for nutrient loading reduction to the constant waters of the GCLME region, the private sector initiatives and the key Non-Governmental Organisations (NGO) in the participating countries will be frontline stakeholders.

#### Incremental Costs Analysis

Financial support for the implementation of the Demonstration will be borne in various ways by GEF, participating countries and IUCN, IOC, UNEP, US-NOAA and FAO. Some activities have already gone in towards the preparation of the Project proposals by experts drawn from the region. Also, arrangements between the Project and existing institutions and personnel which borders in remuneration for this period and during project implementation will be considered as in-kind contribution by Governments. The incremental cost will then be borne by GEF and the identified international institutions.

## Logframe matrix

<b>Intervention Logic</b>	<b>Indicators of Performance</b>	<b>Means of Verification</b>	<b>Risks and Assumptions</b>
<b>Overall Objective</b> The objectives of this project is to assess productivity patterns, nutrient levels and water quality regimes in the Guinea Current LME in order to determine its carrying capacity for living resources.	<ul style="list-style-type: none"> <li>Improved regional capacities for the long-term sustainable development of the resources of the GCLME</li> <li>Documentations and stakeholder participation in the project activities</li> </ul>	<ul style="list-style-type: none"> <li>Adoption of Terms of Reference and Work Plans by relevant stakeholders</li> <li>Appointment of qualified personnel to lead execution of project</li> <li>Provision of Progress Reports</li> </ul>	<ul style="list-style-type: none"> <li>Key regional institutions and national governments working co-operatively</li> <li>Negative changes in economic political and social conditions to a regional approach</li> </ul>
<b>Project Purpose</b> <ul style="list-style-type: none"> <li>Strengthen existing human and institutional capacities for addressing transboundary, water-related concerns</li> <li>Assist countries to better understand environmental concerns of shared international waters and collaboratively address them</li> </ul>	<ul style="list-style-type: none"> <li>Country participation in an commitment of resources to required measures</li> <li>Strengthened capacity in targeted national and regional institutions to carry out assigned tasks</li> </ul>	<ul style="list-style-type: none"> <li>Completed work plans</li> <li>National and donor commitments to work plan elements</li> <li>Training programmes</li> <li>Disbursement records</li> </ul>	<ul style="list-style-type: none"> <li>Economic, political and social changes could affect commitment of governments hosting identified institutions which will coordinate plankton and water quality activities.</li> <li>GEF funds may not be adequately complemented by country commitments and other donors</li> <li>Project aims may be seen as inconsistent or competing with local interests.</li> </ul>
Component I. Preparatory Consultation and Regional Workshops:	<ul style="list-style-type: none"> <li>Mechanism for periodic review of adaptive management objectives</li> </ul>	<ul style="list-style-type: none"> <li>Agendas and meeting minutes of stakeholders</li> <li>Nutrient Activity/Working Group and Plankton Analysis Team</li> </ul>	<ul style="list-style-type: none"> <li>Willingness of stakeholders to participate fully to project activities.</li> </ul>
Component II: Strengthening institutional and infrastructural capacity for effective monitoring	<ul style="list-style-type: none"> <li>Establishment of a network among scientists and researches in the region to</li> </ul>	<ul style="list-style-type: none"> <li>Competent centre in Ghana with scientific and technical capabilities to carry out</li> </ul>	<ul style="list-style-type: none"> <li>Ghana and Nigeria will make available their laboratories for use by the Project, and</li> </ul>

and co-ordination.	<p>tackle transboundary issues pertaining to nutrient pollution</p> <ul style="list-style-type: none"> <li>Establishment of efficient network system to facilitate communication and electronic data transfer</li> </ul>	<p>sustained monitoring of marine plankton in the GCLME region</p> <ul style="list-style-type: none"> <li>Competent centre in Nigeria with scientific and technical capabilities to carry out sustained monitoring of water quality at identified hotspots in the GCLME region</li> </ul>	<p>also agree to co-financing arrangement in project budget.</p>
Component III: Human capacity development through training and consultation workshop	<ul style="list-style-type: none"> <li>Targeted training programs are developed</li> </ul>	<ul style="list-style-type: none"> <li>Production of updated user-friendly identification guide for plankton and a manual for nutrient analysis</li> </ul>	<ul style="list-style-type: none"> <li>Ability of project to develop a suitable education and training programme</li> <li>Willingness of experts from SAHFOS to carry out training of regional team</li> </ul>
Component IV: Establishment of comprehensive programme for monitoring and assessment of productivity indicators	<ul style="list-style-type: none"> <li>Effective monitoring of marine plankton using ships of opportunity</li> <li>Formulation of regionally-based methodologies for water quality monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Regular collection of plankton samples with continuous plankton recorders along established transects, their processing and data collection</li> <li>Regular analysis of water samples to establish nutrient levels</li> </ul>	<ul style="list-style-type: none"> <li>Availability of ships of opportunity willing to undertake plankton collection in a regular manner</li> <li>Regional experts will actively participate in or otherwise establish close links with international observational monitoring programs such as GOOS, ODIN-AFRICA, GLOBEC and other organisations as appropriate</li> </ul>
Component V: Data collections, analyses, interpretation, dissemination and archival	<ul style="list-style-type: none"> <li>Update information on oceanographic conditions, plankton diversity and dynamics, nutrient loading</li> </ul>	<ul style="list-style-type: none"> <li>Data and information synthesis report</li> <li>Internationally peer-reviewed documents and publication on</li> </ul>	<ul style="list-style-type: none"> <li>Availability and reliability of SOP for plankton tow.</li> <li>Efficient telecommunication network system in Ghana and</li> </ul>



	<p>regimes and overall productivity pattern.</p> <ul style="list-style-type: none"> <li>• Inter-calibration exercise for harmonization of procedures for nutrient sampling, analysis and data processing in all participating countries.</li> <li>• Programme to mitigate the negative effects of eutrophication and harmful algal blooms (HABS).</li> <li>• Development of a HAB reporting system at the regional level</li> </ul>	<p>GCLME productivity</p> <ul style="list-style-type: none"> <li>• Nutrient budget models developed for specific coastal waters of the GCLME region</li> <li>• Awareness creation on matters pertaining to HAB</li> <li>• Copies of HAB contingency plans and news material.</li> <li>• List of agreed upon, key environmental indicators</li> <li>• Reports describing extent of country compliance with management plans.</li> </ul>	<p>Nigeria</p> <ul style="list-style-type: none"> <li>• Reliable database facilities</li> </ul>
<p>Component VI: Preparation of regional action programmes for nutrient reductions for municipal, industrial and agricultural pollution control including trading/market-based schemes</p>	<ul style="list-style-type: none"> <li>• Provision of reliable and updated database to provide decision makers with necessary information to help formulate appropriate policies and legal instruments to manage nutrient pollution</li> </ul>	<ul style="list-style-type: none"> <li>• Copies of draft country agreed, regionally based water quality criteria</li> <li>• Preliminary reports of efforts to harmonise existing national policies</li> </ul>	<ul style="list-style-type: none"> <li>• Inability of countries to make appropriate legislative or regulatory instruments or enforce legislation that seek to address nutrient pollution</li> <li>• The ability of stakeholders to see the long term benefits from reducing nutrient levels</li> </ul>
<p>Component VII: Regional stakeholders' workshop for discussion and dissemination of results.</p>	<ul style="list-style-type: none"> <li>• Dissemination of project results and findings including future action plans</li> </ul>	<ul style="list-style-type: none"> <li>• Final report of project and all other deliverables contained in project proposal</li> <li>• Agendas and minutes of meeting to stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>• Successful execution of project</li> </ul>

## Workplan

[illegible]

[illegible]

[illegible]

[illegible]

### Replicability, sustainability, risks and uncertainty of project

The early involvement of the stakeholders in the design and implementation of the project will assure the sustainability of the project. Activities promoting integrated ecosystem management, including water quality management and sustainable use and conservation of biological diversity, will build on indigenous knowledge. This will assure the widespread adoption of sustainable practices and their continued application.

Given the history of mutual collaboration of the countries in resource management and, sharing common signatory under the auspices of Intergovernmental organizations as well as in UNEP WACAF Projects, and considering the success story of the Pilot Phase Project, the current expanded cooperation of managing the GCLME is not seen as being unsurmountable.

The sustainability of the project primarily rests on the political will by participating governments to commit themselves to the protection of the environment against any act that could defeat the overall purpose of the project. Political instability and bureaucratic tendencies in the sub-region is a cause for worry when it comes to implementation of a project of this magnitude. The issue of political instability should be given serious consideration particularly in this case where the project is to be implemented in several countries, involving different governments and states with different political orientation. On a positive note, a high level of political willingness has been exhibited by participating countries during the Pilot Phase Project and it is highly likely that the other countries in the expanded phase will do likewise.

Plankton survey will rely solely on the use of ships of opportunity to tow the CPRs during their normal commercial activities. An associated risk is failure of the CPRs to collect samples thereby losing a season's tow. Besides this, it is possible to lose the CPR entirely during deployment. Secondly, the successful operation of a CPR survey is based on an efficient communication network that will keep track of ship movement. In view of the fact that the Tema laboratory will co-ordinate activities of the plankton survey, the necessary communication network system will be put in place.

In terms of sustainability, will be put on strengthening appropriate human resources and the strengthening of the proposed centres of excellent to facilitate operations during project implementation and also in the future. In addition there will be contingency financial arrangements for the continuation of the CPR survey after donor funds have run out. This will be done by setting some funds aside in installments over time, and also by committing participating countries to support this endeavour.

#### **4. Nypa Palm Clearance and Mangrove restoration: Nigeria**



PROPOSAL ON NYPA PALM CLEARANCE AND MANGROVE REPLACEMENT  
DEMONSTRATION PROJECT IN NIGERIA

GUINEA CURRENT LARGE MARINE ECOSYSTEM PROJECT (PDF-B)

A PROPOSAL ON NYPA PALM CLEARANCE AND MANGROVE REPLACEMENT  
DEMONSTRATION PROJECT IN NIGERIA

FEDERAL MINISTRY OF ENVIRONMENT  
ABUJA, NIGERIA

JUNE 2003

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**LIST OF ACRONYMS/ABBREVIATIONS**

ADB	African Development Bank
CBD	Convention of Biological Diversity
CBO's	Community Based Organizations
CIDA	Canada International Development Agency
GCLME	Guinea Current Large Marine Ecosystem
GEF	Global Environment Facility
GOGLME	Gulf of Guinea Large Marine Ecosystem
ICAM	Integrated Coastal Area Management
IUCN	The World Conservation Union
NCF	Nigerian Conservation Foundation
NEPAD	New Partnership for Africa Development
NGO's	Non-Governmental Organizations
PDF-A	Project Development Funding –Block A
UNCED	United Nations Conference for Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
US-NOAA	National Oceanic and Atmospheric Administration of United States
WWF	World Wide Fund for Nature

**LIST OF FIGURES**

Figure 1: Map showing Mangrove Ecological Zone in Nigeria.

Figure 2: Typical Clump of Nypa Palm along the water's edge.

## 1. PROJECT IDENTIFIERS

<b>PROJECT NUMBER :</b>	<b>NI</b>
<b>PROJECT TITLE:</b>	Nypa Palm clearance/Mangrove Replacement scheme in south –eastern Niger Delta of Nigeria
<b>REQUESTING COUNTRY:</b>	Federal Republic of Nigeria.
<b>POTENTIAL SCOPE:</b>	Nigeria, Cameroon, Equatorial Guinea, Gabon, Benin and Togo
<b>REQUESTING NATIONAL ORGANISATION:</b>	Federal Ministry of Environment Abuja, Nigeria.
<b>POSSIBLE IMPLEMENTING AGENCIES:</b>	UNDP and UNEP in Cooperation with the Secretariat of Abidjan Convention
<b>POSSIBLE EXECUTING AGENCIES:</b>	UNIDO in Partnership with US-NOAA, International Waters of GEF
<b>REQUIRED NATIONAL PARTNERS:</b>	Federal and Coastal States Governments, Private Oil and Gas companies, local Communities, NGOs and CBOs
<b>PRIORITY HOTSPOTS OR SENSITIVE AREAS OF REFERENCE:</b>	Niger Delta and other areas invaded by exotic Nypa Palm.
<b>PRIORITY [GIWA] ISSUE ADDRESSED:</b>	Loss/Modification of Ecosystem, over-exploitation
<b>PROJECT DURATION:</b>	Five (5) years

## 2. EXECUTIVE SUMMARY

Nigeria's mangrove stretches from Lagos to Calabar and covers a zone of about 15-45 kilometers wide. It is the third largest such forest in the world and the largest in Africa. Mangrove plays a vital role as producers of nutrients in primary and secondary productivity and in supporting biologically diverse communities of terrestrial and aquatic organisms of direct and indirect economic value of transboundary significance. In the last decade or so the Nypa Palm, and exotic

species has become distributed throughout the Niger Delta invading and replacing native mangrove species and their associated animal species from many mangrove habitats. Its rapid propagation rate however threatens mangroves further in the region with all known negative consequences.

The Federal Government has identified Nypa palm infestation of the mangrove habitats as a major environmental concern. Arising from this, the Federal Government through the Federal Ministry of environment had launched the National Nypa Palm Eradication Programme in Akwa Ibom, Delta and River States in the year 2001 and year 2002 respectively.

In their effort to support this laudable programme of the Federal Government, Elf Petroleum Nigeria Limited (a subsidiary of TotalFinaElf) in conjunction with the Federal and State Government, has carried out a study on the control of nypa palm and a mangrove re-vegetation Demonstration Programme in Rivers State. Similar studies have been carried out by Chevron Nigeria Limited, Nigeria Agip Oil Company and ExxonMobil. The Nigerian Conservation Foundation (NCF), a non-governmental organization has also carried out a similar programme at Oron in Akwa Ibom State.

The present project proposal main aim is to eradicate the Nypa Palm and simultaneously restore the original mangrove vegetation as a civic duty to preserve the integrity of this ecosystem with all the promises this action holds for the shared international waters and resources of the Guinea Current Large Marine Ecosystem (GCLME). The main activities will consist of clearing the Nypa Palm and replacing it with native mangrove species with the participation of all the stakeholders particularly the host communities.

It is expected that the present proposal would result in the improvement of breeding, nursery and spawning, ground which will result in the increase in the availability of resources and in the maintenance of biodiversity. The increase in the availability of resources would contribute to the well-being of the coastal communities in the region, alleviate human poverty and promote sustainable development.

### 3. COST AND FINANCING (MILLION US \$)

<b>International and Bilateral Sources</b>	
<b>Required Financing by potential source:</b>	<b>USD 1 million</b>
<b>Sub-Total in International Financing Source :</b>	<b>USD 1 million</b>
<hr/>	
<b>Co- financing: Government in cash and kind:</b>	<b>USD .5 million</b>
<b>Private Sector:</b>	<b>USD 1 million</b>
<b>Sub Total Co-financing:</b>	<b>USD 1.5 million</b>
<b>Total Project Cost</b>	<b>USD 2.5 million</b>
<hr/>	

4. **GOVERNMENT ENDORSEMENT** Federal Ministry of Environment

5. **GOVERNMENT FOCAL POINT** Federal Ministry of Environment

## **PROJECT DESCRIPTION**

### Background and Justification

Nigeria's mangrove stretches from Lagos to Calabar and covers a zone of about 15-45 kilometers wide. It is the third largest such forest in the world and the largest in Africa. Mangroves are a particularly important resource for coastal communities and occur almost everywhere along the coasts in the Guinea Current Large Marine Ecosystem and are dominant in certain places such as the nation's Niger Delta which accounts for about 90% of the total national mangrove stock of 10,000km<sup>2</sup>.

The Niger Delta mangrove ecosystem with its complex network of creeks and waterways is a dynamic, sensitive and extremely important ecosystem. Its role among others includes the control of coastal erosion and stabilizing shoreline. They also provide shelter, feeding, spawning and breeding grounds to a large variety of commercially important fish and other aquatic and terrestrial organisms of direct and indirect economic value of transboundary significance, and sustain water based food chains with their debris.

Among the rural folks, mangrove is used for firewood, fish traps, breeding habitat for food (fish and shell fish), medicine, dyes, drying fish, making poles and stakes among others. The mangrove is a source of industrial raw materials. Mangrove ecosystem contains important biodiversity considerations such as reptiles, birds, mammals (e.g chimpanzee) and several endangered species.

Today, Nigeria mangrove forest which is the third largest in the world is now a threatened habitat. Presently, the mangrove forests are under pressure from overcutting for domestic uses (for fuelwood and timber for construction), anthropogenic impacts such as crude oil and petroleum products spillages, seismic activities, canalization and most importantly nypa palm invasion.

In the last decade or so nypa palm, an exotic invasive species, has proliferated in the area and is in the process of threatening to decimate the mangrove. Field assessment carried out during the Pilot Phase Project (PDF-A) revealed that the rapidly growing nypa palm is presently confined to south-eastern Niger Delta. Its rapid propagation rate however threatens the mangrove further in the region with all known negative consequences.

Available information indicates that nypa palm was introduced to Nigeria about 1906 through Calabar and Oron from Indo-Malaysia. Specifically it was imported from Singapore to old Calabar in 1906 (Keay et al 1964). At the onset of the introduction, it was believed that it would supplement other indigenous plant materials for coastal erosion control and provision of roofing materials (Egerton, 1908). However, it was not a close substitute. At the same time attempts were made to tap the palm but this proved unsuccessful. Since its time of introduction, nypa palm has become naturalized to the coastal creeks of Nigeria invading and displacing the native mangrove species (e.g *Rhizophora spp.*) Evidently, it has been found in the creeks and rivers in Akwa Ibom, Cross River, Rivers and Bayelsa states. Delta, Ondo, Ogun and Lagos States are at primary stages of infestation with the highest potential to spread into the neighbouring countries of Cameroon, Equatorial Guinea, Gabon, Benin and Togo. Evidence also shows that infestation transcends the mangrove zone and is already threatening part of the fresh water habitat.

The spread of the nypa palm along the coastal areas has been observed to affect the socio-economic activities of the communities in the region. It has drastically reduced the total space available for fish farming and total population of local mangrove species. It has also been observed that the palm exhibits allelopathic tendencies such that upon invasion of a new area, previously existing plant species cease to exist or are drastically reduced in population (Koyejo, 2001, Ibhanasebor, 2001). Among the fishermen, reduction of fishing ground by nypa palm has also affected the accruable income. It has also impaired visibility and navigation along the coastal waterways thereby affecting commercial activities within these areas. Due to lack of tap roots, nypa palm is unable to stabilize estuarine banks hence the foreshores are prone to erosion.

The rural economy of the coastal states traditionally thrives on the harvest of a variety of biological resources obtained from the creeks, rivers, lagoons and adjoining mangrove ecosystems. The rapid increase in the concentration of nypa palm has reduced the productivity of the mangrove ecosystem leading to decrease in fish production in the estuaries and the near shore waters. The result is increased poverty, heightened rural-urban migration and increased cost of fish.

The Federal Government has identified nypa palm infestation of the mangrove habitats as a major environmental menace that requires direct and urgent intervention. Arising from this, the Federal Government through the Federal Ministry of Environment launched the National nypa palm Eradication Programme at Oron in Akwa Ibom State in 2001, and Orugbo in Delta State and Opobo/Nkoro in Rivers in 2002.

Some major oil and gas companies, whose exploration and exploitation activities adversely affect the ecosystems have shown commitment towards rehabilitating the mangroves. Notable among these companies is Elf Petroleum Nigeria Limited (a subsidiary of TotalFinaElf) which in conjunction with the Federal and State Government has carried out a study on the control of nypa palm and mangrove re-vegetation, e.g the Elf demonstration at Opobo/Nkoro in Rivers State. Similar studies have been carried out by Chevron Nigeria Limited, Nigeria Agip Oil Company and ExxonMobil. The Nigerian Conservation Foundation (NCF) a non-governmental organization, has also carried out a similar programme at Oron in Akwa Ibom State.

The other participating countries are anxious to see Nigeria succeed in stemming this transboundary menace and intend to monitor closely the progress of the double actions of Nypa Palm clearance and mangrove restoration in this sector of their shared resources, the Guinea Current Large Marine Ecosystem (GCLME).

## **2. OBJECTIVES AND RATIONALE**

### **2.1 OBJECTIVES:**

The overall objective of the project is to eradicate the invasive nypa palm species that has invaded and degraded the Niger Delta. It is also aimed at restoring the original mangrove vegetation and to preserve the integrity of this ecosystem with all the promises this action holds for the shared International Waters and resources of the Guinea Current Large Marine Ecosystem(GCLME).

### **2.2 SPECIFIC OBJECTIVES**

The specific objectives are to:

- i) Identify nypa palm infested areas and assess the socio-economic impact of the palm on the mangrove ecosystem and the affected communities;
- ii) Generate awareness among all stakeholders mostly at community level on the importance of mangroves and the need to control the menace of nypa palm;
- iii) Establish mangrove nurseries in different locations for mangrove re-vegetation;
- iv) Eliminate existing nypa palm population along the selected communities;
- v) Establish mangrove species on the cleared sites;
- vi) Build capacity within relevant government departments, NGO's, CBOs, private sector and the communities on the best practices for nypa palm clearance and mangrove replacement programme and management;
- vii) Monitor the growth of the mangrove species.

### 2.3 **EXPECTED RESULTS**

The expected results are:

- Improved breeding, nursery and spawning ground for transboundary fish stocks.
- Increased availability of renewable natural resources.
- Maintained and conserved biodiversity.
- Improved livelihood of the coastal communities.
- Provision of jobs, generation of revenue, and enhancement of food security.
- Improved awareness of local communities on the containment of nypa palm.
- Successful elimination of the nypa palm.
- Availability of mangrove seedlings at designated locations for transplanting.
- Restoration of the health and integrity of the mangrove ecosystem and increase in productivity of the Niger Delta.
- Reduction of the risk of navigation and fishing created by nypa palm.
- Establishment of mangrove restoration demonstration project.
- Full involvement of affected communities in the project as direct beneficiaries.
- Trained personnel to manage the projects for sustainability.
- Protection of the shoreline from erosion.

### 3. **PROJECT COMPONENTS AND ACTIVITIES:**

Broadly, the project comprises seven major components each consisting of a number of project activities. These components will be undertaken in order to deliver the expected results.

**COMPONENT 1:** Identification of experts to constitute the national committee on mangrove restoration.

**COMPONENT 2:** Reconnaissance survey and socio-economic studies of nypa palm infested areas.

**Objective:** To identify the nypa palm infested areas and assess the socio-economic impact of the palm on the mangrove ecosystem and the affected communities.

*Activity 2.1* Identify and map the nypa palm infested areas

- Activity 2.2* Determine the current level of infestation of the mangrove ecosystem and waterways and establish its distribution pattern.
- Activity 2.3* Determine the extent of mangrove degradation in the areas that have been identified.
- Activity 2.4* Assess the social and economic costs of the nypa palm infestation on the affected communities.

**COMPONENT 3: Raising of awareness among the coastal communities and the public on the importance of mangrove restoration methodologies and the nuisance value of nypa palm.**

**Objective:** To raise awareness among the stakeholders (e.g local community, government, private sector, NGOs and CBOs) on the importance of mangroves and the need to control the menace of the palm.

- Activity 3.1* Mobilize and organize education of the public using inter alia workshops, public fora, film shows, meetings, consultations, seminars, radio and television programmes in English, Pidgin English and local languages.

**COMPONENT 4: Establishment of Mangrove Nursery Stock**

**Objective:** To establish mangrove nurseries in different locations for mangrove restoration work.

- Activity 4.1* Identify suitable sites for the establishment – nurseries.
- Activity 4.2* Mobilize communities, educate, motivate and involve them in the exercise.
- Activity 4.3* Acquire and prepare the sites that have been identified.
- Activity 4.4* Procure, process and raise propagules.
- Activity 4.5* Tend the seedlings in the nurseries.

**COMPONENT 5: Site preparation for Mangrove Replacement (Nypa Palm Clearance)**

**Objective:** To eliminate the existing nypa palm population.

- Activity 5.1:* Identify suitable localities and communities in the region for the demonstration project.
- Activity 5.2:* Determine the environmental requirements for mangrove growth.
- Activity 5.3:* Mobilize communities, educate, motivate and involve them in the clearing exercise.
- Activity 5.4:* Clear cut nypa palm stands, pack debris and carry out prescribed burning.
- Activity 5.5:* Pick floating and trapped seeds and dispose.



- Activity 5.6:* Control the resprouting of cut nypa palm stumps.
- Activity 5.7:* Protect the cleared sites from inflow of debris by building barriers.

**COMPONENT 6: Lifting and Transplanting of Mangrove nursery stock on the cleared Nypa Palm sites (Mangrove Replacement Proper).**

- Objective:** To replace the mangrove plant on the cleared nypa palm sites and monitor the growth and development of the transplanted seedlings.
- Activity 6.1:* Mobilise communities, educate and involve them in the transplanting exercise.
- Activity 6.2:* Transplant the propagules to the cleared nypa palm sites.
- Activity 6.3:* Monitor and evaluate the growth and development of the transplanted mangrove seedlings

**COMPONENT 7: Capacity building and enhancement within relevant government departments, NGOs, CBOs, private sector and the communities on the best practices of nypa palm clearance and mangrove replacement management.**

- Objective:** To train personnel by organizing training sessions, meetings, workshops and seminars to enhance skills for project sustainability.
- Activity 7.1:* Organize training sessions, workshops, meetings, seminars for all stakeholders.

**4. LINKAGES TO OTHER NATIONAL OR REGIONAL ACTIVITIES/TRANSBOUNDARY ASPECTS**

The project maintain close linkages with the Abidjan and Nairobi Conventions which seek to promote conservation of biodiversity and Sustainable utilization of ecosystem.

- aspects of programmes by UNEP, UNIDO DFID, GEF, WWF, IUCN have contained elements that reduce directly or indirectly mangrove degradation which include poverty reduction programmes, protection of Coastal areas etc. Projects such as the GOG LME with ICAM components have contributed positively to some degree, to the objectives of this project proposal.
- supports the regional implementation of the Global Programme of Action for protection of the Marine Environment from Land –Based Activities, relevant components of the Abidjan Convention and those of Accra Ministerial Declaration.
- International organizations such as United Nations Conference on Environment and Development (UNCED) at Rio de Janeiro in their Agenda 21 expressed

great concern for the protection, conservation/rational use of the coastal areas and their living resources for sustained development.

- Nigeria Conservation Foundation (NCF) for conservation programmes in Nigeria
- Convention of biodiversity (CBD)
- African Process of NEPAD initiatives

## **5. DEMONSTRATIVE VALUE AND REPLICABILITY**

Mangroves fringe the coastlines of many tropical and sub-tropical nations whose populations depend a lot on its resources for livelihood; which underscores the need to conserve the mangrove ecosystem. The loss of mangrove directly affects the livelihood and the ecological integrity of these areas. Hence a successful demonstrative project on mangrove revegetation in the south-eastern Niger Delta has a high potential of replication throughout the sub-region.

Since the problem of Nypa Palm invasion is transboundary, a successful implementation of this project will encourage countries with similar problems to embrace it.

## **6. RISKS AND SUSTAINABILITY**

The present proposal is designed on the basis that financial and necessary logistics will be available. In the absence of these, the implementation of the project might be difficult.

The cutting and clearing of the Nypa Palm will create a vacuum in the mangrove ecosystem and its habitats structure. Nonetheless an attempt will be made as containing this hazard through the replanting of mangrove species (plants) in existence within the area with special reference to its zonation pattern.

Communication and traveling facilities to project locations which are often in remote coastal communities may be difficult. Therefore traveling particularly to access the sites targeted in the project requires improvement in the communication and traveling facilities.

Sustainability of this project will depend on the active involvement of the local people, the governments, private oil and gas companies as well as NGOs, adequate educations and enlightenment on the menace of the weed at the grassroots, the appropriateness of the implementation of mangrove Replacement guidelines, adequate technical and institutional capacity, the expertise, financial commitment and capacity building at the local and national level.

The most critical measure in sustaining the project will be the educations of the inhabitants of the coastal communities living near the project sites on the importance of the project and the willingness of local authorities and governments to continually support the project. The inclusion of enhanced economic livelihood would ensure self-sustenance of the project.

## **7. STAKEHOLDERS' PARTICIPATION**

The main stakeholders as well as beneficiaries of the Projects are:

- Local people living in the coastal communities.

- Local, State and Federal Government's and agencies related to environments
- Environmental organizations, NGOs and CBO's. They will play a pivotal role as they will serve as a link between government and local communities or between private sector and local communities.
- Sub-regional, regional International bodies such as the World Bank, ADB, GEF, WWF, IUCN, UNDP, UNEP, UNIDO CIDA etc.
- Private oil and gas companies operating to this area, which depends on quality of environment.

## **8. PROJECT MANAGEMENT AND IMPLEMENTATION ARRANGEMENTS**

On the management and implementation of this project, an adequate management/co-ordination structure would be established. The structure would have a top co-rodination at the regional level as well as at the national level. The parties involved would be the Federal, State, Local Government, the affected Communities, non-governmental organization(NGOs) and private sector.

At the regional level, the project will require the appointment of Regional Project Co-ordinator and a technical expert who will have the overall responsibility for providing guidance, supervision and advice on project implementation to the national authority He/She would also be responsible for liaising with relevant international partner agencies and ensuring the required inputs in terms of expertise.

At the national level, a National Scientific and Technical Task Team comprising representatives from Federal Ministry of Environment, private oil and gas companies, non-governmental organization (NGO's), and the Nigerian university system will be constituted. A National Project Director will be appointed and will be assisted by the National Task Team. The National secretariat functions will include the overall management and implementation of the project, define and cost the mangrove replacement project for the region. The secretariat will also be responsible for the monitoring as well as overseeing the activities of the project and the involvement of the different stakeholders. The secretariat will also prescribe working guidelines including the profile of management, financing, auditing, and associated accountability matters. The National Project Director will also represent the country at the project steering committee.

Project implementation at the State level will involve the appointment of the state project supervisors from the State Ministries of the Environment and State NGO officer. At the Local Government level, a project assistance will be appointed from each affected Local Government Area. At the community level, two field overseers would be appointed in each project community. The community must be involved from the planning stage of the activities and in the implementation of the project at the local level, particularly in the implementation of the management strategies at the local level.

## **9. INCREMENTAL COSTS AND PROJECT FINANCING:**

This project is to be implemented for five years and is expected to cost US\$2.5 million. Financial sources for the implementation of the project are expected to come

from the donor community and bilateral arrangement and private Oil and Gas Companies operating in the Niger Delta, co-financing. It is envisaged that the national government should be able to contribute 20% of the total cost of the project in kind (see Annex).

#### **10. MONITORING, EVALUATION AND DISSEMINATION**

Monitoring of the Project will be conducted monthly and evaluated quarterly for a period of five years with an annual progress reporting and reviews. Monitoring should be conducted by at least two experts to be appointed by the National Scientific and Technical Task Team at the National Level. Quarterly evaluation should be conducted by a team set/ approved by the project steering committee at the regional level.

The quality and impacts will be measured through site visits, questionnaires, interviews etc. The main indicators will be the successful replacement and restoration of mangroves on cleared Nypa Palm sites through proven, reliable and environmentally sound method for mangrove regeneration and the improvement in economic lives of the people who depend, on various mangrove resources for their livelihood.

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**5. Waste Stock exchange management system: Ghana**

**Guinea Current  
Large Marine Ecosystem  
Project**



**COUNTRY DEMONSTRATION PROJECT PROPOSAL**

**ESTABLISHMENT OF WASTE STOCK EXCHANGE MANAGEMENT SYSTEM  
(WSEMS)-FOR TRANSFER OF-- ENVIRONMENTALLY-SOUND TECHNOLOGIES  
(ESTs) FOR GCLME POLLUTION PREVENTION.**

2      GHANA

**MINISTRY OF ENVIRONMENT AND SCIENCE, (MES)  
ACCRA  
GHANA.**

**MAY 2003**

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## LIST OF ABBREVIATIONS

ADSC	Average Debt Services Coverage
BOD	Biological oxygen demand
COD	Chemical Oxygen Demand
CP	Cleaner Production
CSIR-WRI	Council for Scientific and Industrial Research-Water Research Institute
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMPRETEC	
EMS	Environmental Management System
EQO	Environmental Quality Objectives
GCLME	Gulf Current Large Marine Ecosystem
GEF	Global Environment Facility
GEPC	Ghana Export Promotion Council
GIPC	Ghana Investment Promotion Council
GOGLME	Gulf of Guinea Large Marine Ecosystem
GPHA	Ghana Ports and Harbours Authority
GSD	Geological Survey Department
GTB	Ghana Tourist Board
IRR	Internal Rate of Return
ISO	International Standards Organization
LBA	Land-Based Activities
LCA	Life Cycle Analysis
LEL	lower Effect Level
MARPOL	International Convention against ships pollution (MARPOL)
MAMSCO	
MES	Ministry of Environment and Science
MEST	Ministry of Environment, Science and Technology
MBA	Marine-based Activities
MOTI	Ministry of Trade and Industry
MOU	Memorandum of Understanding
NPV	Net Present Worth
PDF	Project Development Fund
POPs	Persistent Organic Pollutants
PSC	Port State Control
SEL	Severe Effect Level
TDA	Transboundary Diagnostic Analysis
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Organization
WSEMS	Waste Stock Exchange Management System
WSEMIS	Waste Stock Exchange Management Information System
WACAF	West and Central Africa

## EXECUTIVE SUMMARY

*The Guinea Current Large Marine Ecosystem (GCLME) Country Demonstration Project is one of UNIDO's programmes to assist nations within the Guinea Current region to face challenging issues involving population and urbanization, fisheries depletion, water pollution, public health and sanitation, habitat degradation, loss of biological diversity, land use planning and coastal erosion. Three (3) regional and six (6) national pilot demonstration projects in six countries have been selected to showcase diverse methods, concepts and technologies of providing solutions to these problems. The success stories of these demonstration projects will be replicated in the other countries to decrease both land and sea based sources of pollution as well as sustainable environmental management of the marine and coastal areas resources of the large marine ecosystem in the region.*

*Ghana's demonstration project aims at driving the uptake of environmentally sound technologies and concepts to reduce industrial wastes and effluents and their effects on the GCLME. The project integrates the Cleaner Production (CP) programme instituted by UNIDO and Waste Stock Exchange Management System (WSEMS) developed and adopted under the Gulf of Guinea Large Marine Ecosystem (GOGLME) project. The system is a new concept whose major objective is to provide a "matching service" between the waste generators and potential users of tradable non-hazardous waste to maximize recovery, recycle, reuse to maximize the efficiency of utilization of resources in the production consumption cycle, and thereby ensure effective reduction of discharges of these wastes into the large marine ecosystem.*

It has been established, through feasibility studies, that wastes, which pre-occupy some industries, are potential raw materials for other industries. Waste Stock Exchange Management System, apart from being one of the alternatives to disposal of waste from industrial processes and household, is also a pivot in industrial ecology, which is a means towards sustainable development by actualizing nature's ability to use closed-loop materials and energy.

It is therefore believed that the merging of these two environmentally friendly concepts, representing the beginning of pipe and end of pipe approaches will succeed in minimizing

drastically wastes and effluents from industries and their adverse effects on water bodies and the GCLME. The Ghana Demonstration project under the expanded GCLME project will also seek to establish an independent self-financing and fully functional waste stock exchange system in Ghana. The success of this demonstration project will fuel similar establishments in the GCLME region and create a vibrant stock market in non-hazardous tradable waste in the sub-region as well as in-country.

Additionally, Ghana's demonstration project involves the provision of port reception facilities and the setting up of a waste oil treatment plant to process waste oil from land and marine based sources into liquid fuels and lubricants. Ghana has seaports, and engaged in international trade conducted through these ports, handling thousands of tonnes of cargo, and several hundreds of ships including tankers a year. Ghana depends on crude oil imports for its petroleum needs, which all go through ports to feed its Oil Refineries. Also, there is a ship repair yard located in Tema Port. Ghana is Party to MARPOL 73/78, having ratified Annexes II & I. The Convention requires the provision of port reception facilities. With its ports not having any means of receiving ship-generated waste, providing reception facilities at least in the Tema port financed and operated by the private sector, will be appropriate and will help reduce the risk of illegal discharges from ships in the Gulf Current large marine ecosystem.

Feasibility studies of the Ghana Demo project have established the market potential, technical feasibility and financial viability of an 80,000 tons/annum waste oil treatment plant in Tema. The study also indicated that over 500,000 tons of waste oil can be recovered from marine sources and land based sources country-wide every year. The Ghana project is an excellent example of governmental/private sector/public sector partnership in the transfer of ESTs to facilitate the meeting of a country's obligation under an international instrument (the Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).

The project has attracted private sector financing from RVTJ financing services of the entire port facilities and the waste oil treatment plant to ensure successful implementation of the project. Alpha Filtration Limited, a United Kingdom-based company has also been selected to supply and install the plant/machinery and equipment on turnkey basis, and also provide the relevant technology and training support. The letters of support/intent and a memorandum of understanding (MOU) between all the parties have been enclosed in **Annex C**. The Ghana Demo project further promises to promote increasing interest of the technology suppliers and the financiers in the implementation of other Port reception facilities and waste oil treatment plants under the GCLME project to promote regional cooperation.

The total project investment of US\$7.70 million is made up of US\$4.51 million in fixed assets, US\$1.709 million working capital and US\$1.480 million pre-operating expenses. The project is to be financed by a private sector loan of US\$ 7.0 million, a GEF grant of US\$ 1.06 million, Government of Ghana equity of US\$ 400,000 and private sector equity/loan of US\$6,240,000.

Results of financial analysis are impressive (Annexes F1 to F7). A net profit of US\$1.93 million shall be realized in year 1, increasing to US\$2.88 million in year 2 and steadily to US\$4.28 million in year 5. Total shareholders funds will increase from US\$4.03 million in year 1 to US\$18.9 million in year 5. Current ratios range between 55 and 188.

Cumulative cash balance is positive throughout the repayment period, US\$3.26 million in year 1 and US\$14.57 million in year 5, indicating that the project can generate enough funds to repay the loan and interests thereon. The Average Debt Services Coverage (ADSC) is 2.1

The Internal Rate of Return (IRR) after tax is 48%, when the interest rate of 2.5% is used to discount the project. The Net Present Value (NPV) at 2.5% interest rate is US\$30.86 million. Sensitivity analyses carried out for two scenarios to test the project's viability have shown that the project's viability is not undetermined under (i) a 10% short fall in revenue and (ii) a 10% increase in operating cost, without a corresponding increase in revenue.

In conclusion, the Ghana Demo project addresses key areas of the Trabsboundary Diagnostic Analysis (TDA) of the PDF B of the project. These include:

- (a) Objective I (sub-component 8): The development of a waste stock exchange mechanism to drive the uptake of ESTs for tradable wastes as an economic incentive to promote preventive measures to reduce both land and marine based sources of pollution as well as innovative environmental management system in the region.
- (b) Objective IV: reducing land and sea based pollution and improve water quality through the development and implementation of Port reception facilities and waste oil treatment plant for both land and marine waste oil, and also preparing a national profile regarding status of ratification/implementation/enforcement of the MARPOL convention and its annexes in collaboration with IMO including capacity building to develop and implement Port State Control (PSC) under the West and Central Africa Memorandum on Port State Control (MOU) applicable to the region.

The Ghana Demo project therefore addresses specific targets and priority areas of the environmental quality objectives (EQOs) of the PDF B, which includes reducing annual inputs of all priority land and sea based pollutants to the marine environment by at least 10% by 2015 under the EQO 2 (i.e. High Quality Water to Sustain Balanced Ecosystem) and the priority action of providing investments in environmental sound technologies and cleaner production options for minimization of industrial process emissions to reduce inputs of heavy metals, POPs, and waste oil

## 1. BACKGROUND AND CONTEXT

### 1.1 Introduction

Waste management has been a nightmare in the Guinea Current Large Marine Ecosystem (GCLME) project region. The adverse impact of the wastes from land-based activities on international waters is well recognized. The gradual shift to engineered landfills and waste treatment plants can provide some minimization and/or mitigation measures in addressing the environmental problems. However global trends in seeking innovative approaches, including waste minimization, cleaner production, zero discharge clearly demonstrate that the future lies in mechanisms that minimize waste and maximize recovery, re-cycling, and re-use of what is generally termed waste. The desired outcome of such mechanisms is to maximize the re-use of all materials generated within the production and consumption cycle throughout the supply chain so as to minimize the ultimate discharge into the environment. Such systems therefore acting as an emission discharge valves are expected to effectively prevent and control environmental pollution.

The Guinea Current spans from Guinea Bissau to Angola with a coastline length of 8,000 kilometers. The principal economic activity of countries lined up along this coastline is agriculture and therefore under normal circumstances, the potential for degradation of the marine environment should be of less concern. The last three decades have however witnessed the springing up of industries in these countries and these industries are mostly concentrated in the coastal cities with attendant high population growth rate as a result of urbanization. . The result of these developments along the coastline is the discharge of land based sources of pollution into the coastal areas and marine environment, particularly liquid and solid waste. In addition, the construction of harbours and increased shipping fleet and movement of oil tankers along the coastal states also result in the discharge of ballast water from ships due to lack of facilities and appropriate legislation even though these countries are signatories to various international instruments on the prevention of the pollution of coastal areas resources and marine ecosystem.

For example in Ghana, about 80% of the country's industries established in the coastal areas, principally in Accra, Tema and Takoradi were sited predominantly in the catchment of wetlands, namely rivers, lagoons, and mangroves. Consequently the discharge of untreated effluents poses a lot of environmental problems, with its adverse impact on the ecology. It is estimated that in 1988 alone the annual loss to the economy due to environmental degradation amounted to 41.7 billion cedis, (US\$21 million) equivalent to 4% of the total Gross Domestic Product (GDP).

Untreated industrial effluent is the major cause of health hazards and low productivity of the two major lagoons, Chemu and Korle lagoons, in Tema and Accra respectively. According to Ministry of trade and Industry Directory (Addo *et al.* 1995), *the Greater Region accounts for 64% of 515 medium and large scale industries in Ghana. 49 % of these are located in the Korle lagoon/Odaw river catchment.* Various pollution assessment studies carried out indicate that untreated effluents discharged into the wetlands constitute high pollution loads in excess of the assimilative capacities. High levels of suspended solids, conductivity, salinity, sulphides, Biological oxygen demand (BOD), COD, ammonia and heavy metals generally characterize the effluents. Others are excessive concentrations of organic loading, nutrients and coliform bacteria. Table 1.1 gives the results of water sample analysis in 5 locations in the Korle/Odaw river catchment in April 2000. The results showed that the lagoon is highly deteriorated compared to previous studies.

Table 1.1: Physico-chemical characteristics and heavy metal concentrations –Lagoon waters

Location	pH	conductivity	Turbidity	TSS	DO	Cd	Cu	Zn	Fe
1	7.8	63900	9	256	6.5	0.10	0.11	0.05	
2	7.6	42000	61	396	0	0.12	0.13	0.10	
3	7.1	1592	51	252	0	0.10	0.11	0.04	
4	7.9	1434	36	264	0	0.16	0.24	0.810	
5	7.2	2060	62	4500	0	0.19	0.27	1.0	

Source : Chemu Lagoon Restoration Feasibility Project (EPA, 1998)

Analysis of water quality in the Chemu lagoon catchment in Tema industrial area in six sampling locations (ref. Plate 1) in 1998 is summarized in Table 1.2 The analysis indicated that DO was essentially zero much of the time particularly within the lagoon waters.

Table 1.2- Sample water quality of Chemu Lagoon

Location	pH	Conductivity (us/cm.s)	Turbidity (ntu)	DO mg/l	Temp (°C)
1	7.9	94	10	2.29	29.1
2	8.1	2860	10	3.83	28.9
3	8.2	424	10	6.34	29.5
4	9.3	42100	10	4.12	36.5
5	7.8	920	740	0.28	31.7
6	7.4	30500	112		36.4

Source : Chemu Lagoon Restoration Feasibility Project (EPA, 1998)

Table 1.3 gives the analysis of sediment quality in the Chemu lagoon at various depths compared with Sediment quality guidelines of the Netherlands and in Ontario Canada based on pollution indicators, namely lower Effect Level (LEL) and severe effect level (SEL). The SEL is the level above which there would be severe effect on normal biota. The analysis showed that copper, chromium, nickel, and manganese all exhibited values exceeding the SEL. In addition, relatively high oil and grease, representing hydrocarbon discharges do have severe adverse impact on biological life.

Table 1.3 Comparison of Chemu lagoon Sediment Quality and International Pollution Guidelines

Pollution indicator (mg/l)	Mean	Max	Min	LEL	SEL
Phosphorus	725	2766	124	600	2000
As	1	2		6	33
Pb	2	3		1	10
Cd	54	196	3	31	250
Zn	235	945	21	120	820
Cu	60	393	9	16	110
Cr	67	122	33	26	110
NI	27	77	3	16	75
Mn	293	1474	109	460	1100
Co	13	22	4		
Fe	28	55	12	20000	40,000

Source : Chemu Lagoon Restoration Feasibility Project (EPA, 1998)

Enormous quantities of wastes from both land based and marine-based activities are being discharged into water bodies and eventually the coastal waters daily. Ghana alone produces and collects about 500,000 tons waste oil annually, and it is estimated that the entire sub-region collects and produces about 4,000,000 tons of waste oil into the GCLME annually. Other industrial wastes which pre-occupy waste management authorities in the sub-region include sawdust from wood processing activities, lime waste from acetylene gas producers and gas welders who employ carbide, plastic wastes, gypsum from solar salt mining operations, carbon anodes etc.

The situation in the other countries within the sub-region is not different. It is estimated that, the sub-region produces annually about 3,00,000 tons of sawdust, 12,000 tons of lime waste, and 120,000 tons of gypsum and millions of other wastes from land and marine based activities. (UNIDO/MAMSCO, 1999)

The effect of this gradual build up of industrial waste pollution is evident in our lagoons and water bodies. Aquatic life is almost extinct in our lagoons and coastal waters which once used to be alive with all types of fish. Our beaches have been polluted with tars from oil spillages and are no longer tourist friendly. Erosion of our beaches and disappearance of wood species and vegetation along the coastal areas are growing at alarming rate.

The discharge of pollutants from land based sources of pollution has a transboundary nature as a result of the nature of the gulf currents. For example, in Ghana, the problems of alga bloom are periodically experienced in the western region of Ghana bordering the coast of Cote d'Ivoire. The phenomenon has been attributed to the discharge of high BOD load from industries and phosphate rich run-off of fertilizer application from agricultural plantations and river discharges in the neighboring country.



PLATE 1

**INSERT A PLATE OF SAMPLING SIGHTS OF CHEMU LAGOON**

*Over the years, the International Maritime Organization (IMO) has developed a coordinated scientifically and technically oriented strategy for the protection of the marine environment from pollution generated by the shipping industry. One of the main IMO Conventions dealing with marine environment protection is the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78). The provisions of the Convention require the government of each party to ensure the provision of adequate port reception facilities. A port reception facility is anything, which can receive shipboard residues and mixtures containing oil, noxious liquids, or garbage. For parties to MARPOL 73/78, failure to establish adequate facilities is a breach of international obligations and will increase the risk of illegal discharges from ships into the marine environment.*

Ghana is Party to MARPOL 73/78, having ratified Annexes II & I. The Convention requires the provision of port reception facilities. Regulation 12 of Annex 1 on reception facilities states; *“Subject to the provision of regulation 10 of this annex, the Government of each Party undertakes to ensure the provision at oil loading terminals, repair ports, and in other ports in which ships have oily residues to discharge, of facilities for the reception of such residues and oily mixtures as remains from oil tankers and other ships adequate to meet the needs of ships using them without causing undue delays to ships”*. Regulation 7 of Annex II on reception facilities and cargo unloading terminal arrangements states; *(a) The Government of each Party to the Convention undertakes to ensure the provision of reception facilities according to the needs of ship using its ports, terminals or repair yards....”*

Ghana has seaports, and engaged in international trade conducted through these ports, handling thousand tonnes of cargo, and several hundred ships including tankers a year. Ghana depends on crude oil imports for its petroleum needs, which all go through ports to feed its Oil Refineries. Also, there is a ship repair yard located in Tema Port. With its ports not having any means of receiving ship-generated waste, providing reception facilities at least in the major port financed and operated by the private sector, will be appropriate and will help reduce the risk of illegal discharges from ships in the Gulf of Guinea, which destroy marine life not only in coastal waters but also in inland waters depriving fishermen of their livelihood. The facilities when operational will also offer job opportunities to nationals, thereby contributing to poverty alleviation.

Ghana occupies about 6% of this coastline and contributes its fair share to the transboundary environmental degradation of the GCLME. The demonstration project being put forward by Ghana is aimed at showcasing the possibility of minimizing industrial wastes from land and marine based sources on our coastal waters through the application of environmentally-sound technologies and concepts. The positive outcome of this demonstration will fuel similar establishments in the other countries within the sub-region.

The Waste Stock Exchange Management System (WSEMS), an innovative approach to waste management seeks to identify materials classified as waste generated by certain industries, which can be employed as raw materials by other industries/end-users. The uniqueness of this approach, relative to current approaches lies in the fact that it also seeks to provide Waste Exchange Management Information System, create a wider stakeholder market and economic as a major driver to facilitate the functioning and autonomy of a stock exchange for identified tradable wastes, thereby institutionalizing an integrated pollution prevention and control strategy. The National Demonstration Project will also facilitate reduction in waste, the introduction of Environmentally Sustainable Technologies (ESTs) in Ghana through building capacity.

This innovative approach was identified during the pilot phase of Gulf of Guinea Large Marine Ecosystem (GOG-LME) project, using the industrial enclave of the Tema Metropolis in Ghana as a case study. The preliminary results of identification and limited feasibility studies revealed the scheme's potential as an effective pollution prevention and control strategy, thus leading to its acceptance as one of the six country demonstration projects under the wider Guinea Current LME project.

The Demonstration project under the expanded GCLME project will seek to establish an independent self-financing and fully functional waste stock exchange system in Ghana. The success of this demonstration project will fuel similar establishments in the GCLME region and create a vibrant stock market in non-hazardous tradable waste in the sub-region as well as in-country. This would generate a technology and knowledge-based demand driven recovery, recycling, and re-use of waste consistent with one of the cardinal objectives for waste management under Agenda 21.

## **1.2 Initiation of industrial Waste Stock Exchange Management System (WSEMS).**

As part of the environmental management plan (EMP) programme to ensure sustainability of the Chemu Lagoon restoration programme, the Environmental Protection Agency (EPA) directed that all operations discharging into the catchment area should prepare EMPs to ensure the establishment of Environmental Management Systems (EMS) with the highest corporate commitment. Industries were subsequently asked to operationalize the EMPs by developing costed programme budgets for all improvement plans that would ensure that effluent and emission quality as well as waste disposal management meet EPA guidelines where they exist and in its absence World Bank guidelines.

In response to the EPA directives, MAMSCO Management Ventures Ltd., a private consulting firm undertook consultancy services for some industries for the preparation of their EMPs. From the individual industries EMPs emerged the possibility of evolving a demand-driven trading in industrial waste among industries in Tema industrial area, hence the idea of WSEMS.

Following the positive results of preliminary studies on this innovative approach to waste management, a 2-day workshop was organized jointly by the then Ministry of Environment, Science and Technology (MEST), the United Nations Development Programme (UNDP) and the United Nations Industrial Development Organization (UNIDO) in July 1997. MAMSCO was invited to present its findings to participants drawn from private and public sector institutions, consultancies, NGOs, Ministries and organizations.

The workshop participants expressed their support for the adoption of the WSEMS concept, and the participants pledged their commitment and assistance of their respective organizations to see to the project's success.

The Ghana government through the then Ministry of Environment Science and Technology (MEST) formally adopted this system as a country strategy for waste management. Subsequently, the Government has endorsed the inclusion of the initiative as pilot demonstration project for Ghana under the expanded Guinea Current LME project for covering sixteen (16) countries in the project region.

### **1.3 Further studies undertaken on the development of concept.**

#### *1.3.1 Feasibility study and Preparation of Business Plan for Waste Oil Treatment Plant*

The Ghana Government and MAMSCO have continued with the development of this all important concept since the pilot phase. They have sponsored studies on marine-based waste oil in Tema Port. The studies included technical survey to estimate the quantities of waste oil that could be recovered from sea going vessels which dock in the port and preparation of feasibility study report to establish the market potential, technical feasibility and financial viability of a 40,000 tons/annum waste oil treatment plant.

Results of the studies and analyses completed in September 1999 were quite positive, thus establishing the viability and bankability of the project. An estimated 300,000 tons of waste oil can be recovered from sea going vessels that dock at the Tema port per annum. The total cost of installing a 40,000-tons/annum waste oil treatment plant was estimated at US\$4.0 million. The project would realize a net profit of US\$585,000 in project year 1.

#### *1.3.2 Other potential tradable wastes*

Other potential waste that are discharged into the international waters (GCLME) that have been studied include (a) waste slaked lime recovery from acetylene processing and end-user activities for re-use and (b) Waste gypsum recovery from coastal solar salt mining companies for re-use;

## 2.0 PROJECT RATIONALE AND OBJECTIVE

### 2.1 Rationale

The degradation of coastal habitats, including critical wetlands, causes the loss of spawning and breeding grounds for most living resources in coastal waters and the loss of the rich and varied fauna and flora of the region including some rare and endangered species. Nearly all major cities, agricultural plantations, harbours, airports, industries as well as other aspects of the socio-economic infrastructure in the region are located at or near the coast. Results obtained during the Pilot Phase GOG-LME Project showed that in Ghana, 55 percent of the mangroves and significant wetlands around the greater Accra area have been decimated through pollution and overcutting. These exert phenomenal pollution pressures on this international body of water (WACAF Intersecretariat Co-ordination Meeting, Rome, 1993).

#### *2.1.1 Priority issues and perceived transboundary problems*

Some of the priority issues identified through regional consultations and from various assessments conducted, as possible threats to the sustainability of the GCLME include:

- Habitat loss and pollution of the fragile and relatively pristine nature of the coast of the Guinea Current region due to uncontrolled discharge of untreated industrial and commercial wastes
- Increasing problems of human and ecosystem health caused by introduced species, especially of potentially harmful algae derived from ballast water, and other ship discharges of non-indigenous species;

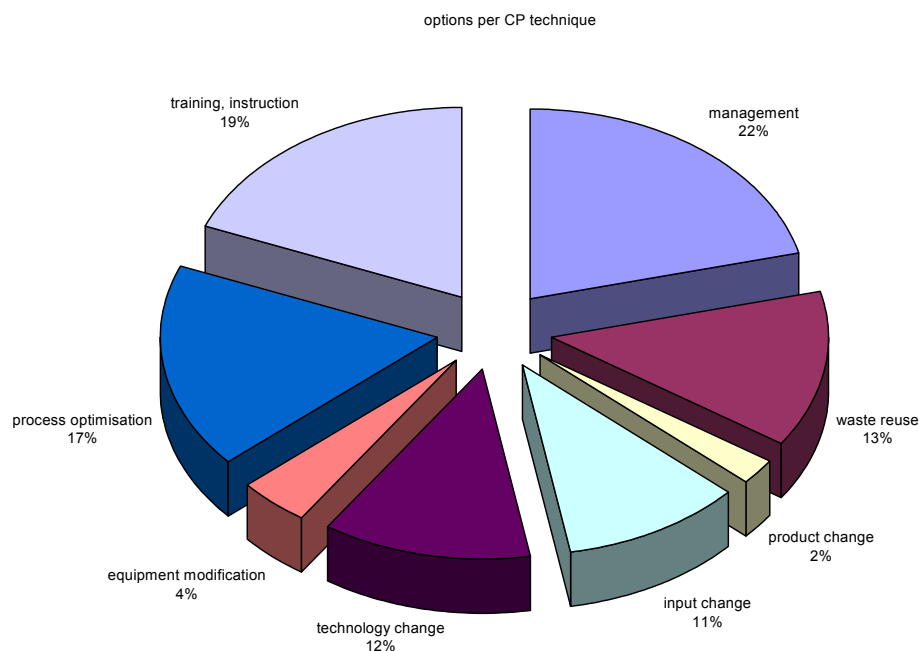
The perceived transboundary problems of industrial and commercial pollution of the GCLME including destruction of coastal habitat that would be addressed is summarised as follows:

- Destruction of coastal habitat	<ul style="list-style-type: none"> <li>• Loss of spawning breeding grounds;</li> <li>• Loss of rich and varied fauna and flora including endangered species</li> <li>• Loss of CO<sub>2</sub> sequestration</li> <li>• Loss of pollution buffer.</li> <li>• Loss of flood and storm surge protection</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of global heritage.</li> <li>• Decimation of life support systems.</li> <li>• Forestry loss</li> <li>• Economic and aesthetic loss.</li> <li>• Increased pollution</li> <li>• Increased flood and erosion risk</li> </ul>
- Pollution from local industry, mining activities, petrochemical processes, maritime transport, oil exploitation, genetic engineering, ballast dumping	<ul style="list-style-type: none"> <li>• Reduced productivity</li> <li>• Much altered biodiversity</li> <li>• Red tides and algal blooms</li> <li>• Invasion of water weeds</li> <li>• Permanently changed LME</li> <li>• Introduction of exotic species.</li> <li>• Eutrophication.</li> <li>• Bioaccumulation of toxics</li> <li>• Increased turbidity</li> </ul>	<ul style="list-style-type: none"> <li>• Economic loss</li> <li>• Disruption of communities</li> <li>• Increased sickness and death</li> <li>• Aesthetic loss and lower quality of life.</li> <li>• Biodiversity loss.</li> <li>• Reduced fishery yields</li> </ul>

### 2.1.2 CP Approaches to Minimization of sources of pollution from LBAs

UNIDO/EPA/GoG Cleaner Production demonstration project US/GHA/01/049 has been implemented in Ghana in 2002. The project focused on the reduction of industrial wastewater and solid waste generated and discharged in catchment of the most degraded wetlands in Ghana, namely Korle and Chemu II lagoons. The 16 participating companies comprised food processing (8), textile (3), metal working (3), and one each of paint, pharmaceutical and a paper processing operation. The assessments of the companies generated 297 CP opportunities aimed at reducing raw materials, water and energy consumption and thereby generate economic and environmental benefits through reduction in waste generation. The results of options identified depicted in Figure 1 included 13 % of reuse/recycling of waste

Fig. 1 –Results of EPA/UNIDO Cleaner Production Program in Industries located in Chemu Lagoon Catchment



The UNIDO/EPA/GoG CP project therefore strengthens the need of effective identification of the potential uses of waste generated in the production and consumption cycle. It also emphasizes the desire of Business for the appropriate transfer of environmentally sound technologies (ESTs) to maximize the recovery, reuse, and recycle of such potential secondary raw materials. These are otherwise discharged as waste that impact on the GCLME and human health. For instance, waste tuna blood identified under a CP project in a fish processing plant is presently being processed into an animal feed product for the pet industry with very high pay back on investment. This blood, which hitherto increased the BOD load, was being discharged into the Chemu wetland and ultimately to the GCLME,

In addition, the EPA of Ghana has embarked on CP opportunity and options identification and generation program with the private sector industries in its environmental permitting strategy implementation. The programs, which among others aims at developing, and disseminating best practice guidelines including environmentally sound technologies has began identifying potential tradable waste. For instance Ceiba wood waste, which currently cannot be used as industrial boiler charges for energy generation due high moisture content can potentially be used directly by small-scale farmers in mushroom production under the Ghana Poverty alleviation strategy initiatives. Alternatively, the wood waste can be dried by preheating to achieve the required moisture level using waste heat recovery technology. The industry assessment also indicates that industries through self-regulation and business approaches to waste management are beginning to engage research institutions to study and develop potential products from process waste recovery projects to prevent impacts of high BOD discharges on wetlands and ultimately GCLME.

Generally, CP approaches lead to implementation of on-site projects, particularly because demonstration projects are largely driven by multilateral funding and government subsidies and not entirely by economics. As a result mechanisms of dissemination to encourage uptake of viable CP results have been observed as constituting one of the barriers and indeed the weakest link in the promotion. Consequently, countries are beginning to develop other approaches to ensure effective knowledge transfer that can drive the uptake of CP projects and transfer of ESTs through private-public partnership programs. For instance, in Australia, the Business Sustainability Initiative of the Environmental Protection Authority, Victoria, has been introduced as a partnership program to repackage CP projects as bankable projects. This strategy is aimed at attracting private sector financing for proven economically viable, socially acceptable and environmentally sustainable CP projects, which is described as the Triple Bottom Line strategy.

### *2.1.3 CP/WSEMS approach to Integrated Pollution prevention, mitigation and control of GCLME pollution*

It is believed that the WSEMS approach aimed at developing and institutionalizing the needed communication strategy for information networking, when integrated in the UNIDO/UNEP cleaner production strategy, would facilitate the transfer of ESTs for waste reuse and recycling options identified through CP approach. An integrated CP/WSEMS approach is therefore anticipated to, inter alia:

- Create the awareness of markets and economic incentives for the transfer of ESTs for minimization of pollution from land based activities (LBA) and marine based activities;
- Develop information networks on clean technologies and waste minimization
- Reduce the production of wastes destined for final disposal, and to induce separation to facilitate waste recycling and reuse;
- Strengthen procedures for assessing waste quantity and composition for the purpose of formulating operational waste minimization policies utilizing economic instruments
- Institute integrated pollution prevention and control strategies and actions within the GCLME project participating countries.

## **2.2 Objectives**

The main objective of the project is to demonstrate the applicability of environmentally sound technology and approaches to minimize industrial waste discharge into the system to facilitate the control of the alarming rate of degradation of marine and coastal environment through industrial activities. The project thus aims at combining the beginning of pipe approach through CP and

WSEMS. The Cleaner Production programme would see to the reduction of waste from processing stage and the WSEMS concept would see to the recycling of tradable waste as raw materials for other industries, which can process them into useful products. The specific objectives of the project include:

- 1) To mainstream and apply cleaner production techniques and environmentally sound technologies in industrial production and institutionalize integrated pollution prevention and minimization strategy
- 2) to build and strengthen institutional capacity through technology transfer for prevention, minimization, and control of pollution on transboundary dimensions;
- 3) To strengthen and harmonize national and regional legal and regulatory framework for pollution reduction and control;
- 4) To carry out a feasibility study and an environmental impact study for the establishment of facilities for the reception of ship-generated waste in the seaports of the country and to also ratify and effectively implement and enforce the other relevant annexes to the Convention. This study will lead to the establishment of adequate reception facilities at the Tema port of Ghana;
- 5) To establish a waste oil recycling plant as a downstream process industry to facilitate the implementation of IMO projects for Port Reception facilities under MARPOL Convention and other related international agreements and protocols.
- 6) To establish a management information system on tradable waste through data collection, data storage/archiving , processing and access
- 7) To create awareness of tradable waste, markets, and available ESTs for effective recycle and recovery leading to reduction in waste generation.
- 7) To replicate the expected success results in the other GCLME participating countries.



### 2.3 Socio-economic benefits of project to the 16 GCLME countries

The main expectations of this project for the countries along the Gulf of Guinea are the socio-economic benefits listed below:

- The project will minimize pollution of water bodies and consequently the GCLME due to waste pollution from both land based and marine based sources;
- The project will provide cleaner environment and consequently minimize health hazards in the sub-region;
- The project will facilitate the restoration of the health and productivity of the marine and coastal environment and thus lead to the resuscitation of aquatic life;
- The project will boost the nations' energy requirements in the wake of growing demand for thermal power plants;
- Rate of deforestation will be minimized when industries like ceramics, brick & tiles, lime etc. which employ firewood for heating their furnaces revert to the use of briquette from wood sawdust;
- Direct and indirect employment shall be created for the youth in the sub-region to improve their conditions of living and reduce crime wave;
- The economic viability of the project to the nations shall be evident in the savings in foreign exchange for the importation of crude oil, gypsum, lime products, activated carbon etc.

### 3.0 PROJECT COMPONENTS/ ACTIVITIES AND EXPECTED RESULTS

The activities to be undertaken in the CP/WSEMS innovative approach would focus on increasing sustainable industrial productivity and minimizing discharge of industrial waste during industrial operations/production process. Some activities to be implemented include life cycle analyses (LCA) EMS, ISO 14001, eco-design and eco-labelling, CP Policy advice, CP and assessment of ESTs for waste recycle and recovery, and enterprise environmental performance measuring and reporting

#### 3.1 Project Components/Activities

The main components of the project include:

##### *3.1.1 Integration of Cleaner Production into Industrial Environmental Management.*

- ❖ Setting up of cleaner production unit
- ❖ Identification and selection of Industries to be used as case studies based on specific criteria established before hand.
- ❖ Conduct of sector-specific in-plant assessments on selected industries/companies and introduction of EMS in industries.
- ❖ Elaboration of Cleaner Production Manuals.
- ❖ Conduct awareness raising/outreach programme for sensitization of industries.
- ❖ Compile an annual report on cleaner production activities.
- ❖ CP technology and investment promotion.

### 3.1.2 *Strengthening of Institutional Capacities, Policies and Legal Frameworks for control of Industrial pollution*

- National and regional training workshops on CP, EST, and WSEMS and Policy and Legal Framework
- Sensitization programmes
- Environmental assessment and cost benefit analysis
- Training in life cycle analysis, EMS and ISO14001.

### 3.1.3 *Establishment of Waste Stock Exchange Management System*

- Communication Strategy
- Waste exchange management information system
- Identification and quantification of tradable waste
- Development of a web site.
- Conduct EMP/EIA

### 3.1.4 *Establishment of adequate port reception facilities*

- Fact finding mission for collection of data and information with a view to preparing a national profile regarding status of ratification/implementation/enforcement of the MARPOL convention and its annexes by IMO;
- A national workshop culminating in a report, which will include proposals for national follow-up activities on the country profile
- The production of a feasibility Report and environmental impact document for the establishment of port reception facilities in Ghana. The Report will be expected to contain the following information:
  - The necessity for reception facilities according to Annexes I, II, and V of the Convention
  - Assessment of waste stream types and quantities to be handled by the reception facilities
  - Existing possibilities to receive waste
  - Selection of the best technical option for port reception and treatment facilities
  - Required additional measures for environmentally acceptable processing and treatment of the received waste
  - Appropriate investment and operating costs
  - A planning period for the design/engineering and construction phases
  - Environmental impact assessment (including primary sampling of pollution sources and testing, environment analyses, etc).

### 3.1.5 *Establishment of a Waste Oil Treatment Plant*

- Sourcing and installation of plant/machinery and equipment to process waste oil into fuel and lubricants
- Dissemination of the project approach and results to the other 15 GCLME project participating countries
- Replicate the integrated WSEMS and CP approach in the other 15 countries.

### 3.2 Project Activities and Expected Outcome

The project activities to be undertaken and expected outcome are summarized as follows.

#### 3.2.1 *Project Activities to be undertaken under each component*

##### *(a) Pre-workshop activities:*

The major objectives of the workshop are to bring together all stakeholders to make inputs, build awareness, review and adopt the programme.

Activities towards the organization of the stakeholders' workshop shall involve Identification of existing and potential stakeholders in the supply chain of the 18 tradable wastes already identified in the pilot phase. This would consist of the waste generators, the potential users, and the regulatory agencies in waste management and environment protection, indigenous technology providers, researchers and the private investment capital market. Others are information dissemination to the identified stakeholders to participate in the workshop, preparation of workshop handouts, drawing of programme and selection of paper presenters, and preparations of venue and other relevant logistics to receive participants.

##### *(b) Integration of Cleaner Production into Industrial Environmental Management*

A Cleaner Production Unit shall be set up to integrate the C.P. approach into industrial processing. Industries shall be selected, based on their criteria and areas of operation, to be used as case studies. The activities shall also cover awareness creation and dissemination of information on C.P. technology within the industry sector to facilitate investment promotion and private sector participation.

##### *(c.) Strengthening of Institutional Capacities, Policies and Legal Frameworks for control of Industrial pollution*

National and Regional workshops shall be organized on the applications of the two environmentally sound technologies, namely C.P and WSEMS as well as Policies and Legal Framework. Institutional capacities on environmental assessment and cost benefit analysis, life cycle analysis, EMS and ISO14001.

##### *(d) The Pilot Demonstration Project—Waste Oil Treatment Plant*

The initial pilot demonstration project shall involve the setting up of waste oil treatment plant in Tema. The technical feasibility and financial viability of both marine-based and land-based activities have already been established through research and feasibility studies. The business plan for the project is enclosed.

A plant with capacity to treat 80,000-tons/annum waste oil is being proposed. The total investment cost for this project is estimated at US\$6.84 million, to be financed by GEF grant, private sector and Government of Ghana equity and a private sector loan. Detailed financial analysis is presented as Annexes F.1 to F.7 and Annex E

ALPHA FILTRATION LTD. has been selected, among other equipment suppliers, to supply and install the plant/machinery and equipment on turnkey basis and provide the relevant environmentally sound technology for the treatment of waste oil. The type of technology to be

adopted here is thermal distillation, which is proven and sustainable environmentally sound technology. The company's experience covers over 14 years work in Germany, France, Sweden, U.K. and Ghana.

*(e) Development and establishment of Waste Stock Exchange Management System*

The demonstration project activities shall be built on the experience of the pilot phase with the tradable wastes. The activities would therefore include identification of additional stakeholders in the supply chains, the update of the data on quantities of the eighteen tradable wastes, identification of potential users, study of the economic and financial feasibility of identifiable recovery, recycling and reuse technologies for six out of the 18 tradable wastes. These activities shall lead to the setting up of the waste stock exchange project, creation of linkages between waste generators and end-users, establishment of supporting industries and implementation, evaluation and monitoring of the entire project.

*The specific activities shall include:*

i) Communication Strategy for Waste Stock Exchange Awareness Creation

The consultants shall organize stakeholders' forum (workshops, seminars) to disseminate the findings to facilitate the functioning and autonomy of the Waste Stock Exchange as well as creating environmental awareness of market and economic incentives for land based pollution prevention and control. The land based sources activities that shall be used for the development of the WSEMS in addition to the land-based sources of oil include the following:

- Establishment of briquette press in Takoradi.

Activities under this heading include the purchase of plant/machinery and equipment and installation of one briquette press in Takoradi to process 20, 000-tons/annum sawdust.

- Lime waste recovery and re-use.

Implementation of recommendations from previous feasibility studies on lime waste recovery and re-use. Linkages between lime waste producers and industries that employ lime, as raw materials, e.g. paint industries, water treatment plants, and pharmaceutical industries, shall be establishment.

- *Gypsum recovery and re-use.*

Activities under this heading shall involve the implementation of recommendations from previous studies on gypsum waste recovery and re-use.

- *Activated carbon manufacturing plant*

Procurement of plant/machinery and equipment and installation of activated carbon manufacturing plant in Tema to utilize waste carbon anodes from aluminium smelting operations for the manufacture of activated carbon.

- *Waste plastic recycling*

Design and implementation of mechanisms to collect and recycle plastic wastes according to the findings from the previous feasibility studies.

(f) Coordination, Monitoring, Evaluation and Management

After the successful implementation of the entire pilot demonstration project in Ghana in the first 3 project years, the consultants shall continue to coordinate, evaluate, monitor and manage the operations of all the various aspects and sections of the project. Project consultants shall continue to supervise the operations of the entire establishment until it attains self sustainability by the end of project year 3.

### 3.2.2 Expected Outcome

Table 3.1 below presents the summary of activities in project year 1 and expected outcome.

Activity	Duration (months)	Expected results
Pre-workshop activities	2	40 participants from representative industries and organizations invited; workshop venue and handouts prepared
Integration of Cleaner Production into Industrial Production.	4	Cleaner production programme integrated in 24 industries in Ghana. Industrial wastes reduced by 25% on the average in these industries.
Strengthening institutional capacities, policies and legal frameworks for control of industrial pollution.	6	Two national and one regional workshops organized to train 80 national and 24 regional stakeholders and create awareness on C.P. and WSEMS applications.
Development and establishment of WSEMS.	2	56 industries visited and 20 wastes identified and quantified. MIS web-site installed.
Set-up and implementation of Waste oil treatment plant.	6	80,000 tons/annum waste oil treatment plant installed and commissioned.

#### 4.0 INSTITUTIONAL ARRANGEMENT

The project shall be implemented as a government-public-private sector partnership program involving the Government of Ghana, relevant public sector institutions, a private sector consulting firm (MAMSCO Management Consortium), private sector waste oil recovery and treatment technology supplier (Alfa Filtration), multilateral funding from UNEP as leverage for private sector financier. The relevant letters of interest from the technology supplier and the invest financing company is attached (Ref. Annex ..Letters of Interest). The roles of the principal stakeholders under the project are defined as follows:

##### 4.1 Government of Ghana

The ownership of the Project rest with the Government of the Republic of Ghana. The Ministry of Environment and Science is the Sector Ministry in charge of the Project. The GCLME Country Director is the Chief Director of the Ministry of Environment and Science.

Under the Project the Government's Responsibilities will include:

- The official acquisition of an appropriate site at the Tema Harbour to serve as the receptacle for the waste from sea-going vessels.
- Firm commitment from Government to the Project in the form of Statement from sector Minister etc
- Promulgation of Legislative Instrument to compel all sea-going vessels (in-coming, Ghana Navy vessels) as mandated by the MARPOL and the Abidjan Convention.

##### 4.2. UNIDO

UNIDO remains the executing Agency of the GCLME Project, while UNEP acts as the implementing Agency under the GCLME

##### 4.3 MAMSCO Management Consortium

MAMSCO, a private organization is the initial Developer of the Waste Stock Exchange Management System concept and under the present arrangement will be the Principal partner to the Government of Ghana. MAMSCO will appoint its own partners in consultation with the Ministry of Environment and Science

##### 4.4 Project Management - Formation of Steering Committee

The project requires appropriate management structures. At the National level, authority for project implementation will be with a Project Steering Committee that will consist of the project focal point (MES) representative, eligible donors (UNIDO/GEF) (as observers) and representative from identifiable stakeholders and Civil Society organizations. The Steering Committee will be chaired by the National Project Director and will oversee the implementation of the entire project.

#### 5.0 STAKEHOLDERS INVOLVEMENT PLAN.

The extent of stakeholder participation in the project is a measure of its success or its failure. Consultants shall involve as much as possible every industry that generates tradable waste. Participants in the impending workshop shall include, Policy Makers, Beneficiaries, Journalists, etc.

Stakeholders will include:

- ◆ Industries that generate tradable wastes, i.e. wastes that can be employed by other industries as raw materials;
- ◆ Industries that can employ these wastes as raw materials;
- ◆ Ashanti Goldfields Company;
- ◆ Textile Association of Ghana;
- ◆ Cargo Haulage and Transport companies;
- ◆ Thermal power plants;
- ◆ Clay roofing tile industries;
- ◆ Lime industries;
- ◆ Ceramic industries;
- ◆ GRATIS;
- ◆ GIMPA;
- ◆ WORLD VISION INTERNATIONAL;
- ◆ EMPRETEC;
- ◆ Ghana Export Promotion Council (GEPC);
- ◆ Ghana Investment Promotion Centre (GIPC);
- ◆ CSIR-WRI;
- ◆ Ghana Ports and Harbour Authority (GPHA);
- ◆ Geological Survey Department (GSD);
- ◆ Accra Metropolitan Assembly (AMA);
- ◆ Environmental Protection Agency (EPA);
- ◆ Department of Fisheries;
- ◆ Ghana Tourist Board (GTB);
- ◆ Centre for African Wetlands;
- ◆ Water Resources Commission;
- ◆ Conservation International;
- ◆ Forest Services Division;
- ◆ Volta Basin Project;
- ◆ The Government of Ghana, through the Ministry of environment and Science (MES);
- ◆ Ministry of Finance;
- ◆ Ministry for Private Sector Development;
- ◆ Ministry of Trade and Industry (MOTI);
- ◆ Ministry of Energy;
- ◆ Ministry of Mines;
- ◆ Financial Organizations;
- ◆ Consultants, Researchers and Technology providers;
- ◆ United Nations Industrial Development Organization (UNIDO); and
- ◆ MAMSCO.

A national inception workshop has been organized to discuss the Ghana Demonstration project. The Workshop adopted the project under the GCLME project.



## 9.0 REPLICABILITY, SUSTAINABILITY, RISKS AND UNCERTAINTIES OF THE PROJECT.

Waste Stock Exchange is altogether a new concept in Ghana and the entire sub-region. Stakeholders are not very familiar with the concept and until such time that participating industries understand and accept the concept, the revenue base will not be solid enough to make the project sustainable.

In the cases of the processing industries, i.e. the waste oil treatment plant and the briquette press, previous feasibility studies have established their viability and sustainability right from project year 1. The WSEMS set-up will however depend on fees and honorarium from participating industries, consultancy services on environmental management and training of personnel, preparation of EMPs and EIAs etc. for its revenue. This revenue base can be made solid by a government legislation enforcing participation of all industries that generate waste.

The programme shall be replicated in all the countries in the sub-region, which generate tradable industrial wastes. This shall be the outcome of the workshop being organized for consultants from the other 15 countries in the sub-region.

The project stands a great risk if stakeholders are not well educated or informed about the advantages in the form of economic gains to the industry, socio-economic desirability and clean environment. In order to achieve this, a team of consultants shall visit factories and industrial set-ups to create awareness on the dangers of continued pollution of our coastal waters and lagoons in order to convince them to participate in the impending workshop for stakeholders.

A major threat to the project is when donor agencies shall fail to support the project for the three year period when, it is supposed, the project shall be self-sustainable.

To summarize, the project's sustainability lies in linking as many industries as possible to trade in waste in order to increase its revenue base, a government legislation to enforce all industries that generate waste to participate in this exercise and the continued support by donor agencies until it attains self-sustainability

**6. Reduction of nutrient discharges: Togo**

MINISTERE DE L'ENVIRONNEMENT  
ET DES RESSOURCES FORESTIERES  
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REPUBLIQUE TOGOLAISE  
Travail-Liberté-Patrie  
-----

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PROGRAMME DES NATIONS UNIES POUR LE DÉVELOPPEMENT  
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PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT  
-----

ORGANISATION DES NATIONS UNIES POUR LE DÉVELOPPEMENT INDUSTRIEL  
-----

FONDS POUR L'ENVIRONNEMENT MONDIAL  
-----

**PROJET GRAND ECOSYSTEME MARIN  
DU COURANT DE GUINEE**  
-----

**« LUTTE CONTRE LA DEGRADATION DES ZONES COTIERES ET LA REDUCTION DES  
RESSOURCES VIVANTES DANS LE GRAND ECOSYSTEME MARIN  
DU COURANT DE GUINEE, PAR DES ACTIONS REGIONALES »**  
-----

**LUTTE CONTRE LA POLLUTION DE LA MER PAR LES BOUES  
DE PHOSPHATES PAR APPLICATION DE LA MÉTHODE  
DE DECANTATION ET IDENTIFICATION  
D'UNE STRATEGIE DE GESTION DURABLE**

***Projet de Démonstration - TOGO***

**Juin 2003**

## **LISTE DES ABRÉVIATIONS**

ADT :	Analyse Diagnostique Transfrontalière
CC/PNAE :	Cellule de Coordination du Plan National d'Action pour l'Environnement
CGILE :	Gestion Intégrée du Littoral et de l'Environnement
DE :	Direction de l'Environnement
IFG :	International Fertilizer Group
MERF :	Ministère de l'Environnement et des Ressources Forestières
ONG :	Organisation Non Gouvernementale
ONUDI :	Organisation des Nations Unies pour le Développement Industriel
PAS :	Programme d'Action Stratégique
SIG :	Système d'Information Géographique

## 1 – Contexte et justification

Le Togo est situé au centre du géosystème marin et côtier animé par le courant de Guinée, avec une étroite ouverture de 50 km de long entre les frontières du Ghana à l'ouest et du Bénin à l'est. Son espace maritime s'étire jusqu'à la limite des 200 miles ; la partie littorale (terrestre), sous influence des masses d'air maritimes et de la marée, s'apparente à la Région Maritime (fig.1).

**Fig.1 – Région Maritime du Togo**



La Région Maritime est la plus peuplée du Togo avec près de 45% de la population totale vivant sur 10% de la superficie. En 2002, la population de cette région se situait à environ 2 040 000 habitants. La projection montre qu'en 2008, la population de la Région sera de 2 600 000 habitants (MERF/ONUDI, 1999 Profil du littoral). Le milieu naturel avec ses multiples composantes biophysiques, subit une forte pression anthropique résultant principalement de l'urbanisation accélérée de la capitale Lomé, des activités industrielles et des infrastructures portuaires et aéroportuaires.

La Région Maritime concentre en effet plus de 90% des unités industrielles (extractives, agro-alimentaires, manufacturières) du pays au nombre desquelles l'International Fertilizer Group (IFG) Industry qui produit des phosphates. La production de phosphate est passée de 1,2 million de tonnes en 2001 à 2,5 millions de tonnes en 2002. Les gisements de phosphate et de calcaire sont les plus importants gisements de la zone. Ils se trouvent dans une stratigraphie du bassin sédimentaire côtier.

Les phosphates sédimentaires sont généralement accompagnés de métaux lourds tels que le Cd, Cr, Cu, Ni, Pb, V, Sr, Zn, Zr, U et de terres rares (Slansky 1980, Altschuler 1980, Piper 1991) qui sont en relation avec les nombreuses substitutions ioniques isomorphiques dans la structure du minéral principal des phosphates qu'est la francolite, une carbonate fluorapatite (Nathan 1984).

L'exploitation des phosphates par l'International Fertilizer Group (IFG) industry, constitue l'essentiel des activités minières. Ces activités sont à l'origine des bouleversements de l'écologie et du paysage avec l'apparition de grands problèmes environnementaux qui sont observés. Il s'agit essentiellement de la pollution de l'air et de la pollution de l'océan Atlantique.

Le cadre juridique national de gestion de l'environnement marin et côtier du pays est constitué par la loi n°88-14 du 3 novembre 1988 instituant code de l'environnement et d'autres textes notamment les codes miniers et des hydrocarbures. Ce cadre est complété par les conventions relatives au milieu marin auxquelles le Togo est partie, notamment, la Convention des Nations Unies sur le Droit de la Mer et la Convention d'Abidjan sur la mer régionale en Afrique de l'Ouest et du Centre.

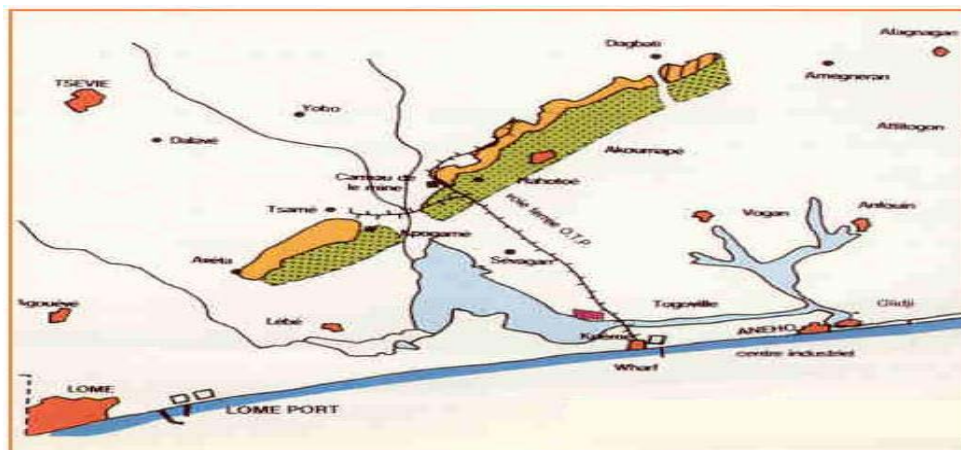
Ce cadre sert de fondement à l'adhésion du Togo à la politique globale et régionale visant à rechercher et mettre en œuvre des solutions pour répondre aux préoccupations environnementales nationales et régionales en matière de préservation et de mise en valeur du milieu marin et des zones côtières et notamment au projet intitulé " *Lutte contre la dégradation des zones côtières et la réduction des ressources vivantes dans le grand écosystème marin du courant de Guinée, par des actions régionales*".

L'ensemble des pays participants travailleront sur des activités conjointes régionales relatives :

- à la gestion durable des ressources halieutiques industrielles,
- à la productivité et à la capacité du grand écosystème du courant de Guinée d'abriter des ressources vivantes ;
- au système régional intégré de gestion des données et de l'information comme outil d'aide à la prise de décision.

En plus, le Togo a le privilège d'exécuter avec cinq autre pays le projet intitulé « *Lutte contre la pollution de la mer par les boues de phosphates par application de la méthode de décantation et identification d'une stratégie de gestion durable* ». Ces boues résultent du traitement du minerai de phosphate par l'Office Togolais des Phosphates dont l'IFG –Togo a pris la succession et poursuit l'exploitation.

L'exploitation se fait à ciel ouvert dans les secteurs de Hahotoé et de Kpogamé. Le minerai est traité dans l'usine de Kpémé, situé sur la côte (Blivi, 1993), à 30 km environ des sites d'exploitation (fig.2).



**Fig.2 – Sites d'extraction et du traitement des phosphates**

Le minerai de phosphate est lavé à l'eau de mer et rincé à l'eau douce à l'usine. Il résulte de ce traitement deux types de déchets miniers faisant à peu près 40 % du minerai brut : des déchets solides constitués de particules grossières et des déchets liquides boueux riches en particules fines dont le volume est de 2,5 millions de tonnes par an. Ces derniers sont déversés directement dans les eaux côtières sans aucun traitement (fig.3).



**Fig.3 : Déversement des déchets phosphatés liquides**

Ces rejets en mer entraînent une pollution visuelle qui se traduit par un panache marin de couleur jaune remarquable dans les eaux côtières du Togo, du Bénin voir du Nigeria dans une frange de 500 m sur une distance d'environ 250 km.

C'est dans cette frange que s'exercent les activités de pêche artisanale. Cette pollution a progressivement contribué à réduire la productivité et la reproduction des ressources biologiques marines et compromis les activités économiques liées à l'exploitation desdites ressources et dans une certaine mesure l'exploitation touristique des plages de la zone affectée en particulier.

***Les résultats de quelques études de recherche révèlent que l'exploitation et le traitement des phosphates représentent une des causes principales de la pollution visuelle de la mer avec le panache de couleur jaune le long des côtes togolaises et béninoises.***

Un audit environnemental de l'Office Togolais des Phosphates<sup>9</sup>, réalisé en 1997, révèle que très peu de données sont disponibles et qu'aucune étude du milieu marin relative aux effets de la décharge dans l'océan n'a été entreprise. L'audit recommande par conséquent de réaliser des études avant toute solution sur le problème de la décharge.

Cet audit fait remarquer que les impacts manifestes sur le milieu marin de ce panache sont à priori et en l'absence de toutes études spécifiques: (i) la turbidité de l'eau avec les solides en suspension, (ii) les dépôts de sédiments au fond de l'océan, (iii) la contamination possibles de l'eau, (iv) la mort des espèces de faune aquatique. Ces effets peuvent donner lieu à des impacts secondaires tels que : (i) les modifications des habitats et des écosystèmes, entraînant des changements au sein de la diversité de faune et de flore marine (ii) la diminution de la productivité des écosystèmes affectés, (iii) la modification de la chaîne alimentaire et des pêcheries, (iv) la contamination et les dommages importants des ressources biologiques dans la zone affectée. Des études sont donc nécessaires pour définir une stratégie appropriée.

En attendant, le déversement en mer demeure encore le mode actuel d'élimination des déchets de boues et au vue de ce qui précède, cela peut représenter un danger pour la santé humaine et la viabilité écologique de l'écosystème marin du Grand Courant de Guinée.

## **2.- Objectifs**

<sup>9</sup> Komex (Cyprus) Ltd « Audit environnemental de l'Office Togolais des Phosphates (OTP) réalisé pour Paribas, Novembre 1997 avant-projet

L'objectif général du projet est de lutter contre la pollution marine par les activités terrestres en vue de la conservation de la diversité biologique, l'amélioration de la qualité de l'eau et de l'environnement marin du Grand Courant de Guinée. Les objectifs spécifiques qui en découlent sont à :

1. maîtriser les données sur le milieu marin dans le périmètre affecté ;
2. évaluer les impacts environnementaux et sociaux des rejets de déchets de boues de phosphates sur les ressources vivantes et les écosystèmes marins ;
3. tester la méthode de décantation pour réduire la pollution de l'océan par les rejets de déchets bruts des boues de phosphates ;
4. définir une solution appropriée pour réduire ou supprimer durablement la pollution marine par les rejets de déchets bruts des boues de phosphates.

Les activités du projet permettront de trouver des stratégies durable de prévention de la pollution marine par les boues de phosphates.

### **3. Activités**

Les activités du projet sont présentées dans le tableau ci-après. Leur identification et réalisation visent à réaliser les objectifs spécifiques susmentionnés.

La maîtrise des données sur le milieu marin affecté est nécessaire pour connaître la situation de référence du milieu marin et assurer le suivi de l'évolution des différents paramètres.

L'évaluation des impacts environnementaux et sociaux résultants des rejets de boues de phosphates va permettre d'identifier les conséquences de la décharge sur le milieu marin et les populations affectées. En plus de cette évaluation dans la zone affectée par la décharge, des travaux seront menées dans la zone non affectée pour identifier les autres formes de pollutions résultants des activités terrestres et qui compromettent la santé de l'écosystème du milieu.

L'application de la méthode de décantation sera expérimentée avec le bassin de 300m<sup>3</sup> existant

Enfin une stratégie appropriée sera élaborée pour réduire et/ou supprimer durablement la pollution marine par les rejets de déchets bruts des boues de phosphates.

Objectif général	Objectifs spécifiques	Activités	Résultats attendus
<i>Productivity patterns in the Guinea Current LME</i> <b>0- Finalisation du cadre de gestion du projet</b>		<b>0.1.</b> Achever la mise en place du cadre institutionnel du projet	Cadre institutionnel projet mis en place ; 31
		<b>0.2.</b> Organiser un atelier de lancement	Atelier de lancement organisé
	<b>1. Constituer et gérer une base de données sur le milieu marin dans le périmètre affecté</b>	<b>1.1.</b> Déterminer et délimiter la zone affectée et les éléments susceptibles d'être affectés par les boues de phosphates	Zone affectée et éléments susceptibles d'être affectés déterminés et délimités ;
		<b>1.2.</b> Faire l'état des lieux sur la zone affectée en s'appuyant sur une synthèse des rares références scientifiques et techniques existantes	Etat des lieux sur la zone affectée connu
		<b>1.3.</b> Traiter et gérer les données recueillies	Données de la zone recueillies, traitées et gérées
	<b>2..Evaluer les impacts environnementaux et sociaux des rejets de déchets de boues de phosphates sur les ressources vivantes et les écosystèmes marins</b>	<b>2.1.</b> Réaliser des études pour préciser la nature et l'étendue des impacts de la décharge sur les ressources vivantes et les écosystèmes marins, les activités économiques et les populations	Etudes sur la nature et l'étendue des impacts réalisées
		<b>2.2.</b> Organiser des concertations et consultations avec les populations cibles sur les conclusions des études et les mesures à mettre en œuvre	Concertations et consultations avec les populations cibles organisées
		<b>2.3 .</b> Ateliers de renforcement des capacités en matière d'évaluation des impacts et de suivi de l'évolution du milieu marin	Ateliers de renforcement de capacités organisés et rapports rédigés ;
	<b>3. Tester la méthode de décantation pour réduire la pollution de l'océan par les rejets de déchets bruts des boues de phosphates</b>	<b>3.1.</b> Procéder à la connexion au bassin des tuyaux d'arrivée et de retour des effluents et à l'installation des moteurs à pompes et autres équipements	Tuyaux d'arrivée et de retour connectés au bassin ;
		<b>3.2.</b> Etude des différentes options et alternatives pour la disposition des sédiments résultant de la décantation;	. Etude des options et alternatives pour la disposition des sédiments réalisée ;
		<b>3.3..</b> Identifier après examens les types de produits à utiliser pour la floculation en fonction de leur efficacité et des risques qu'il présentent pour la santé humaine et l'environnement	Types de produits à utiliser pour la floculation identifiés
		<b>3.4.</b> Mise en fonction et exploitation du bassin de décantation.	Bassin de décantation mis en fonction et exploité ;
		<b>3.5.</b> Renforcer les capacités des laboratoires en équipements d'analyses	Capacités des laboratoires renforcées en équipements d'analyses ;
		<b>3.6.</b> Procéder à des analyses des prélèvements effectués en laboratoire.	Analyses des prélèvements en laboratoires faites ;
		<b>3.7.</b> Evacuer vers la mer, les effluents liquides décantés	. Effluents liquides décantés évacués vers la mer
		<b>3.8.</b> Curer les effluents solides et assurer leur transport et disposition en fonction des résultats de l'activité 3.3.	Effluents solides curés et transportés ;
		<b>4.1.</b> Procéder à une évaluation des résultats de la méthode de décantation mise en œuvre et les comparer aux autres alternatives envisageables	. Résultats de la méthode de décantation et de comparaison évalués et menés ; 31
		<b>4.2.</b> Développer une étude sur une stratégie de gestion des boues de phosphates	Etude sur la stratégie et plan d'action élaborés



#### **4– Participation des parties prenantes et arrangements institutionnels**

##### ***4.1. Participation des parties prenantes associées***

Les parties prenantes concernées et intéressées par les activités du projet et la préservation du milieu marin seront impliquées dans l'exécution du projet suivant les formes appropriées à la prise en compte de leurs intérêts.

La participation des institutions publiques, du secteur privé avec l'IFG-Togo en priorité des ONG opérant dans la zone sur le littoral, des associations et groupements de pêcheurs et des autorités locales et autres entités de la société civile reste fondamentale pour l'orientation du projet et ses activités.

##### ***4.2. Arrangements institutionnels***

Le projet sera exécuté sous la supervision d'un comité de coordination interministériel élargi à d'autres institutions non publiques, axé sur le Comité Permanent de la Commission Interministérielle de l'Environnement en fonction des préoccupations du projet.

Un comité de pilotage rassemblera les experts nationaux, les institutions nationales compétentes. Il regroupera les représentants des institutions et structures suivantes : Ministère chargé de l'Environnement (Cabinet, Direction de l'Environnement et Cellule de Coordination du Plan National d'Action pour l'Environnement) ; le Ministère chargé de l'Agriculture, de l'Elevage et de la Pêche ; le Ministère chargé de la Santé ; le Ministère chargé de l'Assainissement ; le Ministère du Tourisme et des Loisirs ; le Ministère de l'Habitat et de l'Urbanisme ; l'Université de Lomé ; l'IFG-Togo, le Centre de Gestion Intégrée du Littoral et de l'Environnement (CGILE), la préfecture des Lacs, les ONG intervenant dans le milieu, les Collectivités et communautés de base ; les autorités locales .

La Direction Nationale du projet sera assurée par le Ministère chargé de l'Environnement à travers la Direction de l'Environnement qui représente le pays au Comité de Direction du projet sous-régional.

La Coordination Technique sera assurée par le Centre de Gestion Intégrée du Littoral et de l'Environnement (CGILE) pour des raisons d'efficacité et de continuité comme au niveau de certains des 5 autres pays ayant des projets de démonstration. L'équipe de la Coordination Technique sera renforcée.

Un comité technique et scientifique et des sous comités scientifiques et techniques seront mis en place pour les activités techniques chaque fois que de besoin.

## 5.- CADRE LOGIQUE

Objectifs spécifiques	Indicateur	Source de vérification	Hypothèses
<b>Objectif général : Lutter contre la pollution marine par les activités terrestres en vue de la conservation de diversité biologique, l'amélioration de la qualité de l'eau et de l'environnement marin du Grand Courant de Guinée</b>	<ul style="list-style-type: none"> <li>- <i>Données sur la zones affectée et les impacts des rejets identifiés et maîtrisés</i></li> <li>- <i>Réduction de la quantité de déchets de boues de phosphates rejetées en mer</i></li> <li>- <i>Turbidité de l'eau réduite au minimum</i></li> <li>- <i>Stratégie de gestion durable des déchets de boues de phosphates définie</i></li> </ul>	<ul style="list-style-type: none"> <li>- <i>Bassin existant aménagé pour les tests de décantation</i></li> <li>- <i>Résultats des études disponibles</i></li> </ul>	<ul style="list-style-type: none"> <li>- <i>Contributions financières acquises au projet ;</i></li> <li>- <i>renforcement des capacités réalisé</i></li> <li>- <i>importance éventuelle d'autres rejets sous-estimés</i></li> </ul>
1. Maîtriser les données sur le milieu marin dans le périmètre affecté	<ul style="list-style-type: none"> <li>-.Cadre institutionnel mis en place ;</li> <li>-.Atelier de lancement organisé ;</li> <li>- Travaux de délimitation réalisés;</li> <li>-.Etat des lieux sur la zone affectée connu ;</li> <li>-.Données recueillies de la zone affectée traitées et gérées ;</li> </ul>	<ul style="list-style-type: none"> <li>- Rapport d'étude et résultats des données collectées disponibles</li> <li>- Données traitées disponibles</li> </ul>	Délimitation du périmètre affecté et disponibilité de ressources financières et techniques.
2. Evaluer les impacts environnementaux et sociaux des rejets de déchets de boues de phosphates sur les ressources vivantes et les écosystèmes marins	<ul style="list-style-type: none"> <li>- Etudes sur la nature et l'étendue des impacts réalisées ;</li> <li>-Concertations et consultations avec les populations organisées ;</li> <li>- Ateliers de renforcement des capacités en matière d'évaluation des impacts et de suivi de l'évolution du milieu marin organisés</li> </ul>	Rapport d'étude disponibles, Rapports des ateliers disponibles	<ul style="list-style-type: none"> <li>-Besoins en renforcement de capacités identifiés et disponibilité de ressources financières</li> <li>-Connaissances techniques requises et disponibilité de ressources financières</li> <li>- Bonne participation des populations cibles et autres parties prenantes</li> </ul>
3. Tester la méthode de décantation pour réduire la pollution de l'océan par les rejets de déchets bruts des boues de phosphates	<ul style="list-style-type: none"> <li>-.Tuyaux d'arrivée et de retour connectés au bassin ;</li> <li>- Etude sur les options et alternatives réalisée ;</li> <li>-. Types de produits pour la floculation connus ;</li> <li>-. Essaies de décantation réalisés</li> <li>-. Laboratoires renforcés en équipements d'analyses ;</li> <li>-. Résultats d'analyses des prélèvements effectués</li> <li>-. Effluents liquides décantés évacués vers la mer ;</li> </ul>	<ul style="list-style-type: none"> <li>-Rapports d'étude et d'analyse disponibles</li> <li>-Résultats des décantations disponibles</li> <li>-Laboratoires d'analyse équipés</li> <li>-Bassin vidé des effluents</li> </ul>	<ul style="list-style-type: none"> <li>-Bassin de décantation existant est affecté aux travaux ;</li> <li>-Bon fonctionnement du bassin de décantation</li> <li>-collaboration étroite de l'IFG avec l'équipe du projet</li> <li>- une des options en étude par l'IFG-</li> </ul>

	- Bassin curé après décantation		Togo
4. Définir une solution appropriée pour réduire ou supprimer durablement la pollution marine par les rejets de déchets bruts des boues de phosphates	<ul style="list-style-type: none"> <li>- Résultats de la méthode de décantation évalués</li> <li>- Etude sur la stratégie et plan d'action de gestion des boues réalisée ;</li> <li>- Document sur la stratégie et plan d'action analysé et validé ;</li> <li>- Système de suivi de l'évolution de la zone développé ;</li> <li>- Rapport de fin de projet rédigé ;</li> </ul>	<ul style="list-style-type: none"> <li>Résultats de l'étude disponibles</li> <li>Résultats de la méthode de décantation disponibles</li> <li>Rapport sur le système de suivi disponible</li> <li>Rapport du projet disponible</li> </ul>	<ul style="list-style-type: none"> <li>-Disponibilité des résultats de la méthode de décantation</li> <li>- connaissance de l'expérience d'autres pays</li> <li>- Document de stratégie et plan d'action disponibles.</li> </ul>

## 8 – Risques et durabilité du projet

Le projet de démonstration du Togo s'attelle à répondre à des préoccupations à moyen et long termes de qualité environnementale dans le Grand Courant de Guinée et résoudre un problème de pollution transfrontières.

Les orientations et stratégies de la politique nationale de l'environnement et du Plan National d'Action pour l'Environnement vont dans le sens d'une meilleure prise en compte des préoccupations environnementales dans les activités de développement. L'application des dispositions des articles 34 et 35 relatifs aux déchets et les articles 44, 45, 47, 48, 49 et 50 de la loi N°88-14 du 3 novembre 1988 portant code de l'environnement qui sont relatifs aux rejets dans l'atmosphère, dans les eaux et dans les sols. devrait permettre d'assurer l'effectivité et la durabilité du projet en raison des obligations qui pèsent sur l'exploitant.

De plus le projet de démonstration s'inscrit dans le sous programme C du Programme National de Gestion de l'Environnement (PNGE) et dans l'action intitulée « *gestion durable des écosystèmes aquatiques marins et continentaux* » de son objectif 2 qui vise à rationaliser l'exploitation des ressources biologiques du littoral entre autres par :

- la réglementation des activités polluantes en vue de l'amélioration de la gestion environnementale des activités industrielles, commerciales, agricoles, portuaires, piscicoles, médicales, scientifiques et transports ;
- l'élaboration et la mise en œuvre d'une directive spécifique en matière de l'utilisation des ressources ;
- l'appui à la réalisation d'audits environnementaux des activités industrielles, commerciales et sanitaires ;
- l'appui à l'évaluation des audits et à la mise en œuvre des mesures d'atténuation identifiées par les audits ;
- l'aménagement concerté et la mise en valeur du milieu marin ;
- l'aménagement participatif des eaux à des fins de pêche durable avec la résolution des problèmes fonciers ;
- la reconstitution et la gestion rationnelles de la mangrove.

Le principal risque résulterait de l'insuffisance à court et moyen terme des engagements financiers de l'IFG-Togo pour le projet de démonstration relativement au calendrier du projet sous-régional. En effet, l'IFG-Togo procède depuis l'année 2002 à la réhabilitation des infrastructures et équipements d'exploitation tant au niveau de la mine que de l'usine et cela entraîne d'énormes investissements qui se poursuivent.

Toutefois, la réhabilitation en cours pourrait avoir des impacts favorables sur le process industriel de traitement du minerai .

## 9– Suivi, Evaluation et Dissémination

Les données de la zone affectées et les résultats des études seront versées dans un système d'information géographique (SIG) pour un contrôle facile de la stratégie de mise en œuvre du projet et un suivi périodique des activités sera établi. Pour permettre aux différents partenaires

d'être informés, les informations relatives à l'évolution du projet seront diffusées par les voies médiatiques appropriées.

Les résultats des différentes activités seront ventilés aux parties prenantes et aux pays voisins intéressés

La stratégie finale adoptée sera intégrée dans une stratégie plus globale de protection et de mise en valeur du milieu marin et des zones côtières.

Des rapports trimestriels seront élaborés dans le cadre de l'exécution du projet et communiqués aux différentes parties prenantes ;

Des rencontres périodiques seront organisées entre la direction du projet et l'IFG-Togo pour une bonne exécution des activités techniques

Un suivi-évaluation du projet se fera tous les six mois suivant des modalités qui seront définies dans le cadre de l'arrangement institutionnel établi.

■

## 10- Plan de travail

Objectifs spécifi- ques	Code des activi- tés	Mois																																		
		2004												2005										2006												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
Objectif 0	0.1																																			
	0.2.																																			
Objectif1	1.1																																			
	1.2																																			
	1.3																																			
Objectif 2	2.1																																			
	2.2																																			
	2.3																																			
Objectif 3	3.1																																			
	3.2																																			
	3.3																																			
	3.4																																			
	3.5																																			
	3.6																																			
	3.7.																																			
	3.8																																			
Objectif 4	4.1																																			
	4.2																																			
	4.3																																			
	4.4																																			
	4.5																																			



## **7. ICAM for Kribi-Limbe Lagoon: Cameroon**

### **PROJECT BRIEF**

#### **CAMEROON: INTEGRATED MANAGEMENT OF THE KRIBI-LIMBE COASTAL AREA**

*by*

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**Abuja 19 June 2003**



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**LIST OF ACRONYMS/ABBREVIATIONS**

ASC:	Annuaire Statistique du Cameroun
BOD :	Biological Oxygen Demand
CCC :	Complexe Chimique Camerounais
CDC:	Cameroon Development Corporation
CEP :	Compagnie Equatoriale de peinture
CICAM :	Compagnie Industrielle du Cameroun
CNIC :	Chantier Naval et Industriel du Cameroun
COD :	Chemical Oxygen Demand
DELMONTE:	Plantations de Bananeraie Del Monte
EEC:	Exclusive Economic Zone
FAO:	Food and Agricultural Organization of the United Nations
FERME SUISSE:	Plantations de la Ferme Suisse
GDP:	Gross Domestic Product
GEF:	Global Environmental Facility
GNP:	Gross National Product
GOG:	Gulf of Guinea
HEVECAM:	Société des Hévéas du Cameroun
ICAM:	Integrated Coastal Area Management
IC:	Incremental Cost
IDH:	Human Development Index
IOC:	Intergovernmental Oceanographic Commission of UNESCO
LME:	Large Marine Ecosystem
MINEF:	Ministry of Environment and Forestry
NGOs:	Non governmental Organizations
NSC:	National Steering Committee
NTC:	National Technical Coordinator
ODINAFRICA-II:	Ocean Data and Information Network for Africa, second Phase
PAMOL:	PAMOL Plantations Cameroon
PNVRA:	Programme National de Vulgarisation et de Recherche Agricole
PPER:	Project Performance Evaluation Report
PSU:	Parts Salinity Units
PTT :	Project Technical Team
SAFACAM :	Société Forestière et Agricole du Cameroun
SCDP :	Société Camerounaise de Dépôts Pétroliers
SIACC :	Société des Brasseries Isenbeck Cameroun
SMC :	Société de Minoteries du Cameroun
SPE:	Permanent Secretariat of the Environment
SOCAME:	Société Camerounaise des Engrais
SOCAPALM:	Société Camerounaise des Palmeraies
SONARA:	Société Nationale de Raffinage
STAP:	Scientific and Technical Advisory Panel of the GEF
UN:	United Nations
UNEP:	United Nations Environment Programme
UNESCO:	United Nations Education, Scientific and Cultural Organization of the United Nations
UNIDO:	United Nations Industrial Development Organisation
UNDP:	United Nations Development Programme
ZI:	Zone Industrielle

## BACKGROUND AND CONTEXT

### INTRODUCTION

1. The Republic of Cameroon is one of the Central African countries located at the centre of the Gulf of Guinea (GOG) Large Marine Ecosystem (LME) (Figure 1), within the Bay of Biafra. It has an area of 475, 412 km<sup>2</sup> with a population of approximately 15 millions inhabitants (year 2000 estimate). The coastal environment of Cameroon is opened to the Atlantic Ocean with a coastline of about 402km (Sayer et al., 1992). This coastline extends from 2°20' N at the Equatorial Guinea borders to 4°40' N at the Nigeria borders. It is located between Longitudes 8°15' E and 9° 30E (Figure 1)

2. The coastal zone here is defined as the area which extends from high tide mark up to 60 km into the hinterland and 200 nautical mile limits offshore. The continental limits are illustrated by a hypothetical line drawn from the north to the south which passes through: Mundemba, Muyuka, Dibombari, Edea and Nyambessan (Figure 1). This line passes through the national provinces of South-West, Littoral and South. The continental shelf is about 10.600km<sup>2</sup> with an Exclusive Economic zone (EEZ) of about 15,400km<sup>2</sup>. All aquatic ecosystems of this coastal plain of the Atlantic are covered within these limits, notably: ocean, coastal forests, deltas, sand dunes, mangroves, coastal rivers, estuaries, bays, lakes, beaches and muddy coasts. The total river basin drainage area is about  $2.7 \times 10^5$  km<sup>2</sup> with the Sanaga contributing the highest sediment load ( $2.8 \times 10^2$  km<sup>3</sup> / year).

3. The coastal and marine ecosystems of Cameroon and other GOG–LME's have in operation, several socio–economic activities such as fisheries, off and onshore oil exploitation, industrial, port and agricultural activities; sand and mineral resources exploitation. These anthropogenic characteristics exist in line with dynamics in natural features of the zone such as natural disasters, hydrodynamics, winds, ocean waves. These have resulted in very productive ecosystems when considered from a global perspective, with much prospects for socio-economic development.

4. This coastal environment and its resources are under much pressure from natural factors (impacts of eruption of the Cameroon Mountain with the most recent one on the 25<sup>th</sup> May 1999, impact of coastal erosion, etc), human and development activities. The best economic benefit from these and their sustainability depends on an excellent environmental quality and the control on production and diversity of the resources. These will entail that a high value be given to the food and other resources production, tourism with the benefits derived from these.

### COASTAL CLIMATE AND HYDROLOGY

5. The inter-tropical /equatorial climate (hot, moist and dry conditions) of Cameroon's coastal zone is made up of the Guinea, Cameroon and maritime types and distributed as follows:  
The Guinea type extends from Kribi in the South to the Southern plateau and has four seasons (two dry and two rainy seasons) in the year. Abundant rains (between 1500-2000mm) and generally high temperatures (over 25°C) characterize this zone.

Figure 1. Main characteristics of the Cameroon Coastal Zone (Folack, 2002).

The Cameroon type covers the South-Western coastal area near Mount Cameroon (4,070m high) extending to the mouth of the Sanaga River and characterized by 2 seasons (1 wet of about 8 months and 1 dry of 4 months). Maritime type comes from the south west monsoon winds which reach the sea facing slopes of Mount Cameroon peak at right angles, a contributing factor to Debundscha being the second wettest place in the world (about 10,000 – 12,000 mm rainfall per year). The high and constant temperatures typical of Mount Cameroon type climate is also evident in Buea which is marked by lower temperatures. Figure 2 illustrates precipitation changes in some coastal towns of Cameroon

6. Tides are semi diurnal with a maximum height of 2.7m and go as far as 40 km in the Wouri and 20km in the Mungo, Estuaries are usually subjected to the influence of the monsoon winds. Salinity around the Bay of Biafra are low (less than 25 psu) due to the dilution of continental waters by the dense river network and high rainfall. Water temperatures are generally more than 25°C. Several estuaries exist at rivers mouths

#### COASTAL HABITATS

7. Cameroon's coastal zone is characterized by diverse habitats such as the continental shelf, beaches, bays, mangroves / estuaries, lowland coastal forests.

The Cameroon continental shelf gradually descends from the coast through 10,30, 50 and 100 m depths. As a result, there is generally weak water circulation with subsequent high sedimentation rates (Angwe and Gabche 1977). Approximately 30% of Cameroon's coast is occupied by mangrove estuaries. Out of an approximately 350,000ha of mangrove/estuarine zone, that of the Cameroon estuary covers 60km of coastline, which extends from the Sanaga to the Bimbia river estuaries. This extends up to about 30km inland giving an approximate area of 180,000ha. The Rio-del Rey estuarine system covers a coastline of approximately 50km long and 30km inland, giving an approximate area of 100,000ha. These estuaries are productive entities in the sense that the mangrove forests are primary producers, but there are situations with topographic or morphological features that bring about interactions of a particular nature. They also serve as nutrients traps; allowing accumulation of very fine silt from river discharge and terrestrial runoff.

8. From Rio del Rey to Campo, the coast is oriented towards the South meridian with the hauls from South West sector, the transport of sediment is from South to north; the Rio-del-Rey area is low and occupied by muddy mangrove alternating with sand bars. At the level of Mount Cameroon, from Bamusso to Limbe, the coast is rocky. From Tiko to Kribi, the coast is low with muddy mangrove; this area is characterized by the Cameroon estuary with three rivers: Mungo, Wouri and Dibamba. At the kribi level, the coast is made up with rocky beaches alternating with sandy beaches

#### SOCIO - ECONOMIC SETTING

Table 1 gives general and socio-economic indicators for the Republic of Cameroon

TABLE 1. GENERAL AND SOCIO-ECONOMIC INDICATORS FOR CAMEROON

Indicateurs	Cameroun
Political capital	Yaoundé
Length of the coastal zone ( km)	402
Area of the continental shelf ( km <sup>2</sup> )	10600
Area of EEZ (km <sup>2</sup> )	15400
Country surface area (km <sup>2</sup> )	475,4
Population total (2000) x 10 <sup>6</sup>	15,8
Pop. Total estimated (2015) x 10 <sup>6</sup>	20,2
Growth rate (2000) (%)	2,77
Population density (hab./km <sup>2</sup> )	33
Urbanisation rate (%)	47
Live expectancy 1995-2000 (années)	50,0
Children mortality rate (‰)	75
Alphabetisation rate (%)	75,4
GDP (1998) (Million \$)	8701
GDP/inhabitant (2000) (\$)	1022
GDP/activity sector :	
• Agriculture	42.4
• Industry	21.6
• Services	35.9
Population without access to potable water in 2000 (%)	38
Poverty indicator (%)	30,7
Population with less than \$1/day (%)	64,4
Human Development Indicator (IDH) - 2000	0,512
Weight of the debt in 2000 (in% GDP)	6,3

*Sources : Atlas Mondial 2000 (programme Info.) ; Rapport Mondial sur le Développement Humain :*

*Approfondir la démocratie dans un monde fragmenté (PNUD, 2000)*

## Population

9. Cameroon is a highly urbanized country compared to other West and Central African countries. Many of the urban centers are located in the coastal zone which is also the site of 60% of the country's manufacturing industries. This zone presently supports approximately 20% of national population. This population has however, been increasing rapidly within the coastal zone cities when compared to the national rates (Table 2). The coastal zone covers three provinces: south, littoral and south west. The 1987 national census indicated an approximate 13% of national population within the coastal zone with an annual growth rate ranging between 2 and 6%. Approximately 70% of the national economic activities are based within the coastal zone. Consequently, this zone has relatively less employment opportunities in the primary sector and more within the secondary and tertiary sectors. This is why the urban population is about 84% in the coastal zone against 50% of the country in year 2000(table 2). In 1987, these figures were respectively 76 % and 38%.This rapid growth in population continues to place significant pressure on the coastal environment, resources and supporting infrastructure. The hotspots of population pressure are seen in the Limbe-Kribi area (Figure 2), notably within the municipalities of Limbe, Tiko, Douala, Edea and Kribi within which most industrial activities with much potentials for the nearest future are concentrated

**TABLE 2. CAMEROON'S COASTAL ZONE POPULATION (1987 CENSUS) AS COMPARED TO NATIONAL POPULATION; EVOLUTION OF NATIONAL AND COASTAL POPULATION.**

	Area	Popula- tion (1987) X1000	% rural	Population estimated in 2000x1000		Major coastal cities (more than 10.000 inhabitants in 1987)			
				Total	% Rural	Name	Popula- tion (1987)	Popula- tion (2000)	% Rural
Coastal zone	Southern area (South Province)	63	62.4	91.7	50	Kribi Akom II	40.737 18.291	63.972 22.175	35 91
	Central area (Littoral province)	954.8	8	1,781	5	Douala Edea Dizangue Dibombari	834.471 68.794 14.792 28.871	1.591.81 8 118.951 23.155 35.899	2 18 36 85
	Northern area (South West Province)	319.8	60.9	468.3	49	Limbe Buea Tiko Ekondo- Titi Mudemba Bamusso Muyuka	64.878 65.853 48.772 38.246 19.307 17.558 12.971	109.772 102.029 74.973 48.498 25.330 21.027 22.422	22 38 39 80 73 94 86
	Total coastal	1,337.6	24	2,341	16		1.273.44 1	2.260.02 1	
Total country		10,494	62	14,529	50				

**Socio – economic activities***Agriculture and livestock*

10. Cameroon's agricultural sector produce 30% of Gross Domestic production ( GDP), 70% of export revenues and employs three quarters of the labour force. Most agricultural practices (both small and large scale) are based within the coastal zone with crops such as cereals and tubers consumed locally and cash crops being exported. National production of some main cash crops such by various agro-industrial companies such as CDC, SOCAPALM, HEVECAM, FERME SUISSE, PAMOL, DELMONTE, SAFACAM, include rubber (10%), palm oil (29.8%), bananas (21.2%) and pineapples (31%) which show increase in production

11. Animal production provides approximately 36kg / year of protein to Cameroonians. In the coastal zone, there is a dominance of sheep and goats as well as poultry and pigs production. Hundreds of cattle are brought in from the Northern provinces for consumption in the coastal zone. One of the main slaughter houses in the coastal zone is located in the industrial city of Douala. Here, approximately 180 heads of cattle are slaughtered each day for 22 days of each

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month. Each head produces about 7 litres of blood and 30kg of stomach contents (Angwe and Gabche, 1997). A small proportion of the blood, about 5%, is used in the production of blood meal for livestock feed while the rest is pumped into the nearby tributary of the river Wouri. Which meets the sea west of Douala. The stomach contents are dumped at a site near the abattoir and are collected by the farmers for use as fertilizers.

### Fishing

12. Fishing activities within the coastal zone of Cameroon are made up of the artisanal and industrial fisheries. The artisanal fishing activities are carried out by approximately 24,000 maritime based fishermen (Folack and Njifonjou, 1995). The production trends for the last five years are indicated in table 3. Fish production comes from small pelagics such as *Sardinella* and *Ethmalosa*, *Tilapia* and small freshwater Clupeids. Industrial fisheries concern mainly the *sciaenidea* family and shrimps like *Penaeus notialis*.

TABLE 3: PRODUCTION TRENDS (IN TONS) IN THE MARITIME ARTISANAL AND INDUSTRIAL FISHERIES SECTOR

Fisheries products	Year of production				
	1995/1996	1996/1997	1997/1998	1998/1999	1999/2000
Marine industrial fisheries	9,829	7,999	8,364	7,117	8,737.5
❑ Fish	9,258	7,552	7,953	6,783	8,034
❑ Shrimp and molluscs	571	447	411	334	703.5
Marine artisanal fisheries	45,000	45,000	45,000	45,000	45,000
Total Production	54,829	52,999	53,364	52,117	53,737.5

### Port activities

13. The Douala maritime port forms the main port in the coastal zone, and Cameroon as a whole. It is the base of maritime traffic with a regular increase in the transportation of goods (Table 4). An increase is observed in imports with a decrease in volume of exports. This has resulted in the potentials of developing another port on one hand at the natural sea port of Limbe which was abandoned since pre-colonial days, and on the other hand in Kribi. Maritime transportation between African countries is very low with estimates being less than 10% of total transportation traffic for the past years.

TABLE 4. EVOLUTION OF GOODS TRANSPORTATION AT DOUALA SEA PORT

Totals	Unit of measure	1996	1997	1998	1999	2000
Vessels into/out of the port	Number	1157	1159	1154	1284	1215
Imported goods	Tons	2188023	2477512	2839700	990027	3210211
Exported goods	Tons	1967018	2347331	2280549	337899	2152689
Net	Tons	6043	5773	6342	7310	7267

### Tourism

14. Cameroon has a wide ethnic diversity, many landscapes ranging from equatorial forests to the Sudan type savannah, the central high plateau and highlands of the west and abundant wildlife. The coastal zone is attractive due to the many sandy beaches, waterfalls at Edea, Tiko creeks, Lake Osa



around Edea (plate 1), Kribi, Limbe and larval flows from volcanic Mount Cameroon (Plate 2). The impacts of land-based sources of solid wastes on Cameroon's beaches and others from tourism activities are of much concern.

**15. Intense tourism activities take place at tourist sites such as the white sandy beaches in the Kribi region, the Lobe waterfalls, the “rocher de loup”, the Mount Cameroon, Limbe Botanic Garden, Limbe Zoological Garden, Mile Six Beach (Limbe), Seme Beach the mangrove creeks and Lake Osa (Plate 1) in the Dizangue area near Edea and the larval flow at Bakingili (Limbe) (plate 2). ). An economic operator has recently developed an omnisports and games complex –Kajih Sports Academy on the banks of the river Mungo. This are provides various attractions for different classes of people and the various activities have an effect on the environment. Apart from Douala, Limbe and Kribi which attract tourists, coastal tourism remains a minor activity and is little organized. It is essentially a crude form of tourism which unfolds during holidays (Limbe, Kribi) or business trips (Douala, Limbe). Along the Cameroon coast, there are classified hotels and inns, with about 1.600 rooms and 2.615 beds (1996). This potential is concentrated in Douala, Kribi and Limbe, and is less than the current demand, a situation which is preoccupying during peak periods. Natural constraints which militate against coastal tourism in Cameroon are:**

- (a) Limited sunshine and relatively short dry season.
- (b) Frequent accidents amongst swimmers, due to south westerly wind and currents.
- (c) Poor organization characterized by chaotic estate development with no respect for the coastal state domain.

All tourism-related projects must take these problems into account, to ensure a sustainable development of the coastal domain.



Plate 1. Lac Osa, located at Dizangue , near Edea is an attractive tourism site



## Plate 2. Tourism at the lava flow in Bakingili

**Industrial activities**

16. Manufacturing industries in Cameroon account for 21.6% of the country's GNP (Atlas Mondial 2000). Those in the coastal zone cover 60% of national production and can be classified as follows;

- ❑ **Food manufacturing and beverage** - includes breweries, cocoa processing, chocolate production, palm oil processing, flour processing, and slaughterhouse
- ❑ **Textile industry** - includes spinning, weaving, finishing, bleaching, dyeing and printing of textiles
- ❑ **Chemical Industry** - production of soap, rubber, plastic materials, paints, inks, perfume
- ❑ **Petroleum and petroleum products** - crude oil, refining and blending of lube oils **Metal industry** - Aluminium smelter, Aluminium rolling, foundries and metal works, ferrous and non-ferrous metal processing
- ❑ **Wood processing industry** - logging, saw mills and furniture;

17. The immediate consequences of industrial concentration around this region is an increase in population which accentuates the problem of managing wastes from human activities as well as that from these industries.(table 5) This solid waste management poses a serious health hazard to nearby population . Solid waste has been known to block drainage systems resulting in floods and an increase in water related diseases.

18. Sewage collection and disposal is poorly organized and most often wastes are discharged into drains directly. High levels suspended solids, BOD and COD are indicative of potential hazard to the people living in the area.

TABLE 5. LOCATIONS FOR SOME SELECTED INDUSTRIES IN THE KRIBI-LIMBE AREA

No	Name industry	Location	Waste generated	Type
1	Brasseries du Cameroun	Bali/Z.I Bassa	Liquid/Solid	Brewery
2	Guinness Cameroon	Z.I Bassa	Liquid/Solid	Beverage/Brewery
3	SIACC Brasserie	Z.I Bojongo/B'beri	Liquid/Solids	Brewery
4	Fermencam	Z.I Bonaberi	Liquid/Solids	Spirits/Wines
5	Camlait	Z.I Bassa	Liquid	Dairy
6	C.D.C Mondoni	Mondoni	Liquid/solid	Palm oil
7	C.D.C Idenau	Idenau	Liquid/solid	Palm oil
8	Maya et Cie	Z.I Bonaberi	Liquid	Refined Palm oil
9	Nosuca	Z.I Bonaberi	Liquid/solid	sugar
10	Pamol Lobe	Lobe	Liquid/solid	Palm oil
11	Pamol Ndian	Ndian	Liquid/Solid	Palm oil
12	Socapalm	Dibombari	Liquid/Solid	Palm oil
13	Chococam	Z.I Bassa	Liquid	Chocolate
14	Sic-Cacao	Z.I Bassa	Liquid/solid	Cocoa
15	Sodepa	Z.I Ndobob/B'beri	Liquid	Slaughtering
16	S.M C	Z.I Bassa	Solid	Flour

17	Cicam	Z.I Bassa	Liquid	Textile
18	Sicabo	Z.I Bassa	Liquid/Solid	Textile
20	C.E.P	Z.I Bassa	Liquid	Paint
21	C.C.C	Z.I Bassa	Liquid	Detergent
22	Korescam	Z.I Bonaberi	Liquid/Solid	Printing
23	Metrop.Plastics	Z.I Ombe	Liquid/Solid	Plastics
24	Parfumerie Gandour	Z.I Bonaberi	Liquid	Fragrance
25	Socaver	Z.I Bassa	Solid	Glass
26	Sopicam	Z.I Bonaberi	Liquid/Solid	Pesticides
27	C.D.C Rubber	Tiko	Liquid	Rubber
28	Unalor	Z.I Bassa	Liquid/Solid	Matches
29	Cimencam	Z.I Bonaberi	Solid	Cement
30	Sonara	Limbe	Liquid/Solid	Crude oil refining
31	S.C.D.P	Bonaberi	Gas	Gas storage
33	S.C.D.P	Bessengue/Deido	Liquid	Refined product storage
34	C.N.I.C	Ports area	Liquid/Solid	Shipyards
35	Alucam	Edea	Liquid/Solid	Aluminium
36	Alubassa	Edea	Liquid/solid	Aluminium
37	Steelcam Rollform	Likomba-Tiko	Solid	Metal
38	Alpicam	Z.I Bonaberi	Solid	Wood Processing

19. Oil poses a problem of persistence and bioaccumulation in the environment. For this reason particular attention will be given to the oil industry in this area. Activities in the oil industry from upstream to downstream include; exploration, drilling, production, storage, transportation through pipelines and by tankers. Additionally, there is infrastructure for platform construction as well as maintenance and repairs, platform revamping, and dry-dock. There are three crude oil offshore production sites namely; Kole terminal, Moudi terminal and the Ebome terminal. There is one refinery, SO.NA.RA at Limbe (Plate 3) and there are three main depots sites at Douala (Bessengue, Bonaberi and the port). Recently TOTAL FINA, ELF constructed a lube oil recycling plant at the port area. It is also worth mentioning here that the Cameroon Industrial and shipyard is situated at the port area and undertakes ship repairs as well as dry-docking. There are plans to create a shipyard at the Limbe ports area. This project is aimed at creating facilities to cater for various heavy mobile equipment that would ordinarily pose draft problems if they had to be maintained at the Douala base. Alongside is probably going to be a petroleum storage depot, result of a joint venture with an independent operator with whom negotiations are on going.

20. The Chad Cameroon pipeline of 1070km long is under construction and starts at Doba in the Republic of Chad and has a terminal at Kribi (Plate 4) where there will be a floating vessel. The above therefore represent potential sources of environmental degradation if mitigating measures are not taken now.



Plate 3. National Refinery Company (SONARA) located in Limbe



Plate 4. Construction work at the Kribi terminal of the Cameroon - Chad pipeline project. 10

## COMMON PROBLEMS OF THE COASTAL ZONE

21. Most problems existing within Cameroon's coastal zone are cited in Annex D1 and their causal chain analysis in Annex D2. In fact, key environmental issues along the Kribi - Limbe coastal area include pollution (solid waste and land-based and offshore activities), physical degradation (coastal erosion), flooding, unsustainable exploitation of fisheries and other aquatic resources, threats to coastal zone diversity, conflicts among users, conflicts of competency amongst government's departments etc.

## RATIONALE AND OBJECTIVES

### RATIONALE

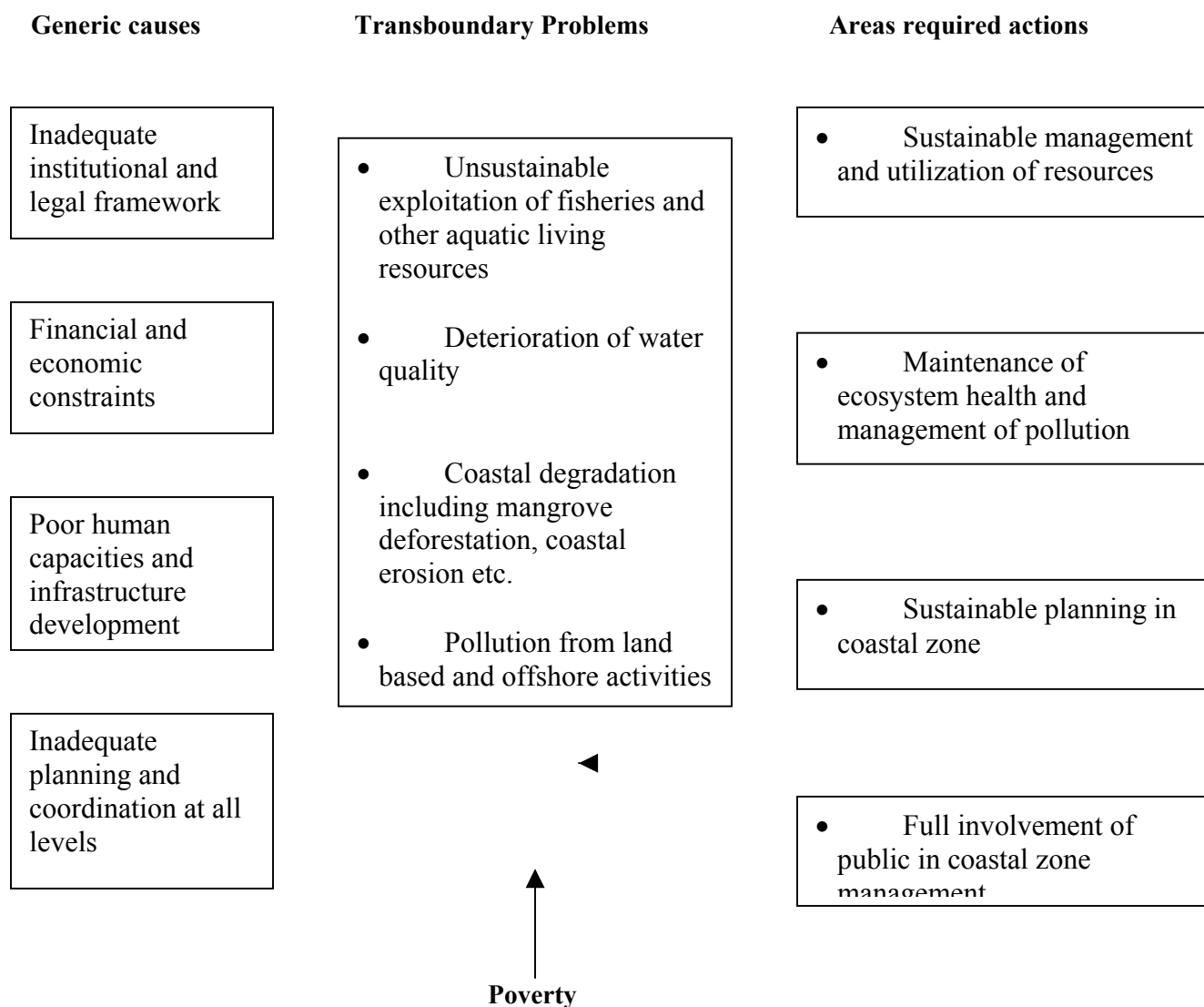
22. Generally coastal areas are governed by the interaction between land and sea, and are characterized by high productivity and biodiversity. Urbanization of coastal areas and utilization of resources eventually lead to the degradation of the coastal environment – the Kribi-Limbe coastal area of Cameroon is no exception.

23. The coastal zone is the industrial nerve centre of the country, as it is the location of almost 80% of the country's industries (Angwe and Gabche, 1997) Douala, the economic capital and main seaport, is located within this zone. More than 95 % of coastal industries are located in the Kribi-Limbe area. Because of the nature and variety of economic activities, it has become the fastest developing area in Cameroon, attracting more and more people from other parts of the country. This zone is therefore a highly urbanised area with major population centres at Douala, Buea, Tiko, Edea, Limbe, Kribi, Muyuka, etc. These seven towns located in the Kribi-Limbe area, represent 95% of the total population of the coastal zone (Table 2). This increased urban population has resulted in many land based activities, such as agriculture, efforts to meet up with their daily needs and strategies to cope with these increases, which are often and industrially difficult to manage. Maritime activities are substantial in this zone e.g. transportation, offshore prospecting and drilling, port activities at Douala etc. Huge agro-industrial companies involved in large scale cultivation of cash crops are based in the Kribi-Limbe zone. Some of which include CDC, DELMONTE, HEVECAM, SOCAPALM, PAMOL, SAFACAM, FERME SUISSE, SPNP, SBM etc. These companies cultivate a variety of crops including oil palm, rubber, bananas, tea etc.

24. A good number of industries have developed in the Kribi-Limbe area (Table 5). These are mainly Food processing, chemical, textile, metallic, and petroleum industries. Cameroon's sole oil refinery, SONARA, is located at Cape Limboh near Limbe. The refinery is at the centre of a variety of activities in the oil sector, which together with many touristic activities (many pleasure beaches and tourist hotels abound), contribute considerably to the dynamism and vitality of the coastal zone. The much publicised Chad-Cameroon oil pipeline will pass through this Area en route to the pressure release station and finally to the offshore terminal in the Kribi area.

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25. These activities produce complex waste discharges and emissions that lead to environmental degradation. The most commonly cited problems related to the management of the Kribi-Limbe coastal area are in line with the main issues of the Transboundary Diagnostic Analysis (TDA) identified in the regional project document and which the description of root causes and Causal Chain Analysis are given in annex D. Major environmental issues and areas required actions are given below:



**26. The Cameroonian Authorities are aware of the effectiveness of Integrated Coastal Areas Management "as a dynamic system in which a co-ordinated strategy is developed in order to assign environmental, socio-cultural and institutional resources with the objective of reaching conservation and multiple and sustained use of coastal areas" and are anxious to apply this principle to the Kribi-Limbe Area which was highlighted in the National Profile of Cameroon as needing urgent intervention of this nature.**

## OBJECTIVES

### Overall objective

27. **To conserve and promote sustainable use of existing resources within the Kribi-Limbe Coastal Area of Cameroon for improvement of the quality of the environment and of the life of the population**

### Specific objectives

Major Components	Objectives
<i>I. Governance, institution and capacity building</i>	1. Establish a management and coordination unit of the project
	2. Reinforce legal and institutional framework for women and youth empowerment
	3. Promote an efficient and effective cooperation, partnership and inter-division collaboration between the state, the private sector and civil society
	4. Develop environmental education programme for strengthening school-based environmental education and short term or computer-based
	5. Strengthen existing capacities and increase the local capacity for carrying out management and training in the Kribi-Limbe coastal area
<i>II. Pollution control and waste management</i>	6. Implement pollution control and waste management measures in order to minimise discharges into coastal ecosystems
	7. Reduce adverse impact of pollution on coastal ecosystems and their ability to support beneficial human uses
<i>III. Coastal planning and development</i>	8. Plan and manage coastal development to minimize risk and natural hazards
	9. Alleviate coastal poverty through proactive initiatives that generate sustainable livelihood options
	10. Preserve, protect or promote historical and cultural resources and activities of the coast
	11. Develop a long term programme for the sustainable management of the coastal zone and its resources
<i>V. Data and information management</i>	12. Develop existing data and information network and management system through capacity building, improved infrastructure, and institutional management

### PROJECT OUTCOMES

28. Cameroon hopes through this project to:

- i) Create of new regulations and set up coordination mechanisms among the different sectors involved in the use of the coastal area
- ii) Generate mechanisms to resolve conflicts,
- iii) Provide adequate scientific and technical information for decision making
- iv) Establish simple and realistic policies for education and public participation
- v) Provide a vantage platform for Cameroon and by applicability other participating countries to test the effectiveness of the ICAM concept
- vi) Verify the veracity of the provisions of the draft National Integrated Coastal Areas Management Plan formulated by the country through a nation wide consultative process during the Pilot Phase of GOG-LME project
- vii) Place the Area on a solid footing to sustainable development

- viii) Reduce poverty and improve livelihoods of the population.

## **PROJECT ACTIVITIES / COMPONENTS AND EXPECTED RESULTS**

The project will be carried out in two demonstrative sites: Limbe and Kribi with the following major issues:

- I. Governance, institution and capacity building
- II. Pollution control and waste management
- III. Coastal planning and management
- IV. Coastal resource management
- V. Data and information management

Detail on project activities/components and expected results are giving in table 6



TABLE 6. PROJECT ACTIVITIES / COMPONENTS AND EXPECTED RESULTS

Major Issues	Components	Activities	Expected results
Governance, institution and capacity building	1. Establish a management and coordination unit of the project	1.1 Determine the institutional and human resources profile 1.2. Recruitment of project personnel 1.3. Set up the project office	<input type="checkbox"/> Collaborating institutions and project personnel identified <input type="checkbox"/> Project personnel recruited <input type="checkbox"/> Functional project office established
	2. Reinforce legal and institutional framework for women and youth empowerment	2.1. Inventory of existing laws and regulation 2.2. Examination of existing laws and regulation 2.3. Application of dispositions concerning women and youth empowerment during project execution	<input type="checkbox"/> Directory of laws and regulations available <input type="checkbox"/> Legal dispositions on women and youth empowerment identified <input type="checkbox"/> Effective implication of women and youths in project activities
	3. Promote an efficient and effective cooperation, partnership and inter-division collaboration between the state, the private sector and civil society	3.1. Put in place an adequate and efficient coordination structure 3.2. Promote partnership between state, private sector and civil society 3.3. Promote good governance with regards to coastal issues	<input type="checkbox"/> Adequate structure for coordination is established <input type="checkbox"/> More active participation by public, private sector and civil society is achieved <input type="checkbox"/> Good governance is effective
	4. Promote public awareness, and develop environmental education programme for strengthening school-based and computer based education of coastal managers and other stakeholders using participatory approach	4.1. Develop and implement a public coastal awareness programme 4.2. Development and implementation of media programme 4.3. Promote public relations among managers and stakeholders	<input type="checkbox"/> public awareness programme on coastal issues is effective <input type="checkbox"/> Effective media programme <input type="checkbox"/> Effective interaction among managers and stakeholders

	5. Strengthen existing capacities and increase the local capacity for carrying out management programme and training in the Kribi-Limbe coastal area	5.1 Inventory of existing capacities 5.2. Organise ICAM stakeholder workshops 5.3. Develop and implement training programmes for managers and other stakeholders	<input type="checkbox"/> Inventory of existing capacities established <input type="checkbox"/> ICAM stakeholder workshops organised <input type="checkbox"/> Managers and stakeholders trained  14
Pollution control and waste management	6. Implement pollution control and waste management measures in order to minimise discharge into coastal ecosystems	6.1 Establish a beach pollution monitoring programme 6.2. Establish a control and penalty system (polluter payer principle) 6.3 Update where available and produce where absent oil spill contingency plans in accordance with IMO regulations 6.4. Assure analysis of the water quality 6.5. Reinforce capacities of existing laboratories	<input type="checkbox"/> Level of coastal pollution minimized <input type="checkbox"/> Polluters prosecuted as an inhibitory measure <input type="checkbox"/> Oil spill contingency plans are updated and effective <input type="checkbox"/> Report of analysis <input type="checkbox"/> Laboratories are operational
	7. Reduce adverse impact of pollution on coastal ecosystems and their ability to support beneficial human uses	7.1. Provide public dust bin and establish an efficient beach waste collection 7.2. Institute a regular monitoring programme for industrial effluents. 7.3. Provision and or encouragement of public toilets, and other beach public facilities.	<input type="checkbox"/> Cleaner pleasure beaches available to the public <input type="checkbox"/> Quality of industrial effluents improved <input type="checkbox"/> Good hygiene maintained in coastal areas

Coastal planning and development	8. Plan and manage coastal development to minimize risks and natural hazards	8.1. Inventory of coastal settlements 8.2. Inventory and mapping of hot spots for risk and natural hazards 8.3. Set up an emergency plan for risk and hazards management 8.4. Monitor the activities of logging and deforestation for farming to determine impact on coastal water and on natural hazards	<input type="checkbox"/> Coastal settlements identified <input type="checkbox"/> Hot hazard spots identified and mapped <input type="checkbox"/> An effective emergency plan exist
	9. Alleviate coastal poverty through proactive initiatives that generate sustainable livelihood options	9.1 Identify development opportunities that seek to eliminate coastal poverty 9.2. Promote meaningful and sustainable livelihood options	<input type="checkbox"/> Coastal poverty alleviated <input type="checkbox"/> Sustainable livelihoods improved.
Coastal resources management	10. Preserve, protect or promote historical and cultural resources and activities of the coast	10.1 Inventory of historical and cultural resources and activities 10.2 Establish and execute a rehabilitation programme	<input type="checkbox"/> Historical and cultural resources and activities identified <input type="checkbox"/> rehabilitation programme established
	11. Develop a long term programme for the sustainable management of the coastal resources	11.1 Identify coastal resources of significant economic value 11.2 Apply ICAM approach for coastal resources management	<input type="checkbox"/> Coastal resources of significant economic value identified Effective ICAM put in place
Data and Information Management	12. Develop existing data and information network and management system through capacity building, improved infrastructure, and institutional management	12.1. Inventory of existing information systems in the government and other agencies 12.2. Set up infrastructure for the data and information management centre and national network 12.3 Capacity building for the data and information management centre	<input type="checkbox"/> Information systems are identified <input type="checkbox"/> Data and information management centre operational <input type="checkbox"/> Capacity building for data and information centre is effective <input type="checkbox"/> Network established

## **RISKS AND SUSTAINABILITY**

### **RISKS**

29. Some preliminary information on ICAM is available from the former GOG-LME project carried out by UNIDO/UNEP. Further consultation with Government and stakeholders are needed to determine the specific coastal areas and activities that should be the focus of this project. Industries and other operators in the coastal zone should be willing to make available relevant data and information on management and operations. Otherwise, this might delay project implementations.

30. There should also be a strong political will from Government if the project is to be successfully implemented. For instance, during project implementation, if Government authorities fail to endorse certain project activities for one reason or another project implementation would be adversely affected. The risk of this occurring, however is low,

### **SUSTAINABILITY**

31. The following elements of the project will contribute to make it sustainable beyond the end of the project:

- The project will promote increased awareness and commitment at political and decision making levels regarding coastal management issues affecting different stakeholders.
- The information base, tools and models for management decision-making will be substantially increased
- The project will enhance existing cooperation between stakeholder institutions
- The project will emphasize and strengthen capacity building.
- Above all, the project could provide lessons that could be adapted to other countries of the Guinean current region. These will be documented and made available.

## **STAKEHOLDERS PARTICIPATION AND IMPLEMENTATION ARRANGEMENTS:**

32. The major stakeholders in this project are:

- National Government departments responsible for Fisheries, Marine Affairs, Tourism Environment, Mines Waters and Energy.
- National marine research institutions and coastal universities.
- National fisheries management and development organizations
- Non-governmental organizations involved in marine and coastal resource issues in the Cameroon coastal zone
- Parastatal companies and industries (including the oil refinery) whose activities may affect the coastal zone.
- Fishermen and other coastal users
- Coastal population
- Analytical Laboratories

33. Concerning implementation arrangement, strategies decisions need to be made as to which instruments will be used to implement the project. These choices are inspired by the various project objectives and may depend on whether the precondition exists for the

effective use of particular instruments. Some or all of the following instruments could be used to implement the project.

- i) The project will have a National Steering Committee (NSC) chaired by the Ministry of Environment and Forestry: members could be government institutions involved in coastal zone management, NGOs, industrial fishing companies and artisanal fishermen, representatives of main coastal industries and laboratories, independents consultants, representatives of the local population, etc.
- ii) The project will be coordinated by a National Technical Coordinator (NTC). For efficiency and effectiveness of the project implementation, the NTC should be proposed by the government for recruited by UNIDO; the project will be hosted by the Research Station for Fisheries and Oceanography and will be co-managed by the Permanent Secretary of the Environment (SPE) of MINEF and the NTC.
- iii) Existing legislation and regulations: these are prescriptive and carry a penalty for non-compliance (e.g. permits; prohibitions; allocation of user rights etc).
- iv) Direct development: proactive actions and construction of physical structures (e.g. shoreline protection works; public access points; public facilities at beaches etc).
- v) Education and training: this helps to increase awareness and build capacity for project implementation. Also encourages participation in initiatives and compliance with regulations. It promotes communication and information exchange.
- vi) Research and monitoring: This helps to track problems and identify solutions. Provides reliable scientific data and information on the basis of which decisions may be taken to improve the quality of the marine and coastal environment.

## 8. Low-cost protection from coastal erosion: Cote d'Ivoire

### PROJET DU GRAND ECOSYSTEME MARIN DU COURANT DE GUINEE

GC-LME / ONUDI

#### *APPLICATION DE TECHNOLOGIES A FAIBLES COÛTS POUR LA LUTTE CONTRE L'EROSION COTIERE CAS DU LITTORAL D'ASSINIE EN CÔTE D'IVOIRE*



Par

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## **List of Acronyms/Abbreviations**

<b>FEM</b>	Fonds Mondial pour l'Environnement
<b>ONUDI</b>	Organisation des Nations Unies pour le Développement Industriel
<b>GC-LME</b>	Grand écosystème marin du Courant de Guinée
<b>UNESCO</b>	Organisation des Nations Unies pour l'Education ; la Science et la Culture
<b>GTZ</b>	Cooperation Allemande
<b>WWF</b>	Fonds Mondial pour la Nature
<b>S.I.G</b>	Système d'Information Géographique
<b>ONG</b>	Organisation Non Gouvernementale
<b>COI</b>	Commission Océanographique Intergouvernementale
<b>FAO</b>	Organisation des Nations Unies pour l'Alimentation et l'Agriculture
<b>IUCN</b>	Union Internationale pour la Conservation de la Nature
<b>PNUD</b>	Programme des Nations Unies pour le Développement

## 1. Contexte

L'érosion côtière a pris des proportions catastrophiques dans la plupart des pays d'Afrique de l'Ouest. Elle a été reconnue dans la Déclaration Ministérielle d'Accra, comme un problème transfrontalier urgent à résoudre avec des moyens technologiques simples et peu coûteux.

L'érosion des côtes cause de sérieux problèmes parce qu'elle détruit les installations côtières, les infrastructures touristiques, réduit les aires agricoles et de loisir, détruit les structures portuaires, de navigation et autres infrastructures économiques. Elle détériore les régimes hydrodynamiques (particulièrement hydrochimique et hydrobiologique) dans les zones côtières. Ce qui se traduit par la réduction des organismes benthiques, l'accroissement de la turbidité, la transparence de l'eau, etc., tout ceci a un impact négatif sur la disponibilité des ressources vivantes.

Etant donné que les cas graves d'érosion sont liés à des sites précis, l'on a tendance à voir l'érosion comme un problème national. C'est une erreur, surtout pour la région du projet, où les sédiments du transit littoral naturel sont charriés par les courants côtiers associés au Courant de Guinée. Ceci pour dire que toute action humaine tendant à interrompre ce flot de sédiments déclenchera une érosion en aval.

Intervenir pour contrer l'érosion suppose une bonne appréciation des facteurs en jeu, de la géomorphologie de la côte, du type de remaniement, des sources de sédiments, de leur parcours et de leurs quantités sur une certaine période, etc.

L'évaluation menée lors de la phase pilote a révélé que la Côte d'Ivoire est un cas typique de la nature transfrontalière de l'érosion côtière. Les structures portuaires perpendiculaires au trait de côte et le changement d'orientation de la ligne de côte depuis la frontière Libérienne produisent un déficit de sédiments qui accentue l'érosion côtière vers l'Est jusqu'au Ghana. Cette érosion est également due à :

- à la construction de barrages hydroélectriques sur les fleuves Comoé, Bandama et Sassandra.
- à l'endiguement des fleuves et l'exploitation de leurs alluvions, réduisant les apports solides vers les milieux lagunaires et marins;
- à l'exploitation du sable de plage qui accentue les effets dus au départ naturel du sable par la dérive littorale;
- et à un niveau moindre, l'élévation du niveau de la mer.

En Côte d'Ivoire, les portions de côtes les plus menacées se retrouvent à Grand-Lahou, à Abidjan (baie de Port-Bouët), à Grand-Bassam et à Assinie. Les vitesses de l'érosion avoisinent 1 m/an en moyenne. Les effets de cette érosion sont plus préoccupants dans la région d'Abidjan à cause des intérêts socio-économiques mis en jeu.

Ce projet de démonstration envisage des technologies simples et peu coûteuses pour la protection des côtes d'Assinie, qui tiennent compte évidemment des mesures d'accompagnement à caractère administratif, institutionnel et légal.

La nature transposable de ce projet lui confère une très grande priorité, non seulement pour la Côte d'Ivoire, mais au-delà, pour les pays de la région voire tous les pays côtiers en voie de développement.



## **2. Objectifs**

L'objectif général de ce projet est la protection et la restauration durable du littoral et de ses ressources y compris la diversité biologique.

Les objectifs spécifiques sont:

- 2.A. Installation de structures de protection adaptées à cette zone ;
- 2.B. Identifier des options pour atténuer les impacts négatifs actuels ou potentiels des activités humaines ou industrielles ;
- 2.C. Développer des modèles à partir des facteurs principaux qui affectent la stabilité de la côte pour sa protection.
- 2.D. inciter au renforcement des capacités locales

## **3. Activités du projet et résultats attendus**

Afin d'atteindre ces objectifs, les activités suivantes sont à entreprendre:

- 3.A.1. Réaliser une étude d'impact environnementale ;
- 3.A.2 Développer des bases de données pour le suivi et la gestion des aires adjacentes ;
- 3.A.3 Identifier les facteurs majeurs (naturel et humain, et écologique) agissant sur la côte ;
- 3.A.4 Recueillir des données sur les indicateurs hydrologiques et géologiques
- 3.A.5 Réaliser des structures de protection afin de restaurer les aires dégradées;
  
- 3.B.1 Faire l'inventaire des activités menées sur le site
- 3.B.2 proposer aux acteurs économiques des options idoines d'occupation du sol
- 3.B.3 Renforcer et impliquer les acteurs
- 3.B.4.Elaborer des programmes de recherches pour réduire l'impact des activités précitées sur la dégradation de l'environnement côtier
- 3.B.5 Proposer, sur la base des critères du développement durable, des solutions pour l'utilisation des ressources, la conduite des activités, la préservation des habitats et des aires à protégées;
  
- 3.C.1.développer un système de base de données et de surveillance
- 3.C.2.mettre un place un S.I.G.
- 3.C.3.Procéder à l'échange d'information au niveau régional
  
- 3.D.1.Renforcer et veiller à l'application des lois et règlements en vigueur
- 3.D.2.Encourager l'éducation, la sensibilisation, l'information des populations riveraines;
- 3.D.3.Encourager l'éducation, la formation, la sensibilisation, et l'information des populations riveraines;

## **4. Risques et Durabilité du Projet**

Les risques seront minimisés par le fait que les fonds du projet seront disponibles pour la gestion, la sensibilisation des populations et la participation des communautés locales dans la mise en œuvre des solutions de protection envisagées.

L'érosion côtière constitue une préoccupation majeure pour l'état de Côte d'Ivoire. Cette préoccupation est contenue dans le livre blanc sur l'environnement, par conséquent l'appui du gouvernement ivoirien est certain. Par ailleurs, la Côte d'Ivoire est signataire de la déclaration d'Accra qui a montré l'engagement des états à résoudre les problèmes environnement dans un cadre concerté.

Il existe sur le plan local, une expertise technique avérée au plan gouvernemental, au niveau des institutions académiques, des instituts de Recherche et des ONG à mesure de conduire un programme de protection du milieu côtier.

En Côte d'Ivoire plusieurs lois existent pour la protection de l'habitat. Trois reformes administratives majeures, en l'occurrence le Plan de Développement Foncier et Rural (Loi 98-750 du 23 décembre 1998), la Réforme Forestière (Décret n° 95-682 du 6 septembre 1995) et le Code Foncier ont été instaurés pour la gestion et la protection des terres.

La poursuite des activités après la fin du projet dépend des capacités économiques du pays liée elles mêmes à l'environnement économique mondial.

## **5. Participation des parties prenantes et modalités de mise en oeuvre**

Le projet impliquera aussi bien les structures du Gouvernement, que les Organisations Nationales, Internationales et les communautés locales.

En Côte d'Ivoire, les ministères en charge de la gestion de l'environnement sont : (i) le Ministère de l'environnement et du Cadre de Vie ; (ii) le Ministère de l'Industrie (iii) le Ministère du Tourisme et de l'Artisanat ; (iv) le Ministère des infrastructures économiques ; (vii) le Ministère des Mines et de l'Energie ; (viii) le Ministère de l'enseignement supérieur et de la recherche scientifique ; (ix) et le Ministère de la santé publique.

*La mise en oeuvre effective du projet sera effectuée au plan national par un comité dont la composition et les responsabilités respectives des membres pourraient être les suivantes : Un Centre National de Coordination qui est le Centre de recherches Océanologiques d'Abidjan, qui par la même occasion abrite le siège du projet GC-LME ; pour l'unité de lieu et d'action.*

vii) Un Comité Directeur National présidé par le Ministère d'Etat, Ministère de l'Environnement dont les membres comprennent les institutions gouvernementales en charge de l'environnement côtier, les ONGs et les populations riveraines.

viii) Un Centre National de Coordination, le Centre de Recherches Océanologiques d'Abidjan qui, par la même occasion, abrite le siège du projet GC-LME (unité de lieu et d'action)

ix) Un Coordonnateur Technique National désigné et recruté par l'ONUDI qui devra être un expert averti en la matière, chargé de faire la liaison entre les équipes de scientifiques, le Ministère de l'Environnement et l'ONUDI. Ce dernier aurait pour tâche, entre autres de :

- Veiller au respect des la législation en vigueur ou dans le cas échéant de proposer de nouvelles mesures pour la préservation du milieu aux législateurs ;
- Suivre au jour le jour l'état d'avancement des travaux de pose des structures de protection ;
- D'informer les populations riveraines de leurs droit et devoirs vis à vis des mesures de protection de leur zone côtière ;

*Le projet bénéficiera de la collaboration des organisations tant à l'intérieur du système des Nations Unies qu'à l'extérieur de celui-ci ( COI-UNESCO, FAO, GTZ, IUCN, WWF, etc.) et autres.*

## 6. Coûts additionnels et Financement du projet

Les calculs du coût global du projet ont été effectués sur le principe suivant:

La différence entre les coûts de base et les coûts engendrés par la mise en œuvre de solutions alternatives constitue les coûts additionnels.

*Coût des solutions alternatives = Ligne de base + Activités complémentaires*

*Activités complémentaires = FEM + Apports nationaux + autres donateurs*

*Apports nationaux = salaires des experts + activités supplémentaires de suivi + équipements + locaux + véhicules + carburant+etc.*

Coût total du projet: **1.915.774 US\$** sur trois ans ( cf. annexes)

## 7. Monitoring, Evaluation & Dissemination

- Les études à entreprendre dans le cadre de ce projet seront basées sur les indicateurs environnementaux en relation avec la géologie, l'hydrologie, la dynamique sédimentaire, le recul du littoral, la biologie.
- Le projet inclut des financements pour la formation, le développement institutionnel et l'amélioration des équipements de recherche pour des études de suivi à long terme de la dynamique sédimentaire littorale et les paramètres environnementaux.
- Le projet financerait aussi des projets pilotes pour tester et évaluer la faisabilité des options de protections identifiées.
- La possibilité de reproduire le projet dans les pays côtiers environnants qui subissent les mêmes dégradations.

- Les scientifiques de la sous région auront la possibilité de participer à la mise en œuvre de ce projet et acquérir une expérience pour des travaux similaires dans les pays respectifs.
- Le projet fera l'objet d'une revue tripartite annuelle par l'Etat de Côte d'Ivoire, l'ONUDI et le PNUD. Le Coordonnateur Technique National préparera pour chaque revue tripartite un rapport d'évaluation de la performance du projet.
- Le projet subira une évaluation en profondeur 4 mois avant sa fin.

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République du Bénin

**MINISTÈRE DE L'ENVIRONNEMENT, DE L'HABITAT ET DE L'URBANISME**

DIRECTION DE L'ENVIRONNEMENT

**TITRE DE PROJET**

LUTTE CONTRE LA DEGRADATION DES ZONES COTIERES ET LA  
REDUCTION  
**DES RESSOURCES VIVANTES DANS LE GRAND ECOSYSTEME MARIN DU  
COURANT DE GUINEE**  
\*\*\*\*\*

**3 PROJET PILOTE DU BENIN**

**DEFINITION DES AIRES PROTEGEES COTIERES ET MARINES**

Cotonou juin 2003

## I- TITRE DU PROJET : Définition des Aires Protégées Côtières et Marines

## II- CONTEXTE ET JUSTIFICATION

Le Littoral situé à **l'Est du Golfe de Guinée du Bénin** s'étend sur environ 125 km et est limité à l'Est par le Nigeria et à l'ouest par le Togo.

La zone côtière telle que définie dans le document du **Profil de la zone cotière du Bénin**, couvre 8692 km<sup>2</sup> environ, soit 7,7% du territoire national, et abrite plus de 50% de la population du pays. Cette forte concentration de la population dans la zone littorale et dans les zones humides explique essentiellement la pression qui s'exerce sur ces écosystèmes et leurs ressources.

Elle est dotée d'écosystèmes très productifs mais fragiles tels que les lagunes, les lacs et les mangroves.

La zone côtière abritant une population relativement pauvre, dépourvue d'aires protégées et de politique adéquate de gestion intégrée, fait face à de multiples problèmes environnementaux, sociaux-économiques, institutionnels et juridiques et à une surexploitation des ressources floristiques et fauniques.

Au Bénin, les populations riveraines ont su traditionnellement mettre en œuvre des stratégies pour protéger le capital écologique et en réglementer l'exploitation afin de satisfaire leurs besoins. Ainsi, elles avaient mis en pratique des droits d'usage, des règlements pour gérer le milieu.

Dans plusieurs localités, la pêche était interdite certains jour de la semaine afin de laisser au repos le plan d'eau. Les chefs traditionnels organisaient des cérémonies dans le sens de la préservation des ressources naturelles.

La perte du pouvoir de l'autorité traditionnelle au profit des élus locaux avec l'avènement de la révolution en 1972 et la faiblesse des structures religieuses ont contribué au déséquilibre observé aujourd'hui entre l'accroissement de la population et l'exploitation des ressources naturelles dans la zone côtière.

L'une des conséquences de la perte du pouvoir de l'autorité traditionnelle est l'exploitation anarchique du milieu marin et de la zone côtière malgré une gamme variée de lois et règlements.

Dans ce contexte, il apparaît clairement que l'exploitation durable des écosystèmes marins et côtiers du Bénin nécessite l'élaboration et la mise en œuvre



d'un plan cohérent de gestion, basé sur l'exploitation rationnelle des données écologiques et socio-économiques.

C'est pour cela que le Bénin espère, par la mise en œuvre du présent projet pilote « **Définition des Aires marines et côtières protégées** », contribuer à la fois, à la promotion des politiques et stratégies de gestion des ressources côtières, au renforcement des dispositifs institutionnels pour une approche multisectorielle de l'exploitation des ressources naturelles, à fournir des solutions techniques aux conflits qui pourraient en découler et améliorer la coopération sous-régionale et régionale.

### **III- OBJECTIFS**

#### **1) Objectif Général :**

L'objectif fondamental du présent projet est de contribuer à la mise en place d'une base durable de développement économique et sociale au profit des populations à travers la gestion et la valorisation de la zone côtière et marine.

#### **2) Objectifs Spécifiques :**

- 1- définir les aires marines et côtières à protéger ;
- 2- favoriser la connaissance et la compréhension des écosystèmes côtiers et marins ;
- 3- mettre en place des mécanismes de gestion durable du milieu marin et côtier.

### **IV- ACTIVITES ET RESULTATS ATTENDUS**

#### **1) Activités**

- identifier de façon préliminaire les aires marines et côtières à protéger ;
- cartographier les aires protégées marines et côtières démarquées (acquisition de photos aériennes et images satellites, travaux de terrain, travaux de laboratoire ; vérification terrain) ;
- réaliser des études aux fins d'identifier des zones et des espèces à protéger(enquêtes, consultations et ateliers) ;

- réaliser une étude pour établir l'état de référence de la zone au point de vue écologique, humain et socio-économique (monographie à une année fixe avec des indicateurs de référence) ;
- évaluer périodiquement la qualité de l'eau et des sédiments, y compris les analyses biologiques du biotope côtier ;
- procéder à une évaluation régulière de la productivité afin de déterminer la vitalité de l'écosystème ;
- élaborer et exécuter un plan de gestion des aires marines et côtières protégées ;
- lutter contre la pollution des eaux côtières et marines ;
- identifier et recenser les besoins en renforcement des capacités des Institutions et des différents acteurs et des collectivités locales (consultations, ateliers) ;
- cartographier les zones marines, lagunaires et lacustres écologiquement vulnérables démarquées (acquisition de photos aériennes et images satellites, travaux de terrain, travaux de laboratoire, vérification terrain) ;
- évaluer le cadre législatif et réglementaire existant en matière de protection des écosystèmes aquatiques (consultations et ateliers) ;
- développer un programme d'appui communautaire au profit des populations riveraines à impliquer dans la gestion des aires protégées (études, planification participative, ateliers) ;
- identifier et recenser les besoins en renforcement de capacités des institutions, des différents acteurs et des collectivités locales ;
- renforcer les capacités d'action des acteurs de contrôle et de surveillance de la zone côtière et du milieu marin. (formation, équipements) ;
- élaborer une base de données pour le suivi et la surveillance (consultation sur la nomenclature des données et des indicateurs, conception de la BD informatique, collecte des données, alimentation de la base, mise à jour régulière) ;
- évaluer et dynamiser le cadre de négociation avec les pays limitrophes côtiers sur la protection du milieu marin et de la zone côtière (consultations, ateliers, rencontres bilatérales, adoption de protocole).

## *2) Les résultats attendus*

- des aires marines et côtières protégées sont déterminées et cartographiées;
- le cadre de concertation avec les pays limitrophes côtiers est opérationnel ;
- une banque de données relative à la protection du milieu marin et de la zone côtière est créée ;
- les besoins de renforcement de capacité des acteurs sont connus ;
- la pauvreté dans les localités riveraines des aires protégées est réduite ;
- la biodiversité de la zone est mieux protégée ;
- la pollution des milieux récepteurs est mieux contrôlée dans la zone.

## **VI- LES RISQUES ET LA DURABILITE DU PROJET**

Les risques inhérents à un tel projet sont les suivants :

- insuffisance des ressources financières ;
- accroissement de la pauvreté ;
- mauvaise coordination avec des activités existantes (pêches, transport maritimes, activités touristiques, etc.) ;
- conflits d'attribution des acteurs/bénéficiaires ;
- faible compétence nationale pour contrôler les pollutions marines internationales et les pollutions telluriques ;
- la pollution due au transport maritime et aux infrastructures pétrolières ;
- la pollution tellurique ;
- etc.

Cependant, l'implication des acteurs à la base, de la société civile et des Institutions en charge du projet ainsi que le suivi rigoureux des activités

prévues par le projet permettra de minimiser les risques ci-dessus cités et de rendre le projet durable.

## V- CADRE INSTITUTIONNEL

### *Institutions nationales associées :*

Le projet est sous la tutelle de la Direction l'Environnement. Cependant, tenant compte de son caractère multisectoriel, ce projet sera géré en collaboration avec les structures telle que : l'Agence Béninoise pour l'Environnement, la Direction de l'Hydraulique, La Direction des Pêches, l'Université d'Abomey-Calavi (le Département de Géographie et de l'Aménagement du Territoire, Faculté des Sciences et Techniques (Biologie), le Collège Polytechnique Universitaire, la Faculté des Sciences Agronomiques), le Centre de Recherches Halieutiques et Océanographiques, la Direction du Développement Industriel, la Direction du Tourisme et de l'Hôtellerie, le Centre Béninois pour le Développement Durable, la Direction des Forêts et Ressources Naturelles, la Direction de l'Energie, la Direction de la Marine Marchande, les Forces Navales, l'Institut de Géographie Nationale, les Directions Départementales de l'Environnement, de l'Habitat et de l'Urbanisme des départements de l'Atlantique, de l'Ouémé, du Littoral et du Mono, l'ONG CEDA, L'ONG Nature Tropicale, l'ONG Bénin 21, les départements de l'Atlantique, du Mono et de l'Ouémé.

### *Les groupes cibles visés par le projet :*

Ils sont constitués de deux types d'acteurs ; il s'agit des acteurs directs et des acteurs indirects.

#### *1) Les acteurs directs*

Les pêcheurs et associés, les agriculteurs, les touristes, les opérateurs touristiques, les affréteurs ( chargeurs), les poissonnières, les propriétaires terriens.

#### *2) Les acteurs indirects*

Les autorités locales et communales, les préfets, les chercheurs et les étudiants, les ministères, les associations des pêcheurs, les ONG et les médias.