BIODIVERSITY THREATS ASSESSMENT FOR THE WESTERN REGION OF GHANA

INTEGRATED COASTAL AND FISHERIES GOVERNANCE INITIATIVE FOR THE WESTERN REGION OF GHANA

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Cover Photos: Coastline of Princess Town (Left); Fish landing site at Dixcove (Right) Western Region, Ghana.

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EXECUTIVE SUMMARY

This report on the Biodiversity Threats Assessment of the Western Region of Ghana contains information obtained from public institutions, individuals, NGOs and published and unpublished literature. The situation in the Region is juxtaposed against the national condition to elucidate the peculiarities in its biodiversity assets.

The coastal zone of Ghana includes all land areas up to the 30 meter contour and the marine waters up to the 200 nautical mile Exclusive Economic Zone. The coastline stretches 550 km. The Western Region has an area of 21, 391 km^2 (about 10 percent of the total land area of Ghana) with a 202 km long coastline. It comprises six coastal Ditricts- Jomoro, Ellembelle, Nzema East, Ahanta West, Sekondi-Takoradi Metropolis, and Shama.

Terrestrial vegetation types in the coastal zone of the Region include Sand Dunes with extensive coconut plantations, Wet Evergreen Forest, Moist Evergreen Forest, Moist Semi-Deciduous Forest, Grasslands and Evergreen shrubs occurring further inland.

The Region has many wetland systems some of which are freshwater habitats unlike the eastern coast of the country where the lagoons are typically brackish. Lagoons of importance in the Region are Tano/Aby/Ehy Lagoon at the coastal border between Ghana and Ivory Coast, and Amanzule Lagoon. While five wetlands in the country are designated as Ramsar Sites none is located in the Western Region.

The coastal marine resources of the Region include various species of pelagic and demersal fishes as in the coastal waters of other parts of the country with sardinellas (Sardinella aurita and Sardinella madarensis) as the most important. The wetlands in the Region are dominated by freshwater species notably Chrysichthys nigrodogitatus, and are nursery grounds for juveniles of some marine fishes. Invasive species found in the Region are the Water hyacinth Eichhornia crassipes in the Tano/Aby/Ehy lagoon and the seasonal blooms of the filamentous green alga Enteromorpha flexuosa in the coastal waters from Jomoro to Nzema East which constitute a nuisance to fishing and other economic activities.

The sandy shores of the Region are important nesting areas for endangered marine turtles; dolphins are landed at Dixcove and Axim and manatees could be found in the Tano/Aby/Ehy lagoon system while the Amanzule wetlands and Cape Three Points Forest Reserve are Important Bird Areas.

Threats to terrestrial and marine biodiversity in the Region are identified as

- Overexplitation of marine fisheries resources due to overcapitalization of the fishing industry, use of small mesh nets in the beach seine fishery and other illegal fishing methods
- Loss of coastal habitat through establishment of monocrop plantations, destruction of wetlands for infrastructure development, solid waste disposal, harvest of mangrove forests, beach sand mining and tourism development
- Pollution of the marine and coastal environment from domestic and industrial solid waste, siltation, sewage disposal, mining waste, pesticides and fertilizers

- By-catch of endangered species like seabirds, sea turtles, sharks, dolphins and manatees from the use of nonselective gears in the fishing industry
- Accelerated coastal erosion from deforestation, sand and stone winning, and infrastructure development as the Takoradi Port and the nearby fishing harbor

- Increasing population density which could bring about an increase in the rate of exploitation of resources of fragile ecosystems
- Weak governance, legislation and institutional framework due to the fragmented nature of environmental legislation and lack of political will to enforce legislation
- Development of oil and gas resources which has the potential to increase conflicts with the fishing industry over the use of marine space, and its potential negative impacts on coastal and marine habitats
- Climate change and sea level rise which has the potential to severly impact the shoreline and further weaken the resilience of coastal habitats and biodivervsity and human communities
- Spread of invasive species such as the Water hyacinth *Eichhornia crassipes* in the wetlands and blooms of the green alga *Enteromorpha flexuosa* in the marine coastal waters could significantly hamper fishing activities and affect the livelihoods of coastal communtities
- There are a number of key government ministries, departments and agencies (MDAs) with policy and legislative functions affecting biodiversity management and conservation in the Western Region but with weak governance on biodiversity and habitats.

The current priorities for terrestrial and marine biodivervsity conservation in the Region:

- Establishing Marine Protected Areas and Coastal Ramsar Sites at the Amanzule wetlands and Esiama beach, and the Ahunli and Belibangara lagoons, because of their special biodiversity features
- Enact legislation for the complete protection and conservation of the Cape Three Points Forest reserve because the “Hot Spot” is under severe threats from anthropogenic activities.
- Addressing harmful algal blooms and invasive aquatic plants in wetlands and coastal marine habitat
- Undertaking fisheries management reform to ensure compliance with fisheries regulations
- Protecting endangered species such as marine turtles, cetaceans and manatees
- Completion, adoption and implementation of Policies, and Strategies and Action Plans for biodiversity conservation

In respect of the terrestrial and marine biodiversity conservation in the Western Region the following recommendations are made:

- Coordinated planning and utilization of coastal zone and resources
- Improved fisheries management and conservation
- Protection of existing forest reserves
- Lagoons and wetlands protection

- Awareness creation on habitats and biodiversity values
- Climate change mitigation and adaptation
- Strengthening relevant governmental and nongovernmental institutions through capacity building
- Building research capacity

1.0 BACKGROUND

1.1 PURPOSE OF THE DOCUMENT

This document is purported to present a review of existing information relating to threats to biodiversity conservation of coastal resources in Western Region of Ghana, to serve as a reference point for comparison with future change in the condition of coastal ecosystems and the governance system. The information would ultimately facilitate reconstruction of long term trends for key variables within the coastal zone. This threats assessment will also include information obtained through interviews with selected key informants and consultations with local experts.

It is generally acknowledged that the Coastal Zone of Western Region of Ghana has been severely and negatively impacted as suggested by the declining fisheries resources in the country as a whole and the destruction of aquatic and terrestrial habitats in the Region in particular. There is also the potential source of environmental damage from the exploitation of oil in the marine environment. The need for a study that highlights issues on conservation of aquatic and terrestrial environments and their biodiversity cannot therefore be overemphasized. Such a study would provide a basis for initiating actions for recovery of the depleted fisheries, conservation of endangered species of birds, reptiles and mammals, restoration of degraded land and aquatic habitats, and reducing marine and land-based pollution through establishment of a management frame work for sustainable use of the coastal resources. Such actions would in the long run benefit the communities in socio-economic terms.

The objectives of this assessment are to:

- Identify and document areas of coastal and marine biological significance in Ghana and their assets
- Identify and analyze key threats to these biodiversity assets
- Provide orientations for further priority research activities that are needed to design and implement biodiversity conservation strategies and actions
- Provide recommendations on how the ICFG Program can address these threats

1.2 BRIEF OVERVIEW OF THE ICFG PROJECT

The *Integrated Coastal and Fisheries Governance (ICFG)* Initiative is a four-year initiative supported by the U.S. Agency for International Development (USAID). It is implemented through a cooperative agreement with the Coastal Resources Center (CRC) University of Rhode Island (URI) United States of America (USA).

Program activities are concentrated in the six coastal districts of the Western Region of Ghana, where coastal communities and the local government are the intended primary beneficiaries. Given the nature of some of the issues and the scale at which they need to be addressed, however, the Program will need to link local actions with National initiatives as well.

The stated goal of the ICFG Program is: to support the government of Ghana in achieving its development objectives of poverty reduction, food security, sustainable fisheries management and biodiversity conservation by contributing to the following vision: Ghana's coastal and marine ecosystems are sustainably managed to provide goods and services that generate long term socio-economic benefits to communities while sustaining biodiversity.

This aspect of the ICFG program will assess biodiversity threats for the Western Region of Ghana in fulfillment of the Initiative's biodiversity earmark and will provide information that feeds into the overall baseline and State of the Coast report. The threats assessment report will also identify and orient more detailed research activities that will need to be conducted during the life-of-the-Initiative in order to design biodiversity conservation strategies and actions, including a thorough coastal habitats study to be completed later in 2010.

2.0 THE COASTAL ZONE OF GHANA

Ghana lies along the Gulf of Guinea (30 5´ W and 1010´ E and 40 35´N and 110 N) and has an area of about 239,000 km2 and a 550 km coastline with about 90 lagoons and associated wetlands. Some of the lagoons are closed and others open (Boughey, 1957; Kwei, 1977; Mensah, 1979).

Ghana's coastal zone encompasses a land area extending to the 30 meter contour, and a coastal offshore shelf area to either the end of the continental shelf or the 200 nm exclusive economic zone limit (EPA/WB 1996; Armah & Amlalo, 1997) (Fig.1). However, for management purposes the definition includes land areas within the 75 meter contour. The landward zone is generally low lying, not more than 200 m above sea level while the continental shelf is narrow extending outwards to between 25 km and to 35 km except off Cape Coast to Saltpond where it reaches up to 80 km.

The coastal zone covers 6.5% of land area but is inhabited by a quarter of the population. The zone contains 21 Districts in four administrative regions namely Western (4 Districts), Central (7 Districts), Greater Accra (5 Districts) and Volta Region (5 Districts) (EPA/WB, 1996). In 2008, 5 new Districts were created increasing the number to 26 nationally and six for the Western region.

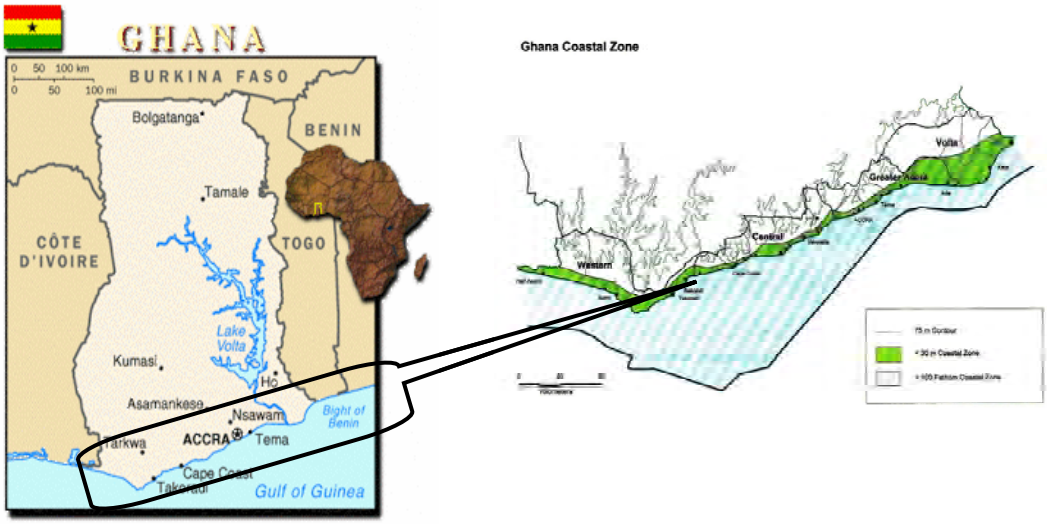

Figure 1: Maps showing the coastal zone of Ghana

The coastline has three geomorphic units. The West Coast (≈95 km) extends from the Ghana's-Côte d'Ivoire border to the Ankobra River estuary where there are gently sloping sandy beaches along with 49 lagoons, the Central Coast (≈321 km) and the East Coast (≈149 km) (Ly, 1980). The Central Coast from the Ankobra estuary to Tema has rocky headlands and sandbars or spits enclosing coastal lagoons. The East Coast stretches from Tema to the Ghana-Togo border where the shoreline is sandy; this area characterized by considerable erosion (Ly, 1980).

2.1 COASTAL ZONE OF THE WESTERN REGION

The Western Region is approximately 21,391 km^2 (about 10 per cent of Ghana's total land area) with a 202 km long coastline. About 75 per cent of Ghana's high forest vegetation occurs in the Region. It is also the wettest part of the country with an average rainfall of 1,600 mm per annum. The Region is bordered on the east by the Central Region, the west by Ivory Coast, the north by Ashanti and Brong-Ahafo Regions, and the south by the Gulf of Guinea. The southernmost part of Ghana lies in the region, at Cape Three Points near Busua, in the Ahanta West District.

Figure 2: Map of Western Region (Source: www.ghanadistricts.com)

The 2000 population and housing census indicted a population of 1.92 million for the Western Region (Ghana Statistical Service, 2005) and the distribution for the then four Districts is shown in Table 1. The Region presently has six coastal Districts namely Jomoro, Ellembelle, Nzema East Municipality, Ahanta West, Sekondi-Takoradi Metropolis, and Shama

Table 1: Population of the Coastal Districts of Western Region in 2000

DISTRICT	JOMORO	NZEMA EAST	AHANTA WEST	SHAMA AHANTA EAST
POPULATION	111,348	142,871	95,140	369,166

Jomoro District

The District (4° 55´ – 5° 15´ N and 2° 15´ – 2° 45´ W) has an area of 1344 km^2 with Half Assini as the District Capital. Until 1988, this District was part of Nzema East Municipality. It has a 60 km coastline stretching from Ekebaku to New town with the beach fringed with coconut plantations, while also serving as a nesting habitat for marine turtles. The beaches are yet to be extensively developed for tourism though there are a few privately-owned sites such as Beyin Beach Resort, Axim Beach Resort and Green Turtle Lodge at Akwida where clients can watch marine turtle activities. The Ghana Wildlife Society (GWS) is currently implementing a marine turtle conservation project along the coastal stretch of the District. The project, among others, seeks to conserve marine turtles and their habitats and develop the turtle watch eco-tourism activities to generate income for the benefit of the coastal communities.

The project has succeeded in attracting two local private investors to develop beach resorts near Ekabaku and Ngelekazo.
The District has a number of wetlands ecosystems, the major ones being the Amanzule, located near Beyin, Dormuli and Aby wetlands. The Amanzule is the only known intact swamp peat forest in Ghana. The famous 500 years old Nzulezo village where houses are built on stilts and traditional life adapts to the watery conditions is built on the Amanzule Lagoon. The area has already been designated as an Important Bird Area based on Birdlife International criteria. The Government is currently, taking steps to designate the Amanzule wetlands, including some wetlands in Nzema East, and Ellembele as Ramsar Sites (MLFM, 2007). The Dormuli wetland although small has intact and beautiful mangrove forest and estuary and is inhabited by monkeys, crocodiles, marine turtles and birds. The Abby Lagoon is a transboundary wetland important to both Ghana and Ivory Coast due to its high productivity especially fish. The West African manatee (*Trichechus senegalensis)* has been reported in the Abby Lagoon (Ofori-Danson and Agbogah, 1995).

The marine environment in the district has the potential for sea tourism, watching sea animals such as whales, dolphins and turtles. From mid-July to October a number of whales and dolphins visit the seas in the District while August to March is the nesting season for turtles.

Nzema East Municipality

The Nzema East Municipality is about 2,194 km^2 representing 9.8 percent of the total area of the Western Region. It has some 70 kilometres of sandy beach. The District is rich in tourism attractions although most of these are still undeveloped. It has beautiful sandy beaches which can be developed for conventional beach tourism. The Ankobra River is another tourist attraction for river boat trips.

Ellembelle District

Ellembelle district with its capital Nkroful forms part of the new districts and municipalities created in February 2008.These new creation arose as a result of the large size of some of the then 138 MMDAs which was not one way or the other allowing the government to fully implement its policies of local governance to the benefit of the entire citizenry. Relevant data concerning its location and size, topography and drainage, climate and vegetation, geology and soil, social infrastructure, economy conditions are therefore not currently available.

Shama District

Like the Ellembelle district, the Shama district with its capital Shama forms part of the new districts and municipalities created in February 2008. Relevant data concerning its location and size, topography and drainage, climate and vegetation, geology and soil, social infrastructure, economy conditions are not currently available.

Ahanta West District

The Ahanta West District (4° 45´N and 1° 58´W) is located at the southern most part of the country with its capital as Agona Nkwanta also called Agona Ahanta. It has a total land area of 591 km2 with a population of 95,140 according to the 2000 Population and Housing Census report (Ghana Statistical Service, 2005).

The District has some beautiful beaches suitable for swimming and sunbathing at Egyambra, Miamia, Princess Town, Akwidaa, Busua, Butre and Adjoa. Butre, Miamia and Cape Three Points are also noted for the occurrence of a variety of shellfish. Cape Three Points is part of the migratory route for whales, dolphins and sharks which calls for its consideration as a Marine Protected Area (MPA). The Cape Three Points Forest Reserve which occupies a total area of 51,102 km2 is the only primary forest in Ghana located very close to the sea. Though now at risk from encroachment and poaching, the reserve has a wide variety of tree species, butterflies, monkeys and birds. Importantly, the different plants have medicinal value. Also of significance in the District is the Egyambra crocodile pond and shrine located about 10 kilometres west of Princess Town.

Sekondi-Takoradi Metropolis

The Sekondi-Takoradi Metropolitan Area occupies the south-eastern part of Western Region. Dubbed the “twin city”, Sekondi-Takoradi is about 200 km west of Accra. It has some of the finest beaches located at Essipon (Paradise Beach), Essikado, Whin River Estuary and Esai Lagoon.

3.0 MARINE AND COASTAL BIODIVERSITY ASSETS IN GHANA

3.1 OVERVIEW OF BIODIVERSITY IN GHANA

Terrestrial Ecosystems

Ghana lies in the Upper Guinea Forest Ecosystem, extending from Guinea to Sierra Leone and eastward to western Togo. This ecosystem is biologically rich and because of its high degree of species endemism is considered as one of the world's priority biodiversity conservation areas (Conservation International, 1999).

Two main vegetation types, the forest and savannah are peculiar to Ghana. The forest is subdivided into Wet Evergreen, Moist Evergreen, Moist Semi-deciduous, Dry Semi-deciduous, Upland evergreen and Southern marginal, South-east outliers and Mangroves (Hall and Swaine, 1981). The savannah is variously described as Coastal savannah in the eastern coastal belts, the Northern Interior wooded savannah found mainly in the south central northern zone, and Drier Sudan wooded savannah in the north east corner of the country (World Bank, 2002). About 6.4 percent (353,000 hectares) of the land area of Ghana is occupied by primary forest with a closed forest zone located in the south-west of the country (http://rainforests.mongabay.com/deforestation/2000/Ghana.htm).

There are over 3600 plant species in Ghana (MES, 2002) of which 2,900 are indigenous, 250 are introduced species and 43 species are endemic. Table 2 shows the numerical representation of vascular plants in Ghana. The flora in the southwest forests has the highest diversity. Most of the forests are located on substrates rich in gold, diamonds and bauxite.

Table 2: Vascular Plant Census of Ghana

Indigenous	Families	Genera	Species
Group			
Pteridophytes	15	43	124
Gymnosperms	1	1	1
Angiosperms			
Monocotyledons	30	227	780
Dicotyledons	127	806	2069
Subtotal	**173**	**1077**	**2974**
Introduced (Naturalized)			
Group			
Monocotyledons	15	42	53
Dicotyledons	63	149	200
Subtotal	**78**	**191**	**253**

Source: MES, 2002

The faunal diversity includes 225 mammal species (incudes forest and savanna elephants, monkeys such as chimps, red, olive, black and white Colobus and Mona and several angulates), 74 bat species, 37 species of rodents, and 724 bird species, 221 species of Amphibia and reptiles, and 850 species of butterflies in the forest zone alone.

Thirty-one species of amphibians have been recorded in the Volta Region (National Biodiversity Strategy & Action Plan, 2002). Three frog species, one lizard species and 23 species of butterflies are endemic to Ghana (MES, 2002). Bobiri Forest Reserve contains over four hundred species of butterflies and an estimated 550 butterfly species have been recorded in Kakum National Park. The species of concern is the rare African giant swallow tailed butterfly.

Crocodiles are rare but occur in some rivers and streams, and in the Volta Lake. Large populations occur in the protected Paga crocodile pond in the Upper East Region. Three species of crocodiles namely the slender-snouted crocodile *Crocodylus cataphractus*, the dwarf crocodile *Osteolaemus tetrapsis*, and the Nile crocodile *Crocodylus niloticus* have been identified in the country.

Intertidal Ecosystem

Mangrove forests in Ghana are sparse and are associated with coastal lagoons and estuaries (Hughes and Hughes, 1991). In 1995, the total land area covered by mangroves was estimated at 10,000 ha (Saenager and Bellan, 1995) and is expected to have been significantly reduced currently. Good mangroves stands are restricted to three main areas: the Amanzule wetlands in the Western Region, the Kakum River estuary west of Cape Coast (Central Region), and the Volta Delta.

Five species of mangroves are found in Ghana- the red mangroves, *Rhizophora racemosa, Rhizophora mangel* and *Rhizophora harrisonii* and the white mangroves *Avicennia germinans* and *Laguncularia racemosa.* The red mangroves occur in open lagoon systems which have regular tidal exchange whereas the white mangroves are primary colonists of closed lagoons (Sackey *et. al.*, 1993). The richest diversity of mangroves occurs in the flood plains of the Kakum River at Iture which contains all five species of mangroves.

Marine Ecosystem

Seagrass beds

Seagrass beds are rare in the coastal waters of Ghana due to unfavorable environmental conditions such as relatively high turbidity which inhibits their growth. However, Armah & Amlalo (1998) have reported the occurrence of the seagrass *Rupia maritima* in the Keta lagoon. *R. maritima* has also been reported from the Fosu lagoon in Cape Coast and an irrigation dam at Mankesim (deGraft-Johnson pers. com.).

Plankton

The inshore and offshore phytoplankton communities of Ghana include diatoms, dinoflagellates, and coccolithophores. The principal species of diatoms in Ghana during the upwelling belong to the genera *Skeletonema, Nitzschia, Chaetoceros, Rhizosolenia,* and *Thalassiosira* (Wiafe, 2002). Other planktonic groups such as chaetognaths are abundant from September to November, thaliaceans, mainly *Thalia democratica*, in December and July, and appendicularians in June and October (Thiriot, 1977). The explosive development of these plankton groups influences the

fishery of the nearshore and adjoining coastal water bodies. It has been reported (Mensah, 1966) that maximum occurrence of the zooplankton copepod *Calanoides carinatus* during the upwelling season in Ghana is related to the seasonal abundance of *Sardinella* species in the coastal waters.

Littoral invertebrates

The sandy beach fauna is dominated by the ghost crab, *Ocypoda cursor*, and the rocky beaches by bivalves, whelks, limpets and crabs *e.g. Grapsus grapsus.* Other commonly encountered fauna include isopods, amphipods, mysids and polychaetes. The littoral benthic organisms include polychaetes, arthropods, bryozoans, and echinoderms. Edmunds (1978) recorded 68 taxonomic families. Some species such as the gastropods *Cymbium* spp. and the spiny lobster *Panulirus* sp. appear to be declining in abundance while the sea star *Astropecten* sp. and other starfishes have completely disappeared.

Macroalgae

Various species of green algae, brown algae and red algae are present in Ghana waters. However since 1993 annual blooms of the filamentous green alga *Enteromorpha flexuosa* have been reported in western Ghana, a phenomenon of major concern to fishermen and other users of the coast.

Marine fish

About 347 fish species belonging to 82 taxonomic families have been recorded in Ghana. The marine fish resource exploited by artisanal, semi-industrial and industrial fishery sectors is classified into small pelagics, large pelagics, demersals, and shellfishes comprising crustaceans and molluscs (Mensah and Quaatey (2002). Appendix 2 shows the different categories of fish and their representative species. Marine fish production is largely dependent on the strength of the seasonal upwelling phenomenon (Mendelsshon and Cury, 1987) and rainfall (Biney, 1982). A major upwelling period occurs between June and September whilst a minor upwelling period occurs between December and February (Mensah, 1983). The total fishery production of Ghana averages 300,000 metric tons per annum (Anon, 2003). According to Kwei and Ofori-Adu (2005) the annual production averages are 240,000 metric tons for small pelagics (sardinellas, anchovy, chub mackerel, etc.), 36,000 metric tons for large pelagics (tunas, skipjacks, etc.), 40,000 metric tons for demersal fishes (breams, carangids, snappers, groupers, etc.) and 260 metric tons for shellfishes (shrimps and lobsters).

Small Pelagic Fish

The sardinellas (*Sardinella aurita* and *Sardinella maderensis*) are the most exploited small pelagics (Mensah and Koranteng, 1988). The stock size of *S. aurita* has been estimated as 60,000 mt Knudsen (1971) with a projected MSY of 42,000-49,000 mt (FRU/ORSTOM, 1976, quoted in Mensah and Koranteng, 1988). *S. madarensis* has a lower biomass and lower annual catches (Mensah and Koranteng, 1988).

Annual catches of *S. aurita* were below 40,000 mt until 1972 when the fishery for the species virtually collapsed following the landing of about 90,000 mt of the species that year, but catches improved substantially to reach 51,000 mt in 1978 comparable to that of pre-collapse years (Mensah, 1981).

Other small pelagic fishes of economic importance are the chub mackerel (*Scomber japonicus*), scads (*Decapterus* spp.), jack mackerels (*Caranx* spp.), horse mackerels (*Trachurus* spp.), the bumper (*Chloroscombrus chrysurus*), and the anchovy (*Engraulis encrasicolus*) (Mensah and Koranteng, 1988).

Large Pelagic Fish

Large pelagic fish of commercial importance in Ghana are tunas and tuna-like species, e.g. the yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), skipjack (*Katsuwonus pelamis*), little tunny (*Euthynnus alletteratus*), Atlantic bonito (*Sarda sarda*), *Auxis thazard* (Frigate mackerel), Atlantic sailfish (*Istiophorus albican*s) and the broadbill swordfish (*Xiphias gladius*) (Mensah and Koranteng, 1988). The capture of these large pelagics with drift gill nets often results in the accidental capture of sea turtles and dolphins.

Demersal Fish

Demersal fishes are caught by trawlers and some artisanal gears like beach seines, set nets and long-lines (Mensah and Koranteng, 1988). The most important of these are sea breams mainly the red Pandora (*Pagellus bellottii*), Canary dentex (*Dentex canariensis*) and blue-spotted sea bream (*Sparus caeruleostictus*), burros (*Pomadasys* spp.), the burrito (*Brachydeuterus auritus*), croakers (*Pseudotolithus* spp.), snappers (*Lutjanus* spp. and *Lethrinus* spp.), red mullets (*Psedupeneus prayensis*), groupers (*Epinephelus* spp.) and threadfins (*Galeoides decadactylus, Polydactylus quadrifilis* and *Pentanemus quinquarius*).

Shellfish

Four species of shrimps (Crustacea), i.e. the pink shrimp *Penaeus notialis*, the tiger shrimp *Penaeus kerathurus*, the rose shrimp *Parapenaeus longistrostris* and the white shrimp *Parapeneopsis atlantica* are the most abundant of the shrimp resources in the Gulf of Guinea (Mensah and Quaatey, 2002). There are two lobster species in the area namely the royal spiny lobster (*Panulirus regius*) and the red slipper lobster (*Scyllarides herklotsii*) of which *P. regius* is the most abundant and valuable (Mensah and Quaatey, 2002). Molluscan shellfish in the Gulf of Guinea are dominated by cephalopods mainly the cuttle fish (*Sepia officinalis hirredda*) (Mensah and Quaatey, 2002). Shellfish species comprising crustaceans, bivalves and mollusks have been found in many lagoons in the country (Pauly, 1975; Mensah, 1979; Koranteng *et al*., 1998, 2000; Obodai and Yankson, 1999,).

Lagoon and Estuarine Fish

A number of the coastal lagoons have a high productivity and are exploited for their fisheries resources on subsistence and commercial basis. Pauly (1976) estimated a production of 120 kg/ha for Sakumo Lagoon near Tema, and Blay and Asabere-Ameyaw (1993) determined production values of 452-664 kg/ha for Fosu Lagoon in Cape Coast.

The fish fauna of a number of lagoons and estuaries have been documented. The dominant species in most lagoons belong to the Cichlidae, notably the black-chinned tilapia *Sarotherodon melanotheron* which makes up 80% to 99% of the fish biomass (Pauly, 1975, 1976; Ntiamoa-Baidu, 1991; Blay and Asabere-Ameyaw, 1993; Koranteng *et al*., 1998, 2000).The remaining fish fauna are freshwater and marine elements. Juveniles of marine fish are notably common in open (tidal) lagoons (Mensah, 1979, Pauly, 1975, 1976; Blay, 1998).

Sea turtles

Sea turtles (Leatherback *Demochelys coriacea*, Hawksbill *Eretmochelys* sp., Green turtle *Chelonia mydas*, Loggerhead *Caretta caretta*, Olive-Ridley *Lepidochelys olivacea*) which are listed as endangered are found in Ghana.

Birds

Of the 728 bird species occurring in Ghana, 408 are non-passerine and 320 are passerine. It is also believed that 494 are resident and 176 are regular seasonal migrants including 100 from the Palaeartic region. Of the total number of species recorded 180 are restricted to the Guinea-Congo Forest biome and 37 to the Sudan-Guinea Savannah biome (Ntiamoa-Baidu *et al*. 2001). Furthermore, 11 of the 15 endemic bird species within the Upper Guinea Forest occur in Ghana. Six of the total species are considered threatened and 12 near-threatened (BirdLife International, 2000). The country is also important for water-birds, being on the boundary of the East-Atlantic flyway and the Mediterranean flyway (Smith & Piersma, 1989; Ntiamoa-Baidu *et. al*, 2001).

There are 36 important Bird Areas (IBA) in Ghana according to Birdlife International for critical bird habitats in Ghana of which six occur along the coast including the Amanzule wetlands in the Western region. Most of the coastal wetlands harbor about 70 species of resident and migratory bird life (Ntiamoa-Baidu *et al*., 2000).

Marine mammals

Dolphins have been reported in the coastal towns of Apam, James Town, Ningo-Prampram and Keta (Debrah, 2000, Ofori-Danson, *et al*., 2003). Migratory dolphins, mainly *Stenella* and *Delphinus* spp., are ’common. Sharks are normally caught together with dolphins (Risso’s dolphin *Grampus griseus*, Atlantic spotted dolphin *Stenella frontalis*) in drift gill nets. Shark species of the family Carcharinidae dominated by *Rhizopionodon acutus* are mostly landed. Whales e.g. the humpback *Megaptera novaeangliae* and the melon-headed *Peponocephala electra* occasionally beach on the shores of Ghana or are accidentally caught in fishing nets.

Freshwater Ecosystems

Fresh water ecosystems include the rivers and streams, lagoons, a number of man-made lakes notably Lake Volta, and Lake Bosomtwi, the only natural lake in the country.

Fish

Ghana's freshwater fish includes 28 families, 73 genera and 157 species. About 121 species have been recorded from the Volta system, which drains a major part of the country. It is estimated that about 124 fish species from 62 genera and 26 families inhabit the major rivers (MES, 2002). Eighty one species are of food importance and species of cultural importance include *Chrysichthys nigrodigitatus*, *Clarias gariepinus, Heterobranchus longifilis, and Heterotis niloticus*, (MES, 2002).

Manatees

The West African manatee (*Trichechus senegalensis*) is globally classified as vulnerable by the International Union for Conservation of Nature and Natural resources (IUCN). It occurs in large rivers and coastal waters of West Africa including Ghana; however, no assessment of the manatee population has been carried out in this country. Large numbers of manatee have been reported by hunters in the Tano and Afram Rivers (Ofori-Danson and Agbogah, 1998), and Avu lagoon (Hadja, pers. com). In one dry season, over 40 manatees were reported killed in the Avu lagoon. A hunter was reported to have killed over 17 individuals in the Afram River. Fishermen in the Lower Volta wetlands as well as in the Afram and Digya wetlands have reported fewer sightings of manatees of late compared to periods prior to impoundment of the Volta River (Hadza, pers. com, Ofori-Danson and Agbogah 1998).

Ungulates

The rare ungulate, the Sitatunga (*Tragelaphus spekei gratus*), the world's only amphibious antelope and once considered extinct in Ghana for over 50 years has recently been reported in the Avu lagoon in the Lower Volta wetlands (NCRC, 2005).

4.0 MARINE AND COASTAL BIODIVERSITY ASSETS IN THE WESTERN REGION

4.1 COASTAL ECOSYSTEMS

Marine Ecosystem

Madreporarian corals

The continental shelf of the western region is traversed by a belt of dead madreporarian coral from 75 m depth. Beyond this coral belt, the bottom falls sharply, marking the transition from the continental shelf to the slope (Figure 3).

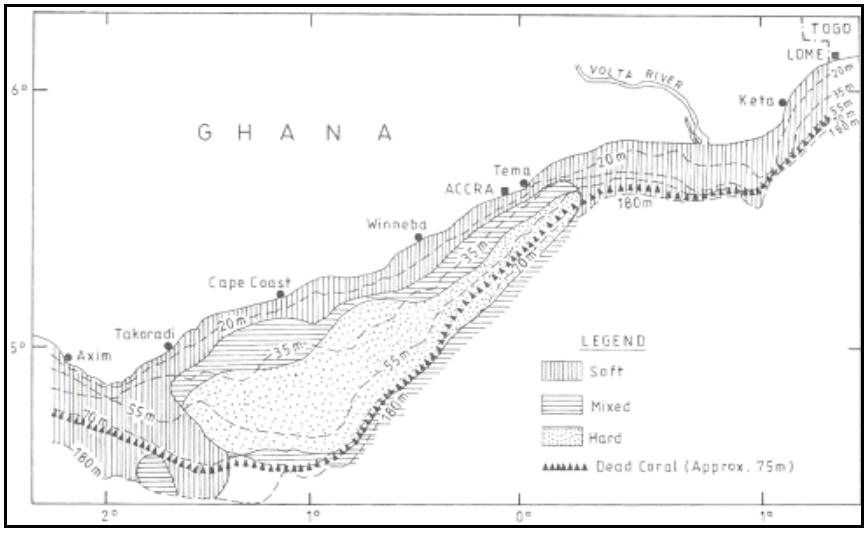

Figure 3: Map of southern Ghana showing the location of dead madreporarian corals

Sandy Shores

In the Western Region sandy beaches occur over a distance of 72 km from the Amanzule estuary to New-Town on the Ghana-Ivory Coast border. Sandy beaches can also be found near the Pra, Whin and Butre estuaries.

The sandy shores are important nesting grounds for marine turtles, and for beach tourism. Species diversity on the sandy beaches with steep slopes is generally low, with the ghost crab *Ocypoda cursor* as a common species. Species diversity is however relatively higher on the fine-grained flat beaches. Commonly encountered fauna include isopods, amphipods, mysids and polychaetes.

Rocky Shores

Rocky beaches occur at Takoradi, Princess town, and Axim with considerable colonization by barnacles (Plate 1). They also support a wide variety of macroalgae which serve as important microhabitats for epifauna and fish. There are also a wide variety of molluscs, and crustaceans including littorinid snails and crabs.

Plate 1: Rocky Shore at low tide showing algae growth
(Source: EPA, 2004)

Marine Fisheries

Fish Species Composition

Composition of finfish and shellfish species in catches of the four Districts (combined data for 2007 and 2008) are presented in Appendices 3 and 4. Forty-eight species of finfish and unidentified sea breams, snappers, groupers, sea catfishes, rays and sharks occur in the catches from the area. Two species of shellfish plus unidentified shrimps are present in the catches from the Region. Small pelagic fish are the most important in the fisheries followed by large pelagic fish and demersal fish. The most important small pelagic fishes include the round sardinella, *Sardinella aurita*, the flat sardinella *Sardinella madarensis*, the long-finned herring *Ilisha africana* and the chub mackerel *Scomber japonicus*. Important large pelagic fishes as the skipjack tuna *Katsuwonus pelamis*, Atlantic sailfish *Istiophorus albicans* and blue marlins *Makaira nigricans* are found in Shama-Ahanta East and Nzema East, and the flying fish (Exocoetidae) in Ahanta West. Large pelagic fishes are however absent in the Jomoro catches apparently because the main fishing activity is beach seining which targets the resources in shallow coastal waters.

A number of demersal species occur in the catches, the most important being the burrito *Brachydeuterus auritus* in Shama-Ahanta-East, Ahanta West, and Nzema East. Most species of the Sparidae, a highly economic group e.g. *Dentex congoensis, D. angolensis, D. gibbosus, Pagellus bellottii,* and *Boops boops* are also found in Shama-Ahanta East. Shrimps and lobsters occur in Shama-Ahanta East and Ahanta West but these are lowly represented in the fishery.

Wetland Ecosystems

Ten wetlands types based on the classification of the *Ramsar Convention on Wetlands (Ramsar, Iran, 1971)* occur in the coastal zone of Ghana (Gordon, *et. al.*, 1998). The wetland types occurring in the Western Region are shown in Table 3. Unlike lagoons in the eastern coast of Ghana, several Western Region lagoons are freshwater due to the high precipitation in the area (> 2000 mm per annum) engendering high freshwater runoff and stream flow into the wetlands (Finlayson *et al*., 2000). Some of these are "depression wetlands" with no connection to major water courses (Table 4). Lagoons of importance in the Western Region are Tano/Aby/Ehy Lagoon (410 km^2) and Amanzule Lagoon (2.5 km^2) near Benyin both in Jomoro District. The latter has been proposed for designation as a Ramsar Site. Other lagoons in the Region are relatively small (<1 km^2). Major rivers and their associated estuaries are also located in the coastal area. These are Tano, Amanzule, Ankobra, Butre and Pra River. Red mangroves (*Rhizophora harisonii*, *Rhizophora mangle*, and *Rhizophora racemosa*) with their distinct prop roots are common in these estuarine wetlands where there is mixing of fresh and saline waters (Plate 1).

Table 3:Coastal Wetland Types

Type	Example/Location
Shallow marine water	Entire coast
Rocky marine shores	Cape Three Points, Dixcove, Axim
Estuarine waters	Ankobra, Butre, Whin, Pra estuaries
Salt marshes	Whin River estuary
Mangrove tidal forest	Ankobra, and Pra estuaries
Brackish/saline lagoons	Open lagoons, e.g. Butre, Whin, Esai Closed lagoons, e.g. Ahunli,
Coastal freshwater lagoons	Belibangara, Ndumakaka, Efasu lagoon

(Source: WB/EPA, 1996)

Table 4: Depression Wetlands

Name	Size (km^2)	Uses
Belibangara	0.5	WH, F
Ndumakaka	0.2	WH
Efasu	0.3	WH
Ehuli	1.4	WH, F

WH = wildlife habitat; F = Fishing

(Source: Armah, 1993b)

Plate 2: Red mangrove forest at Amanzule River at Esiama
(Photo credit: F. K. E. Nunoo)

Wetland Vegetation

In the Western Region mangrove stands are best developed between Cape three Points and Ivory Coast. These stands are restricted in area and usually found as thickets at estuaries and along some lagoons (Hughes and Hughes, 1991). The lagoon mangroves exhibit zonation of communities. Typically *Rhizophora* and *Laguncularia* species arre found on the seaward side of saline lagoons whilst *Avecinnia* is found on the landward side of the swamps (FAO/UNEP, 1981). In the open shoe mangroves are generally absent.
In "Open" lagoons, *Rhizophora* are common in main channels whilst *Avecinnia* species occur in the quieter backwaters. In "Closed" lagoons where salinities can be very high *Avecinnia* predominates with *Rhizophora* normally absent (Ewer and Hall, 1972). Mangroves are typically accompanied in the marshes by the fern *Acrostichum aureum* and grass *Paspalum vaginatum*.

Fresh and sometimes near brackish swamp forests have fewr large tress which include *Hallea stipulosa* and *H. ladermanii*. Other swamp vegetation includes raphia palms (*Raphia palma-pinus*, *R. hookeri* and climbing palms (*Calamus deeratus* and *Lacosperma secondiflora*).

Wetland Fisheries

Aby Lagoon

Dankwa and Abban (1996) identified 27 species belonging to 25 genera and 18 families while Dankwa *et al*. (1997) reported 33 species from 20 families in this lagoon. The fishes include freshwater, brackish water and marine elements but freshwater fish are dominant. Fishes of the Family Bagridae (26%) dominate the community of 11 families from the littoral areas while the 15 families in open waters are predominantly Mugilidae (37%). The high incidence of freshwater species in the lagoon has been attributed to the high influx of freshwater from the Tano River (Dankwa and Abban, 1996).

Amanzule Lagoon and Estuary

The Amanzule wetlands comprise a network of freshwater and brackish water lagoons. Seven fish species have been reported in the Amanzule freshwater lagoon

(Abban and Dankwa, 2001; Entsua-Mensah and de Graft-Johnson, 2004) with numerical compositions as follows: *Chrysichthys nigrodigitatus* (60%), *Hepsetus odoe* (12.4%), *Hemichromis fasciatus* (8.1%), *Brycinus longipinnis* (8%), *Tilapia guineensis* (5.9%), *Sarotherodon melanotheron* (4.8%), and *Parachanna obscura* (0.5%).

Abban and Dankwa (2001) have also reported five species mainly *Chrysichthys nigrodigitatus* (75%) in the Amanzule Estuary including two marine species (*Mugil bananensis*, 6.3% and *Elops senegalensis*, 6.3%). The black-chinned tilapia *Sarotherodon melanotheron*, which dominates many lagoons on the eastern shores of Ghana (Pauly, 1975, 1976; Ntiamoa-Baidu, 1991; Blay and Asabere-Ameyaw, 1993), constitutes just 6.3% of the fish community Amanzule Estuary.

Other Lagoons

Lists of the fish fauna found in a number of smaller lagoons in the Western Region have been provided by Dankwa *et al*. (1997) with species richness ranging between 3 species and 26 species. Most of the communities are represented by freshwater, brackish water, and marine species.

Ankobra and Pra Estuaries

The available information on the fishes of estuaries of the Ankobra and Pra Rivers is a checklist of the species found in these waters (Dankwa *et al*., 1997). Of the 31 species found in the Ankobra Estuary 25 species are from the sea. The only freshwater elements are *Chrysischthys nigrodigitatus* (Bagridae) and the Cichlidae species *Tilapia zillii*, *T. guineensis* and *Sarotherodon galilaeus*. The black-chinned tilapia *Sarotherodon melanotheron* and the goby *Periophthalmus barbarus* (designated as *Periophthalmus papilio* in the list) are the only typically brackish water fish recorded in the list.

Among the 32 species found in the Pra Estuary, ten are freshwater species, two are brackish water species (*Sarotherodon melanotheron* and *Periophthalmus barbarus*) and the remaining are marine fishes.

4.2 TERRESTRIAL VEGETATION TYPES

The coastal terrestrial vegetation types of the Western Region are shown in Figures 4a and 4b.

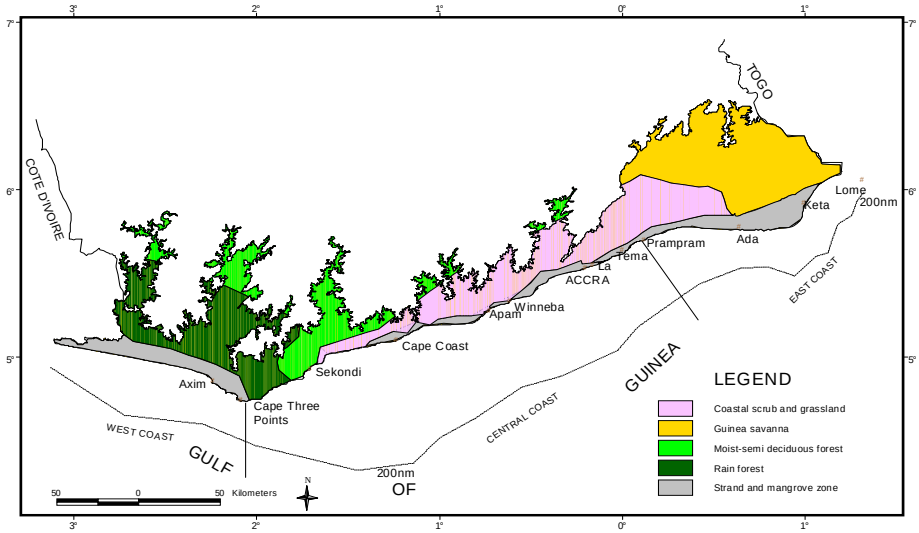

Figure 4: Map of Western Region (Source: www.ghanadistricts.com) Vegetation of the Coastal Zone of Ghana

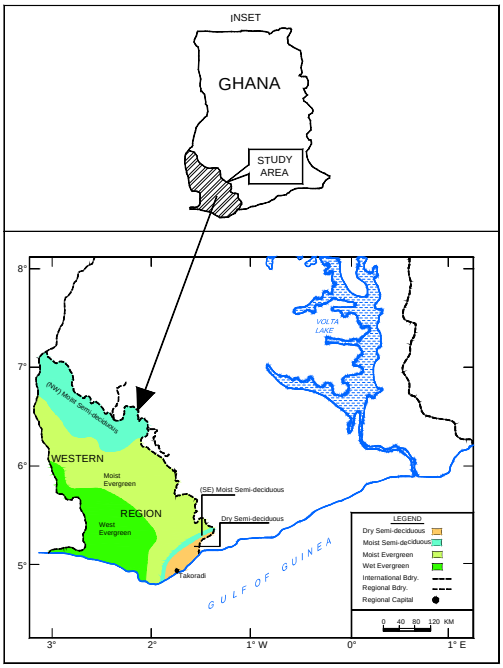

Figure 5: Forest Vegetation of the Western Region

Forest Vegetation

The Rain Forest is made up of the Moist Evergreen (ME) and Wet Evergreen (WE) Forests

Wet Evergreen (WE) Forest

The wet evergreen forest is restricted to the highest rainfall (1500-2100 mm) areas and contains the highest concentration of rare and endemic species in the country (Hawthorne and Abu-Juam, 1993). It is the least disturbed forest type in Ghana and is reasonably well represented in the Nini-Suhien National Park and Ankasa Resource Reserve where the only endemic forest genus, *Monocyclanthus* (Annonaceae), is found.

Moist Evergreen (ME) Forest

This forest type is located in areas that receive 1500 to 1750 mm of rainfall and is usually found between the WE to the south and the Moist Semideciduous (MSD) forest to the north. The flora is slightly less diverse than the WE but contains more commercial timber tree species and has, therefore, been more heavily impacted by logging. Timber trees of economic value include *Khaya ivorensis* (African mahogany), *Triplochiton scleroxylon* (African white wood) and *Terminalia ivorensis* (Ivory Coast almond).

Moist Semi-Deciduous (MS-D) Forest

This forest type is found in areas with annual mean rainfall between 1250 mm and 1700 mm. It is the most productive although species diversity is relatively lower than the ME and represents about 40 percent of the closed forest zone. Two subtypes are recognized; the drier northwest subtype, where forest elephant populations occur, and the southeast subtype. This type of forest can be found at the Bia National Park and Ajenjua Bepo.

Dry Semi-Deciduous (DSD) Forest

A narrow strip of DSD forest occurs to the north and east of the MSD subtypes separating the closed forest from the northern savanna. Rainfall varies between 1250 and 1500 mm. Species diversity is low with fewer economic timber trees. Like the MSD, the DSD also has two subtypes, a wetter Inner Zone with a higher amount of rainfall and a drier Fire Zone characterized by periodic fires. The latter zone is often referred to as derives savanna due to its destruction by farming and subsequent invasion by grass savanna trees. This zone, along with the northern savanna, supplies much of Ghana's fuel wood.

Coastline Vegetation

Zone of Saline Grasslands and Evergreen Shrubs and Thickets

The saline grassland zone is characterized by salt tolerant grasses like *Paspalum vaginatum*, *Sporobolus robustus*, the rhizomatous sedge *Cyperus articulatus* and the succulent forb *Sesuvium portulacastrum* foun madreporarian corals d nearer to the shore of lagoons. Further landwards on floodable higher ground are grasses such as *Brachiaria distachyoides, Imperata cylindrica, Panicum repens*, tall grasses such as *Andropogon gayanus, and Vetiveria fulvibarbis.* Others are the herbs *Cassia mimosoides and Croton lobatus*, and sedge *Fimbristylis pilosa.*
The coastal evergreen shrubs and thickets zone originally formed a narrow band, usually less than 1 mile wide and has fewer indigenous woody plants but most of it has now been cleared for coconuts. This thicket is not of the compact thorny type found further east, but is more open, consisting of bushes and small trees, many of them belonging to the Rubiaceae. The commonest species is *Syzygium guiñéense*, a shrub or tree with shiny leaves and purplish black edible fruits, which is often associated with *Dialium guineense, Chrysobalanus ellipticus, Gaertnera paniculata, Uvaria globosa, Baphia nitida, Ochthocosmus chippii* and species of *Canthium* and *Ixora*.

Sand Dune Vegetation

Coconut (*Cocos nucifera*) plantations dominate the dunes whilst the ground cover is dominated by rhizomatous and straggling species including the sedges *Cyperus maritime* and *Remirea maritime*, the herbs, *Alternanthera maritima, Canavalia rosea*, and *Ipomoea pes-caprae*, and the grasses *Paspalum vaginatum, Sporobolus robustus* and *S. virginicus.* The creeping succulent forb *Sesuvium portulacastrum, Philoxerus vermicularis*, and xerophytes *Euphorbia glancophyll* and *Opuntia vulgaris* exist in the zone. Occasionally *Thespesia populnea* and the Indian almond *Terminalia catapa* may also occur.

4.3 INVASIVE SPECIES IN COASTAL WATERS

The Tano/Abby/Ehy lagoon complex on the south west border of Ghana and Ivory Coast has a large population of invasive plants notably the water hyacinth *Eichhornia crassipes*, the Kariba weed *Salvinia molesta*, water lettuce *Pistia stratiotes* and the Hippo grass *Vossia cuspidata.* Up to 25 km of the shoreline of the lagoon on the Ghanaian side is covered by these weeds (EPA, 2004) thus inhibiting transportation of goods and people between the two countries. The weeds have caused a reduction in fish catches (Holcik, 1995), and there is evidence of total blockage of the River Tano at times. Dense green filamentous algal blooms identified as *Enteromorpha flexuosa* have periodically been recorded between Axim and Half Assini, a phenomenon which hinders fishing activities in the area.

4.4 SPECIES OF SPECIAL CONCERN AND FLAGSHIP SPECIES

Marine Turtles

GWS (2000) has reported that the 72 km stretch of beach from the Amanzule estuary to New-Town on the Ghana-Ivory Coast border in the Western Region is a major turtle nesting area. Few turtles have also been found nesting on the sandy beaches of Butre, Princess Town, Miamia and Axim. The Olive Ridley, the Green and Leatherback turtles are common during the nesting season (Table 5). Major beaches in the region important for turtle nesting and conservation occur at Butre, Busua, Akwida, Azile, Cape Three Points, Axim, Beyin, Ankobra, and Half Assini (Doak, 2009).

Table 5: Sea turtle species occurrence in the west coast of Ghana

Common Name	Genus	Possibility of being Observed
Olive Redley Turtle	*Lepidochelys olivacea*	Most common
Green Turtle	*Chelonia mydas*	Common
Leatherback Turtle	*Dermochelys coriacea*	Common
Hawksbill Turtle	*Eretmochelys imbricata*	Rarely
Loggerhead Turtle	*Caretta caretta*	Not seen in recent years
Kemps Ridley Turtle	*Lepidochelys kempii*	Yet to be recorded

(Source: Doak, 2009)

Manatees

Roth and Waitkuwait (1986) and Powell (1996) reported that the West African manatee (Trichechus senegalensis) might occur in the Abby/Tano/Ehy Lagoon complex. However, studies conducted by the Institute of Aquatic Biology of the Council for Scientific and Industrial Research (CSIR) and the Wildlife Department in Ghana indicate they do occur in the Tano river and the Tano/Abbey/Ehy Lagoon complex (Entsua-Mensah and Ankudey, 1995). Locations of manatees in Ghana are shown in Fig. 6.

Although the Nzema regard the manatee as a deity, they nevertheless exploit it as food. Because it is a taboo for a woman to behold the face of a dead manatee, elaborate rituals are performed and the head cut off before the carcass is delivered to the women for processing.

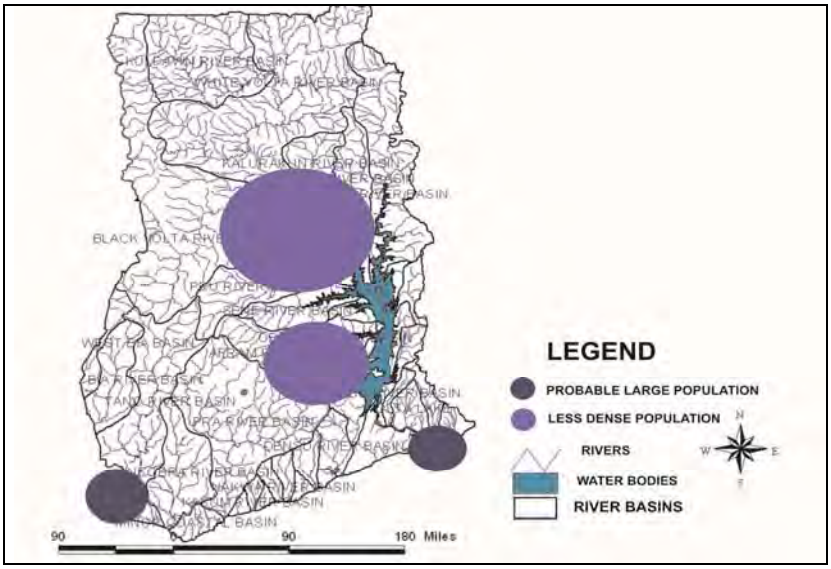

Figure 6: Manatee Locations in Ghana
(Source: EPA, 2004)

Dolphins

Dolphins occur as bycatch in the fisheries of some areas in the region. Three species have been reported at Dixcove and Axim (Debrah, 2000; Ofori-Danson, 2003).

Shore Birds

The shorebirds in Western Region include various species of waders and terns (GWS Annual Report, 2001, 2002/2003). Other coastal birds found in the Region include ducks, cormorants, herons and egrets. The most abundant species include the white-face tree duck, little egret and the Western reef heron (GWS Annual Reports 2000, 2001, 2002/2003).

The beach at Esiama, reported to host about 10,000 shore birds annually (EPC, 1990), and the River Whin estuary are important bird sites (GWS Annual Report, 2001). The Amanzule wetlands are also among the 36 Important Bird Areas (IBAs) designated by Birdlife International in Ghana (Birdlife International, 2009).

4.5 IMPORTANT BIRD AREAS (IBAs) AND BIODIVERSITY 'HOT' SPOTS

An inventory by Ntiamoa-Baidu *et al.* (2001), showed that of the 36 Important Bird Areas (IBAs) identified in the country eighteen occur in the Western Region (Fig. 7). Two of these, the Amanzule wetlands and Cape Three Point Forest Reserve, are located on the coast.

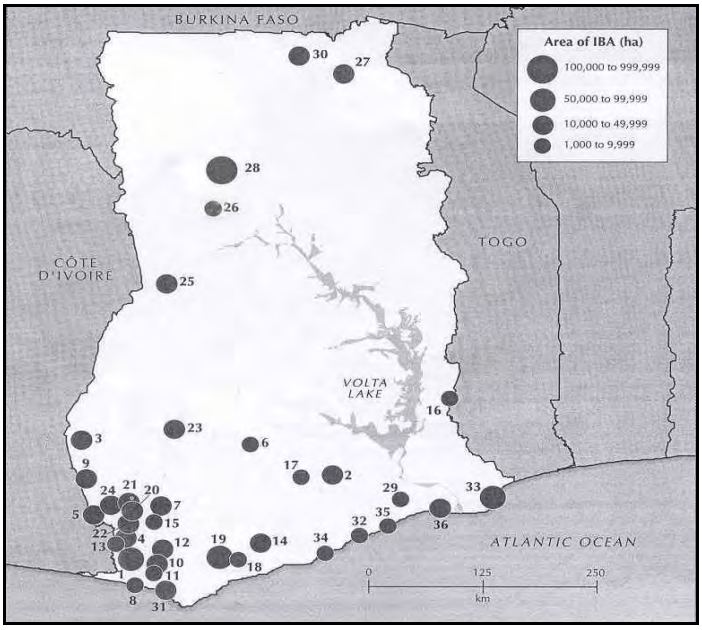

Figure 7: Location and size of Important Bird Areas in Ghana (Source: Ntiamoa-Baidu, *et al*., 2001).

Amanzule Wetland

The Amanzule wetlands (4º 55' N 20º 15' W) covers an area of 3.8 km2. The area is designated as an IBA by Birdlife International and has been proposed for listing under the Ramsar Convention in the National Wetlands Conservation Strategy and Action Plan (2007-2016) (MLF, 2007).

The soils of the basin belong to the Fredericksburg association. There are two main series in evidence. The Mpataba series is a black, acid, peaty soil. It is formed under waterlogged conditions where accumulated organic matter cannot decompose rapidly. It is classified as a very acid cumulosol. The Atuabo series is a highly leached ground water podzol with a well-developed organic pan. It occurs in the flat low lying, fine alluvial deposits that fill the sites of the former coastal lagoons. It is unique in that it forms small edaphic savanna patches.

Plate 3: Edaphic savanna patches with Borasus palm Borasus aethiopum (Photo credit: K. A. A. de Graft-Johnson)

The Amanzule catchment lies within the Wet Evergreen forest zone of Ghana. This forest type is restricted to the highest rainfall zones. The vegetation in the wetland is described as swamp forest on the basis of its floristic composition. The swamp forest contains fewer large trees than surrounding high forest and is also poorer in species.
Recent preliminary biodiversity survey carried out in the wetland indicates that five main vegetation types exist in the area. These are the aquatic vegetation, swamp and mangrove forest, 'forest islands' or thickets, grassland and farmlands. More than 70% of the area is covered by swamp and mangrove forest. The main aquatic vegetation comprises of floating macrophytes Vossia cuspidata, Pistia and Nymphaea species. A total of 237 plant species belonging to 51 different families have been identified in the swamp and mangrove forest, 'forest islands', grassland and farmlands.

Plate 4: Peat swamps with dead tree stumps in R. Ebi in Amanzule catchment
(Photo credit: K. A. A. de Graft-Johnson)

Life form categories of species in the forest indicate that trees mainly constitute 48% compared to climbers and lianes (20%), shrubs (3%) and herbs (3%). In the swamp forest the common tree is the Raphia vinifera (Enu Kwesi and Vordzorgbe, 2001).
The Amanzule's coastal catchments: including the coastal lagoon, estuary and Esiama beach, all support appreciable numbers of waterbirds. Up to 30 Himantopus ostralegus are regularly seen on the beach, the only site along the Ghana coast where the species is seen with any degree of frequency. Some important bird species occurring in the inland freshwater lagoon and swamp areas include gallinules, crakes and jacanas.

Nine mammal species are of global and national conservation interest have been recorded at the site. These include Beecrofts flying squirrel (Anomalurus beecrofti), Forest palm squirrel (Epixerns ebii), Black-and-white colobus (Colobus polykomos), Senegal galago (Galago senegalensis), Bosman's potto (Perodicticus potto), Tree pangolin (Phataginus tricuspis), Long-tailed pangolin (Uromanis tetradactyla), African civet (Civettictis cita) and African palm civet (Nandina binotata) all of which are wholly protected in Ghana.
Five reptiles species; Leatherback turtle (Dermochelys coriecea), Green turtle (Chelonia mydas), Olive ridley turtle (Lepidochelys olivacea), Slender-snouted crocodile (*Crocodylus cataphractus)* and Dwarf crocodile (*Osteolamus tetraspis)*

listed in IUCN *Red list of Threatened Animals* and are also wholly protected in Ghana have also been recorded at the site (Attuquayefio, 2000).
The catchment area and the nearby Esiama beach support appreciable numbers of waterbirds. Key bird species include the Sanderling (*Calidris alba*) and Royal Tern (Sterna *maxima*). Other common species occurring at the site include *Pluvialis squatarola, Charadrius hiaticula, Tringa hypoleucos* and *Arenaria interpres*. Up to 30 *Himantopus ostralegus* are regularly seen on the beach, the only site along the Ghana coast where the species is seen with any degree of frequency. In addition to *Sterna maxima*, small flocks of *S. sandvicensis, S. hirundo* and *Chlidonias niger* also regularly roost on sandbanks in the estuary. Species occurring in the inland freshwater lagoon and swamp areas include gallinules, crakes and jacanas. The avifauna of the rest of the catchment has not been studied.

Cape Three Points Forest Reserve

Cape Three Points Forest Reserve (4° 50' N and 2° 30' W) is located near Princess Town. It has an area of 51 km² and is about 12 km long on its north-south axis. It is the only extensive remnant of intact moist evergreen rain forest in Ghana (Hall & Swaine, 1976). The scenic beauty of the area and its close proximity to the sea (c. 3 km from the coast) makes it unique. This forest is traversed by small tributaries which feed the Nyani River on the western side and the Sweni stream on the eastern side.

Three globally-threatened bird species are known to occur in this forest- the "near threatened" hornbill *Ceratogymna elata*, the "vulnerable" greenbulls *Bleda eximius* and *Criniger olivaceus*, which are uncommon but characteristic of this type of primary forest (Dowsett *et al*., 2005).

Ankasa Conservation Area

The Ankasa Conservation Area is a twin component reserve covering 523.2 km^2, and comprises the Ankasa Resource Reserve (348.7 km^2) in the south and the Nini-Suhien National Park (174.5 km^2) in the north (Hall & Swaine, 1976). The reserve was established in August 1976 (Wildlife Reserves Regulations; L.I. 1085) as a Wildlife protected area, and a revocation of the formerly Ankasa River Forest Reserve, under the then Forestry Department. The Ankasa Resource Reserve had been selectively logged sporadically in the southern area from 1891 up to the 1950's and again from 1974 - 75, where after, logging operations were prohibited (Martin, 1976). The Nini-Suhien National Park has presumably never been exposed to commercial logging, and remains the largest virgin rainforest in Ghana.

According to Martin (1976), wildlife was abundant at the time of establishing the reserve, including presently endangered primates: Western Chimpanzee *Pan troglodytes verus*, Miss Waldron's Red Colobus *Procolobus badius waldroni*, Western Black & White Colobus *Colobus polykomos vellerosus*, Roloway's Diana Monkey *Cercopithecus diana roloway* and White-crested Mangabey *Cercocebus atys lunulatus*. Subsequent high hunting pressures reduced abundances of virtually all species, with some, such as the Red Colobus and Diana Monkey facing threats extinction. Hunting activities emanated from a settlement, the Nkwanta village, which

already existed prior to establishment of the Reserve, and has recently been resettled outside the reserve.

The preservation of the Ankasa Conservation Area is of paramount concern and important for scientific study, environmental stability, educational and recreational purposes. It is home to over 800 vascular plant species, 639 butterfly species, more than 131 species of birds and harbours a number of charismatic, rare and endangered species, including forest elephants, bongo, leopard, chimpanzees and possibly up to eight species of forest primates. It has an impressive avifauna and a network of streams that serve as important breeding ground for many of the fish species of the Eburneo-Ghanaian icthyofaunal region.

Ankasa is Ghana's most "special" forest with the highest Genetic Heat Index, where scientists are expected to find more that is unfamiliar than any other forest in Ghana (Hall and Swaine, 1976).
It has been given the highest global conservation rating with high conservation priority species endemic to a small part of the globe. The most recent survey revealed the presence of a number of species, which have uncertain or no names, and pending the confirmation of their taxonomic status.
Ankasa represents the supposed epicentre of one of several Pleistocene refugia around the Gulf of Guinea, ranking alongside forests of southwest Ivory Coast and Mount Cameroon. Relatively little is known of the vegetation of Ankasa compared to the rest of Ghana, largely because the Forest Services Division deemed that the Reserve was of low timber importance during the period when it was gazetted as a Forest Reserve.
The most recent detailed studies (MLF, 1994) have shown the presence of approximately 800 vascular plant species.
A number ornamental of plants also occur on the forest floor of Ankasa, including the 'house plant' *Psychotria ankasensis*, which has key potential for commercialization with financial returns to the surrounding communities.

Plate 5: Psychotria ankasensis: A ground cover plant endemic to Ankasa
(*Source:* WD, 2010, Anakasa Conservation Area Management Plan).

Other ornamental plants of economic importance, but not restricted to the Ankasa area and may all be in cultivation already, are the red-flowered *Ixora coccinea*; the three common *Begonias*–*Begonia ciliobracteata* (common on rocks near rivers); *Begonia macrocarpa* (more widespread) and *Begonia quadrialata* (with peltate leaves and pinkish hairs, often near streams as well).

The original faunal composition of Ankasa, prior to its gazettment, was undoubtedly very diverse and complex in nature and similar to other large protected areas in the wet evergreen rainforest of the Upper Guinea forest belt, e.g. *Taï* in Ivory Coast. However, due to over three decades of excessive commercial and subsistence bushmeat hunting, populations of several larger mammals, particularly canopy dwelling primates, reptiles and lately also bird species have been severely reduced in numbers. However, recent reliable observations give substantial indications that nearly all species believed to have been present in prehistoric times still exist. Presently, only the avifauna is relatively well explored. Fish and small mammals recently have been covered by short-term surveys under the Protected Area Development Programme (PADP).

Ankasa holds viable populations of large and charismatic mammals, such as the Forest Elephant *Loxodonta africana cyclotis*, Bongo *Tragelaphus euryceros*, Leopard *Panthera pardus* and Yellow-backed Duiker *Cephalophus sylvicultor*.
Primates are represented by at least 9 species, including Western Chimpanzee *Pan troglodytes verus* and 3 rare or endangered subspecies endemic to Côte d'Ivoire and Ghana: Roloway Diana Monkey *Cercopithecus diana roloway*, Geoffroy's Pied Colobus *Colobus vellerosus* and White-naped Sooty Mangabey *Cercocebus atys lunulatus*. Presently, it is highly speculated that the highly endangered subspecies, Miss Waldron's Red Colobus *Piliocolobus badius waldronae*, endemic to Ghana/Eastern Côte d'Ivoire and that had recently been declared extinct in Ghana, is to be found in *Ankasa* (Oates, *et. al.*, 2000).
Other very rare mammals of restricted range within Ghana include the Water Chevrotain *Hyemoschus aquaticus*, Giant Forest Hog *Hylochoerus meinertzhageni* and Giant Pangolin *Smutsia gigantea*. Recent studies of small mammals, i.e. rodents and bats (PADP, 1998), showed a relatively high diversity, particularly in the Resource Reserve and along forest edges.

Ankasa has an impressive list of nearly 131 species of birds, the majority of these being truly forest dependant (The list contains several rare birds endemic to the Upper Guinea Forest, e.g. White-breasted Guinea Fowl Agelastes meleagrides, Yellow-throated Olive Greenbul Criniger olivaceus and Rufous-winged Illadopsis Malacocincla rufescens. It is very likely that two other endangered endemics occur in the reserve, namely Western Wattled Cuckoo-shrike Campephaga lobata and Rufous Fishing Owl Scotopelia ussheri). Other species of conservation importance are four species of large casqued hornbills Ceratogymna spp, which still occur in fairly large numbers. The Ankasa bird fauna certainly provides a basis for very attractive bird watching tourism.

Ankasa has little information on reptiles and amphibians. The extensive network of smaller streams, together with the 3 main rivers of the reserve similarly supports a variety of reptiles including the Broad-fronted Crocodile Osteolaemis tetraspis. The extensive permanently waterlogged Raphia swamps situated in the eastern and southern parts of the Resource Reserve is an ideal habitat for all species of rainforest turtles and aquatic snakes, tortoises and lizards. Terrestrial and aquatic frogs and toads, particularly, tree frog diversity is believed to be high, due to the consistent high humidity in the upper closed canopy.

The icthyofauna of Ankasa holds many important endemic species of the eburneo-Ghanaian icthyofaunal region, some of them occurring only within the borders of Ghana. Several species not previously recorded in Ghana are present. However, the drainages within the forest block differ in species distribution and are therefore not homogeneous in biogeographical and ecological terms. In a 1998 survey two species of fish new to science and still to be named were found in streams draining from the Protected Area (PADP, 2000).

Again, little is known of the invertebrates expected in such a forest as Ankasa. Very few butterfly inventories exist for any parts of West Africa. However, according to Larsen (1997) Ghana has a total butterfly fauna of almost 900 species. A butterfly inventory of Ankasa estimated 600 species (Larsen, 2000).

The major threats to the integrity of the Ankasa Protected Area comes from external pressures arising from the increasing human population, uncontrolled immigration and settlement, change in land use with subsequent depletion and degradation of natural resources off-reserve. The fringing off-reserve areas of Ankasa PA are governed by a plethora of national and local government institutions and traditional authorities, arbitrated by archaic legislation and conflicting policies frequently developed in isolation of each other. The implementation of the laws and regulations are further constrained by lack of both human and physical resources. The future integrity of Ankasa Protected Area lies on developing a system through which these disparate players can interact and a programme of intervention involving resource input, training and education (WD, Anakasa Conservation Area Management Plan, 2010). This will enable and empower stakeholders to regulate their resource use efficiently.

5.0 THREATS TO TERRESTRIAL AND MARINE BIODIVERSITY CONSERVATION IN THE REGION

5.1 INTRODUCTION

The major threats to terrestrial and marine habitats and their biodiversity conservation in coastal Western Region have been identified as over-exploitation of fisheries resources, loss of coastal habitats, pollution of the marine and coastal environments, high population growth, by-catch of endangered species, and coastal erosion (World Bank/EPA, 1996). These have further been exacerbated by weak institutional capacity to deal with the threats.

5.2 OVER EXPLOITATION OF MARINE FISHERIES RESOURCES

The factors responsible for overfishing in the marine waters of Ghana are over-capitalization of the fishing industry, use of small mesh nets (< 1cm stretched mesh) in the beach seine fishery resulting in "growth overfishing" and hence low recruitment of juvenile fish to the "fishable" stocks, and exploitation of the resources using poisons which pollute the environment and affect non-target organisms. 'Light fishing', a technique with profound negative effects on fisheries productivity because it takes undersize and spawning fish, is also popular among many inshore fishers despite continuous education about its demerits.

Records from the Fisheries Directorate show some increases in the number of various fleets from the early 1990s to the early 2000s (Table 6). The number of industrial trawlers almost doubled while canoes increased by about 24% over the period. The introduction of pair trawling in 2000 further increased the pressure on the stocks. In spite of the increasing fishing effort due apparently to the increasing coastal population, there has not been any significant increases in the catch rate in recent times as catches (Fig. 9) fluctuated around the MSY of 300,000 mt between 1993 and 2004 (Anon, 2003; Fisheries Directorate, 2005) while 291,000 mt was landed in 2007 (Fisheries Directorate unpubl. data).

Table 6: Changes in national fishing fleet sizes from 1990-2002

Year	Ind. Trawl	Shrimper	Pair Trawl	Inshore	Canoes
1990	27	10		183	8052
1991	22	12		148	8052
1992	35	5		152	8688
1993	24	5		161	8688
1994	34	11		141	8688
1995	45	17		182	8641
1996	35	16		165	8641
1997	40	13		149	8610
1998	36	8		173	8610
1999	35	7		173	8610
2000	30	8	3	167	8610
2001	37	6	-	178	9981
2002	48	2	-	200	9981

(Source: Fisheries Directorate)

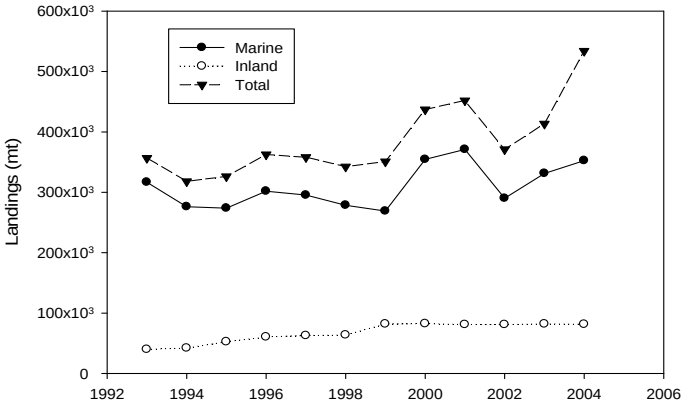

Figure 8: Fish Production in Ghana (1992-2004)

Approximately 2,400 motorized and non-motorized dugout canoes operate from 80 landing sites in the Western Region (Amador *et al.*, 2006).

5.2.1 BY-CATCH OF ENDANGERED SPECIES

One of the crucial factors contributing to the depletion of endangered species is the by-catch and subsequent discarding of species. Except for tunas which are caught mainly by pole-lining, there are no specialized gears for catching pelagic species in Ghana, and as a result several pelagic fishes are taken as by-catches in the sardinella fishery which employs set gill nets, drift gill nets, and purse seines (Mensah and Koranteng, 1988). These fishing gears occasionally capture significant numbers of endagered species including sea turtles, seabirds, dolphins and sharks. The West Africa manatee population in the Tano/Aby/Ehy lagoon and river complex is also threatened by accidental catches in fishing nets

5.3 LOSS OF COASTAL HABITATS

There are no records on the rates of coastal habitat loss in the Region although losses have occurred over the years. Natural coastal habitats have been replaced with coconut, rubber and oil palm plantations over several years resulting in large hectares of mono- crops and thus threatening indigenous biodiversity.

Wetland reclamation for development and waste disposal has led to the loss of many lagoons and wetlands. Examples are the Esai lagoon in Sekondi, Effiakuma wetlands, and Whin River estuary and wetlands at Takoradi. Excessive harvesting of mangrove as fuel wood as fuelwood and 290,705 mt in 2007 (Fisheries Directorate) building material has affected the mangrove ecosystem along the River Ankobra estuary the Amanzule wetlands and the Whin River estuary. However, the extent of mangrove depletion in the country as a whole and the Western Region in particular is unknown (WRI, 2006).

Mining of beach sand and gravel for infrastructure development has also impacted negatively on sandy shore fauna while tourism development on the beaches have potential negative on turtle nesting.

5.4 POLLUTION OF MARINE AND COASTAL ENVIRONMENT

The threats to aquatic biodiversity in the Region come from municipal, agricultural, and industrial activities. The key sources of pollution in the Regions's coastal Districts are waste products from coconut oil extraction, discharge of human excreta, and solid waste especially plastics into streams, wetlands and the sea. Litter entering the marine environment is known to kill sea turtles, dolphins and sea birds (UNEP, 1995). An assessment in 1994 indicated a 'high' domestic pollution for Sekondi-Takoradi Metropolis compared to Nzema East, Ahanta West and Jomoro (EPA, 2004). The projected pollution indices for domestic and industrial pollution (Table 7) indicate that by the year 2020 pollution in the coastal Districts would have increased severalfold from the 1994 estimates.

Table 7: Pollution indices in four coastal districts

DISTRICT	Domestic Pollution Index 1994	Domestic Pollution Index 2020	Industrial Pollution Index 1994	Industrial Pollution Index 2020
Nzema East	249	527	5	100
Ahanta West	261	521	5	111
Ahanta East	672	1702	39	827
Jomoro	194	406	4	74

Source: World Bank/EPA (1996)

5.5 COASTAL EROSION

The Ghanaian coast is exposed to various degrees of erosion with moderate rates occurring in the Western Region (World Bank/EPA, 1996; Armah and Amlalo, 1998). Erosion at Essipon (Turtle Cove) in the former Shama Ahanta East District, Busua in Ahanta West and Axim in Nzema East District has resulted in loss of sea turtles nesting beaches. In adition fish landing sites at Princess Town, Poasi (Nkontonpo) and Essipon have been deserted as a result of severe coastal erosion (EPA, 2004).

Generally, the natural causes of erosion are compounded by the effects of human-induced vegetative loss or deforestation. Re-inforcements of waves due to adjacent headlands and man-made structures like breakwaters at the Takoradi Port, Bosumtwi Sam Fishing Harbour and Naval Base at Sekondi seem to be the most likely cause of erosion at Princess town, Adjoa, Nkontompo, and Essipon. Sand and stone winning activities along the coast especially in Axim have led to considerable sea erosion which continues to threaten some communities in that area. Other human causes arise from improper land use such as bush burning, over-grazing and other forms of agricultural land use.

5.6 CHANGES IN SPECIES COMPOSITION AND TROPHIC BALANCES

Some species such as the gastropods Cymbium spp. and the spiny lobster Panulirus sp. appear to be declining in abundance while the sea star Astropecten sp. and other starfishes have disappeared completely. The triggerfish Balistes capriscus was of little interest prior to 1973 but assumed great importance in the demersal fishery from that year (Mensah and Koranteng, 1988) to 1987. The species has since disappeared (Mensah and Quaatey, 2002) a phenomenon that has been attributed to changes in physical oceanographic parameters in the Gulf of Guinea (Koranteng et al., 1996; Aggrey-Fynn, 2007). Collapse of the grey triggerfish (Balistes capriscus) fishery in Ghanaian waters since its dominance in the demersal fishery in the 1970s and 1980s is a major example of a fish species under threat of extinction.

5.7 INCREASED POPULATION DENSITY

Population growth has been identified as an important factor impacting resource conservation planning in the Region. Population growth in rural areas tends to increase the rate of exploitation of resources of fragile ecosystems such as wetlands, the demand for arable land and fuel wood, often resulting in loss of vegetation in marsh and swamp lands. As urban populations increase, demand for food, timber, wood energy and other natural resources grows.

The wave of urbanization and development currently taking place in the coastal areas where 60 per cent of all industries are sited has contributed largely to the increasing population density. With the recent oil and gas find in the Region, coastal wetlands are increasingly being encroached upon for different purposes notably, agriculture, aquaculture, beach sand winning, residential housing development, and economic and social infrastructural development. The net effect is degradation of the coastal environment including wetlands.

While national population density is around 67 persons per km2, the population density in the coastal zone is 263 persons per km2 (WB/EPA, 1996). The Western region has an average population density of 80.5 persons per km2 which is about a quarter of the coastal population. Between 1960 and 1970 the population in the Region grew by 23%, and more than doubled between 1970 and 1984 while increasing by 66% between 1984 and 2000 (Jubilee Field EIA, 2009).

5.8 WEAK GOVERNANCE, LEGISLATION AND INSTITUTIONAL FRAMEWORK

Environmental legislation in Ghana is fragmented, and much of it has been initiated on ad hoc basis due to lack of coherence in environmental planning and policy process. This has resulted in poor coordination of biodiversity conservation and management actions among Government departments, institutions and agencies. The lack of political will, tenure and access rights, non-compliance with regulations, inadequate penalties, unreliable judicial systems, inadequate funding and logistical resources for biodiversity conservation, breakdown of traditional management and cultural traditions militate against good biodiversity conservation practices.

5.9 DEVELOPMENT OF OIL AND GAS RESOURCES

The discovery, of offshore oil and gas reserves in the Region in 2007 and eventual production is envisaged to be a major driver of the economy over the next decade. This development may raise many concerns regarding the potential increase in conflicts with the fishing industry over the use of the marine space, and its potential negative impacts on coastal and marine habitats.

The Jubilee Oil Field is located in deepwater (1100 – 1700 m) approximately 60 km from the nearest coast in western Ghana. The first phase of development will involve the drilling of 17 wells. These wells will constitute a group of nine hydrocarbon production wells to bring oil and gas from underground reservoirs to the surface, and six water and two gas injection wells used to re-inject water and gas back into the reservoirs to maintain pressure and to increase reserve recovery. The wells will be connected on the seabed through a series of subsea wellheads, manifolds and pipelines to a Floating Production Storage and Offloading (FPSO) vessel located on the surface. The FPSO will be used to process and store crude oil and gas. Crude oil will be exported to markets using export tankers (some may be transported direct to the Tema Oil Refinery in Ghana). The on-shore support base will be located at the Takoradi Port or Sekondi Naval Base (Jubilee Field EIA, 2009).

The oil production is likely to have some negative impacts on the marine environment if not properly managed. Notable impacts on biodiversity include noise effects on aquatic mammals such as dolphins and whales, oil spill risk to plankton, benthos and nekton biodiversity including fish stocks. Lights at the facility can negatively affect the orientation of marine turtles as well as attract fishes to the area. Further, the lighting can disturb the timing and spawning behavior of fishes and may likely cause reproductive failures. There is a potential for oil and gas blowout event and this can have devastating impacts on biodiversity covering several kilometers of coastline and even beyond the boundaries of the Western Region.

5.10 CLIMATE CHANGE

Climate change and sea level rise has the potential to severely impact Ghana's shoreline and further weaken the resilience of coastal habitats and biodiversity and human communities living in these areas. Sea level rise will drown mangroves, and requires setting aside buffers to enable coastal dwellers to retreat inland. Productivity of fisheries ecosystems will be altered and migration patterns of highly mobile stocks will likely change and thereby affecting the economy and security of the coastal communities in the Region.

Specific examples of impacts of climate change on Ghana’s coast can be seen at Ngyiresi, Nkotonpo and Dixcove where the beaches have been severely eroded.

5.11 INVASIVE SPECIES AND ALGAL BLOOMS

Invasive species have a major impact on Ghana's coastal environment, threatening fishery resources, and habitats and causing untold socio-economic hardships to coastal communities.

Currently invasive species in the Region include the world's most notorious water weed Eichhornia crassipes (Water hyacinth), Salvinia molesta (Kariba weed), Pistia stratiotes (Water lettuce) and Vossia cuspidata (Hippo grass). These weeds have seriously invaded the Tano River and Tano/Aby/ Ehy lagoon complex. .In addition, the Siam weed (Chromolaena odorata) known locally as "Akyeampong" has also invaded almost all open and fallow lands, whilst Cecropia peltata (French Odwuma) is fast invading the forest ecosystems in the Region.

Since 1993, marine algal blooms caused by the filamentous green alga Enteromorpha flexuosa known locally as "green-green" (EPA, 1996) have been occuring every year (December-February) from Newtown to Cape Three Points. It has also been reported in the rivers and wetlands of the Amanzule at Bakanta and Ankobra at Sanwoma respectively. It is also unsightly and unpleasant (Nunoo & Ameka, 2005). The algal bloom goes beyond the western border into Ivory Coast. It is suspected that the alga grows and blooms in an organic nutrient-rich Ivorian lagoon, most likely the Abidjan lagoon, and are dislodged and washed into the marine environment during the major rains in April-June and September-October/November. The easterly movements of the Gulf of Guinea ocean currents then drive the algal bloom into Ghanaian waters. Cooperation between the two countries is therefore imperative to locate the source and deal with the problem.

There is also the destruction of coconut plantations along the coastal belt by the "Cape Saint Paul's Wilt" (a phytoplasma disease) and erosion of the coastline and its resources. The Ghana Living Standards Survey of 2000 reported that over 73,000 households in the coastal regions of Ghana harvested and depended on coconuts (copra industry) for the year 2000. This constitutes about 61% of the national total of households that depended on coconut harvested for that year. The harvest was valued at US $2.3 million, which was 88% of total national value of harvested coconuts. This gives an indication of the relative importance of the coconut industry in the coastal area of Ghana. It must be noted that the industry as a whole was valued at US $8.84 million in 1997 (Armah & Amlalo, 1998). The destruction of the coconut plantations means the loss of biodiversity associated with coconuts plantations such as lichens and algae and epiphytes on the tree trunks, and undergrowth.

5.12 HUNTING AND POACHING OF BUSH MEAT

Increased population growth in the Western Region has lead to over-exploitation of forest and wildlife resources in recent times. The felling of trees within Forest Reserves is only an infrequent occurrence. The extraction of chewing stick and rattan from Ankasa and other Protected Areas in the Region, for example, are widespread and highly organised. Again in, Ankasa, there is increased pressure on wildlife resources for bush meat trade. The list of animals hunted for bushmeat comprises 82 named species (42 mammal, 35 bird and 5 reptile species). Preferred species by hunters are rodents and antelopes including five species, which make up 60-70% of

the volume of most hunted animal species - Cane Rat, Giant Rat, Black Duiker, Maxwell's Duiker, Brush-tailed Porcupine and Bushbuck

A number of species, especially monkeys, are now severely threatened (Martin, 1976). These include the Diana Monkey and White-naped Mangabey. While the Red Colobus is probably locally extinct, the Bongo, Ogilby's Duiker, Forest Buffalo, Yellow-backed Duiker, Giant Forest Hog, Giant Pangolin, Leopard and White-breasted Guinea-fowl are all threatened from poaching activities (Holbech, 1996).

Sustainable production of bushmeat through domestic sources, such as Cane Rat (grass-cutter) farming, that generates income while encouraging conservation and adequate enforcement of regulations could reduce the threats to wildlife poaching in the region.

6.0 INSTITUTIONAL ARRANGEMENTS FOR BIODIVERSITY CONSERVATION IN GHANA

6.1 INSTITUTIONAL ARRANGEMENTS

Several key government ministries, departments and agencies (MDAs) and non-government organizations (NGOs) and institutions have policy and legislative functions that directly or indirectly affect biodiversity management and conservation of forest, wildlife, and fisheries in Ghana. The key ministries are:

- Ministry of Lands and Natural Resources
- Ministry of Food and Agriculture
- Ministry of Water Resources, Works and Housing
- Ministry of Mines and Energy
- Ministry of Justice
- Ministry of Local Government and Rural Development
- Ministry of Trade and Industry
- Ministry of Environment and Science

Details of the mandates of the key implementing departments, agencies, NGOs and other institutions are presented in Appendix 1.

6.2 INTERNATIONAL MEASURES RELEVANT TO BIOLOGICAL CONSERVATION IN GHANA

Ghana recognizes the important role of international cooperation and linkages in biological diversity conservation. It is a member of a number of international organizations such as the United Nations and its Commissions and agencies, International Tropical Timber Organization, African Timber Organization, the World Conservation Union (IUCN), the African Union, Economic Commission of West African States, etc. Ghana also collaborates with the World Bank, International Monetary Fund and the African Development Bank in programmes aimed at the sustainable development of the country's natural resources.

Ghana is also a signatory to the Convention on Biological Diversity, the Convention on Migratory Species (Bonn), the Convention on International Trade in Endangered

Species (CITES), the Convention to Combat Desertification, the Convention on Climate Change, the World Heritage Convention and the Ramsar Convention on Wetlands under which five coastal and one inland Ramsar Sites have been designated. Ghana also participates in the UNESCO Man and Biosphere Reserve Programme under which one Biosphere Reserve, the Bia National Park in the Western Region has been established. Regionally, Ghana is also a signatory to the African Convention on the Conservation of Nature and Natural Resources.

The Wildlife Division of the Forestry Commission is the implementing agency for four of these biodiversity-related conventions - the African Convention, Bonn Convention, Ramsar and CITES. The Biodiversity Convention is overseen by Ministry of Environment, Science and Technology.

6.3 GOVERNMENT RESPONSE TO POLICIES AND INTERNATIONAL CONVENTIONS

Government has issued a number of policies aimed at sustainable use of resources and managing the environment. However, there is no specific policy on the coastal zone. The policies that are of relevance to the coastal zone and freshwater ecosystems include:

- The National Environmental Policy
- National Wetlands Conservation Strategy and Action Plan (2007-2016)
- Agricultural Policy
- Water Policy
- Tourism Development Policy
- Land Management Policy
- National Health Policy
- Energy Policy
- Minerals Policy
- Forest and Wildlife Policy
- Fisheries Policy
- Biodiversity Strategy and Action Plan
- Oil Spill Contingency Planning Strategy and Response Plan
- Sanitation Strategy

The main thrust and orientation of these policies on the protection, management and development of the marine and coastal environment including freshwater habitats is pivoted around the following areas: -

- Integrated coastal zone management and sustainable development
- Marine environmental protection, both from land and sea-based activities
- Sustainable use and conservation of freshwater and marine living resources

With respect to the above, steps undertaken to ensure the realization of prudent management of the coastal, marine and freshwater resources include:

- Coastal Zone Management Indicative Plan, 1990
- National Environmental Action Plan, 1994

- Draft Integrated Coastal Zone Plan, 1998
- National Oil Spill Contingency Plan with specific reference to the marine environment 2002
- Environmental Sensitivity Map of the coastal areas of Ghana, 1999 and 2004

In addition to the national oil spill contingency plan (2003) a regional oil spill contingency plan is being prepared.

Response to marine and coastal pollution include the ratification and national implementation of international agreements such as the Convention for the Prevention of Pollution from Ships (MARPOL) which emanated from the Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (Abidjan Convention). It is designed to ensure that resource development in West and Central Africa's coastal zone is in harmony with the maintenance of environmental quality.

6.4 ASSESSMENT OF THE GOVERNANCE EFFECTIVENESS FOR BIODIVERSITY CONSERVATION IN GHANA

Most of the legal framework for conservation is considered inadequate. Enforcement has been constrained by limited funding, lack of adequate human capacity, and other logistics. Development considerations have usually taken precedence over conservation issues and this has often been attributed to the ineffectiveness of the EIA process and lack of political will. There is also little coordination among the legislations governing the coastal and marine ecosystems for effective conservation.

Wildlife Resources
The Wildlife Division's management of wildlife resources outside Protected Areas had been mainly geared towards regulating hunting. The Division's effectiveness has been limited because of inadequate funding and lack of human capacity.

Wetlands
The most significant negative impacts on wetlands are from infrastructural development and pollution. While communities try to protect wetland resources because of their benefits, pollution and development of medium and large-scale enterprises often with political backing continue to erode coastal resources.

Fisheries
Fisheries regulations are difficult to enforce because of the limited number of fisheries personnel and logistics. The fisheries sector is currently moving towards a co-management approach that allows communities to participate in the enforcement of regulations.

Mining
Regulating the mining industry poses significant problems because it involves several small-scale and artisanal operators that are constantly migrating, and operating in areas that are difficult to access. In recent years, large-scale mining concerns have moved towards greater compliance with environmental regulations including social responsibility packages. However, because many of the mineral resources are in

forested areas, a significant negative impact of large-scale mining is unavoidable. There is currently an apparent 'conflict of interest' in decision-making by the sector Ministry responsible for biodiversity conservation. This is because key government departments and agencies responsible for managing lands, forests and wildlife, and mining activities are all under the Ministry of Lands and Natural Resources.

6.5 EFFECTIVENESS OF GHANA'S PROTECTED AREAS FOR BIODIVERSITY CONSERVATION

Wildlife Protected Areas, including wetlands (Ramsar sites) are spread throughout the ecological zones (coastal and northern savanna, and forests) of Ghana. There are still ecosystems that are under-represented in the Protected Area systems. These include inland wetlands and marine reserves (Ministry of Environment and Science, 2002). Marine resources receive only minimal protection through fisheries and endangered species (CITES) legislations.

Management of Wildlife Protected Areas is primarily constrained by logistical resources, both human and financial. A study supported by USAID on Environmental Threats and Opportunities Assessment (ETOA, 2006), revealed that while conservation is a long-term effort, the Wildlife Division is unable to plan on a long-term basis since funds are provided on annual basis.

Ramsar status confers a degree of national and international recognition on wetlands and calls for legal backing for wise use of wetland resources. Ramsar sites in the country, however, remain threatened by unsustainable use, inappropriate infrastructural development and pollution. Undesignated inland and coastal wetlands some of which are pristine are either under serious threat or in a much poorer state ecologically.

Globally Significant Biodiversity Areas (GSBAs) and Community Resources Management Areas (CREMAs) are innovations that could provide improved protection and conservation of Ghana's areas of high biodiversity importance. The participatory management approach in the GSBA and CREMA concepts can provide benefits for adjacent communities most affected by wildlife and/or the Protected Areas and help build advocates for conservation and models for sustainable use.

6.6 EFFECTIVENESS OF THE IMPLEMENTATION OF INTERNATIONAL TREATIES

Many of the international conventions and treaties have been the basis for Ghana's legal frameworks for biodiversity conservation. However, the implementation of most of these treaties suffers similar constraints of limited funding and logistical resources. There have always been difficulties in monitoring and enforcement of penalties for non-compliance mainly because of lack of efficient surveillance systems and weak policing along the country's extensive borders. This is compounded by lack of political commitment. For example, there is inadequate data to determine the extent of illegal trade across Ghana's boarders with its neighbors. While wildlife that passes through the Accra airport and major sea ports are regulated using CITES permits, there is much less known about overland trade in wildlife product at Ghana's borders.

A National document on Reducing Emissions from Deforestation and Degradation (REDD Strategy) known as the REDD+ Readiness Preparation Proposal (R-PP) has been developed to address Reducing Emissions from deforestation and forest degradation. The document outlines the roadmap to address drivers of deforestation with its REDD Strategy options to mitigate the effects of climate change.

Ghana has established a multi-stakeholder National Climate Change Committee (NCCC) hosted by the Ministry of Environment, Science and Technology. The committee is made up of relevant government agencies including EPA, FC, MOFA, MLNR, MEST and is responsible for advising government on the issues relating to the climate change in Ghana.

7.0 CURRENT PRIORITIES FOR TERRESTRIAL AND MARINE BIODIVERSITY CONSERVATION

7.1 ESTABLISHMENT OF MARINE PROTECTED AREAS (MPAs) AND COASTAL RAMSAR SITES

Currently there are no marine protected areas (MPAs) in the country while the Western Region unlike the other coastal Regions has no designated Ramsar Sites. Given the importance of MPAs and Ramsar sites in the management and protection of marine and coastal ecosystems, urgent consideration should be given to establishing MPAs and Ramsar sites in the Region. It is recommended that the Amanzule wetlands, the Ahunli and Belibangara lagoons, and Esiama beach be considered for such designations.

The Cape Three Points and Ankasa Conservation Area are terrestrial areas of crirtical concern as regards endangered habitats and biota. The conservation practices in place must be improved.

7.2 ADDRESSING HARMFUL ALGAL BLOOMS AND INVASIVE AQUATIC PLANTS

Considering the enormous havoc caused by blooms of the green alga Enteromorpha flexuosa in the Western Region since 1993, it is necessary for scientific cooperation between Ghana and Ivory Coast to address this menace. Similarly cooperation will be required to control the invasive Water hyacinth Eichhornia crassipes in the Tano/Abby/Ehy lagoon complex on the south west border of Ghana and Ivory.

7.3 FISHERIES MANAGEMENT REFORM

The fish resources in the country, especially the marine demersal stocks, are over-exploited and their maximum exploitable level exceeded. It is imperative that a more effective fisheries strategy and management plan involving the following is put in place:

- Enforce ban on pair trawling, “light fishing” and other destructive fishing methods such as use of small mesh nets and poisons in all aquatic habitats
- Enforce ban on the use of explosives in the fishing industry

- Provide support for closed seasons in lagoons imposed by traditional authorities
- Conduct research on abundance and distribution of fish stocks for effective planning, development, exploitation and management of fish resources
- Control foreign fishing trawlers in Ghanaian waters

7.4 ENDANGERED SPECIES

There is urgent need to protect marine turtles and cetaceans (dolphins and whales) which are currently under threat from exploitation by fishermen. In addition the endangered primates: Western Chimpanzee Pan troglodytes verus, Miss Waldron's Red Colobus Procolobus badius waldroni, Western Black & White Colobus Colobus polykomos vellerosus, Roloway's Diana Monkey Cercopithecus diana roloway and White-crested Mangabey Cercocebus atys lunulatus must be further protected from poachers and hunters. The rare avifauna Himantopus ostralegus must be protected in the Amanzule wetlands along with important bird species including gallinules, crakes and jacanas.

Educational programs and enforcement of legislation should be undertaken in this direction; the Community-Based Wildlife Management Policy initiated by the Wildlife Division which places responsibility for biodiversity conservation in the hands of local communities should be vigorously pursued. There is also a need for a comprehensive survey of the coastal waters in the Region to investigate the occurrence and population size of manatees to facilitate planning of effective conservation strategies.

7.5 OTHER NATIONAL AND REGIONAL PRIORITIES

- National Biodiversity Strategy and Action Plan for Ghana prepared in 2002 is currently under revision by the Ministry of Environment Science and Technology.
- National Fisheries and Aquaculture Policy under Review - Fisheries Commission.
- National Fisheries Regulations under preparation – Fisheries Commission.
- Plans to commence research to establish the biology and ecology of important commercial fisheries to help in IUCN Redlist categorization - Fisheries Commission.
- National Wetlands Conservation Strategy Action Plan (2007–2016) adopted – Forestry Commission.
- National Buffer Zone Policy for Water Resources under preparation – Water Resources Commission.
- Policy on Community Resource Management Areas (CREMAs) adopted – Forestry Commision
- Natural Resource and Environmental Governance (NREG) being implemented – Ministry of Lands and Natural Resources.
- Draft proposal for the establishment of a Climate Change Commission to facilitate awareness creation and sensitization on issues of climate change under consideration by the Ministry of Environment Science and Technology.

8.0 RECOMMENDATIONS FOR TERRESTRIAL AND MARINE BIODIVERSITY CONSERVATION IN THE WESTERN REGION

Though sectoral measures are essential in sustainable management of natural resources, efforts should be made for an efficiently co-ordinated integrated governance approach to manage the biodiversity assets of the Region.

8.1 IMPROVED FISHERIES MANAGEMENT AND CONSERVATION

The continual recorded depletion of fish stocks and reduced catches is negatively impacting the socio-economy and livelihoods of the communities. It is therefore necessary to undertake the following measures aimed at improving fisheries management and conservation in the Region:

- Resource and build capacity of Fisheries Department in the Region to ensure comprehensive data collection for inclusion in the national fisheries database
- Enforce ban on pair trawling, “light fishing” and other destructive fishing methods such as use of small mesh nets, poisons and explosives in all aquatic habitats
- Provide support for closed seasons in estuaries and lagoons as imposed by traditional authorities
- Control activities of foreign fishing vessels in Ghana waters

8.2 PROTECTION OF EXISTING FOREST RESERVES

The Western Region has one coastal forest reserves, the Cape Three Points Forest Reserve. While many of the coastal protected areas in the Region are in good condition, developmental activities in the area will put Cape Three points at a high risk. Already, the reserve is at risk from widespresd encroachment and poaching. There is, therefore, the need to establish baseline information on these reserves that will aid sound biodiversity conservation and management.

8.3 LAGOONS AND WETLANDS PROTECTION

Of particular concern is the fact that sensitive lagoons that are important bird habitats and turtle nesting beaches are becoming increasingly vulnerable to degradation from development. The oil find in the region is attracting more people to the area and therefore likely to increase pressure on these wetlands. There is a need to strengthen local and formal governance systems with a view to conserving these critical habitats.

8.4 MANAGEMENT OF ALGAL BLOOM

Address the infestation of coastal waters by the green alga *Enteromorpha flexuosa* by conducting studies to find source of infestation and contributory factors to the blooms. This may ultimately involve the collaboration of the Ivorian authorities.

8.5 TOURISM AND BIODIVERSITY CONSERVATION

The activities of some tourist agencies in the Region have shown the potential for biodiversity conservation and wealth creation. There should be collaboration between these private operators and MDAs in the promotion 0f biodiversity conservation as basis for local ecotourism.

8.6 AWARENESS CREATION ON HABITATS AND BIODIVERSITY VALUES

All relevant stakeholders, especially women and children within communities along the coast should be continuously sensitized and empowered to understand the values and processes within coastal ecosystems with a view to protecting and conserving these resources.

8.7 CLIMATE CHANGE MITIGATION AND ADAPTATION

Recognising the problem of Climate change and its effects on biodiversity conservation and the people, there is a need to harmonise activites aimed at helping critical habitats to adapt to these changes. A concerted integrated effort should be made to mitigate anticipated effects of the phenomenon on habitats and biodiversity. Awareness creation on climate change should be stepped up nationwide involving relevant stakeholders such as Chiefs and opinion leaders in communities, District Assemblies, Civil society, NGOs and CBOs.

8.8 CAPACITY BUILDING

There is an urgent need to build capacity to address coastal biodiversity and conservation issues among the various stakeholders, especially the District Assemblies and Governmental agencies. In addition, the graduate curriculum of tertiary institutions should be restructured and where necessary introduce new programs to address specific issues on coastal biodiversity and conservation to building the competence of graduate students.

8.9 RESEARCH PRIORITIES

- Detailed biodiversity inventory (incl. digitized images)
- Monitoring of invasive plants
- Assessment & Management of fishery resources
- Establishment of MPAs & Ramsar sites
- Monitoring of marine and environmental quality
- Monitoring and management of biodiversity “hot” spots

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APPENDIX 1 Coastal Ramsar Sites Characteristics

Name and Site No.	Location	Area (ha)	Key characteristics
Muni-Pomadze (564)	West of Winneba approximately 55 km west of Accra: 05º 22'N, 00º40'W	9,461.12	Sand dunes, open lagoon, degraded forest and scrubland. Lagoon opens into the sea during rainy season.
Densu Delta (564)	11 km west of Accra: 05º 30'N, 00º15'W	5,892.99	Sand dunes, lagoons, freshwater marsh and scrub, salt pans, Scattered stands of mangrove with extensive areas of open water.
Sakumo (565)	3 km West of Tema: 05º 30'N, 00º08'W	1,364.35	Blackish lagoon with narrow connection to the sea. Main habitats are open lagoon, surrounding flood plains, freshwater marsh, and degraded coastal savanna grasslands.
Songor (566)	About 100 km east of Accra: 05º 45'N - 00º30'E	51,113.33	Closed lagoon with high salinity and a large mudflat with scattered mangroves
Keta Lagoon Complex (567)	05º55'N, 00º 50'E	101,022.69	Open lagoon with blackish water influx from Volta River. Coastal savanna grasses with patches of trees and scrubs. Largest shorebird populations of all coastal wetlands of Ghana.

APPENDIX 2 Important Fishery Resources of Ghana (Aggrey-Fynn, 2007: from FAO Fishery Statistics 1983, 1987, 1998 and 2006)

Resource	Family	Species	Common Name	Catches (tons)				
				1979	1987	1992	2002	2004
Small pelagic	CLUPEIDAE	*Sardinella aurita*	Round sardinella	-	47 407	125 814	64 300	82 396
		Sardinella madarensis	Flat sardinella	-	27 177	14 410	13 755	27 052
	SCOMBRIDAE	*Scomber japonicus*	Spanish/chub mackerel	97	746	11 982	7 018	6 010
	ENGRAULIDAE	*Engraulis encrasicolus*	Anchovy	36 676	87 984	85 384	57 639	52 629
	CARANGIDAE	*Decapterus spp.*	Scads	-	-	993	2 944	1 435
		Trachurus spp.	Horse mackerels	844	36	762	504	2 714
		Selene dorsalis	African moonfish	1 950	4 555	1 202	690	1 479
		Chloroscombrus crysurus	Atlantic bumper	3 854	5 422	5 153	5 670	5 747
		Caranx hippos	Crevalle jack	1 851	3 278	5 321	2 872	9 111
		Caranx rhonchus	False scad	8 612	3 234	2 472	1 605	2 016
	SPHYRAENIDAE	*Sphyraena spp*	Barracudas	1 008	3 773	1 753	1 193	3 541
Large Pelagic	SCOMBRIDAE	*Thunnus albacares*	Yellowfin tuna	528	10 830	7 300	23 499	15 137
		Thunnus obesus	Bigeye tuna	171	1 000	-	5 893	6 944
		Katsuwonus pelamis	Skipjack tuna	4 200	24 347	23 756	31 887	33 600
		Euthynnus alletteratus	Little tunny	5 547	5 551	11 608	4 768	7 060
	ISTIOPHORIDAE	*Istiophorus albicans*	Atlantic sailfish	2 691	2 325	297	529	503
Coastal demersal	SPARIDAE	*Pagellus bellottii*	Red pandora	-	7 789	8 724	3 132	4 922
		Pagrus spp.	Pargo breams	754	718	1 200	2 624	461
	HAEMULIDAE	*Brachydeuterus auritus*	Bigeye grunt	15 010	16 627	11 024	9 267	26 456
	BALISTIDAE	*Balistes spp.*	Triggerfish	13 362	18 283	198	12	1
	SCIAENIDAE	*Pseudotolithus spp.*	West African croakers	2 453	2 379	2 340	1 067	1 126
	LUTJANIDAE	*Lutjanus spp.*	Snappers	361	948	635	774	756
	MULLIDAE	*Pseudupeneus prayensis*	West African goatfish	988	737	247	278	427
	SERRANIDAE	*Epinephelus spp.*	Groupers	1 186	800	225	233	231
	POLYNEMIDAE	*Galeoides decadactylus*	Lesser African threadfins	-	3 313	1 826	2 204	3 098
Deep water demersal	SPARIDAE	*Dentex angolensis*	Angolan dentex	190	-	284	990	1 975

	TRICHIURIDAE	*Trichiurus lepturus*	Largehead hairtail	2 646	2 157	4 341	3 154	1 760

APPENDIX 3 Marine Fish Landings from the Four Districts of the Western Region- 2007-2008

Resource	Family	Common name	Species	Catch (metric tons)			
				Shama-Ahanta	Ahanta West	Nzema East	Jomoro
Small Pelagic	Clupeidae	Round sardine	*Sardinella aurita*	16 265	6098	4513	0
		Flat sardine	*Sardinella madarensis*	5050	1949	893	0
		Sardinella	Unspecified	2	0	0	0
		Long-Finned Herring	*Ilisha africana*	7518	160	1746	606
		West African shad	*Ethmalosa fimbriata*	17	0	0	0
	Engraulidae	Anchovy	*Engraulis encrasicolus*	4180	227	962	0
	Scombridae	Chub Mackerel	*Scomber japonicus*	530	711	1010	0
		Kingfish	*Scomberomorus tritor*	775	439	0	0
		Frigate Mackerel	*Auxis thazard*	1219	1572	662	0
	Hemiramphidae	Half-beaks	*Hemirhamphus spp*	931	1533	0	0
	Carangidae	Atlantic horse mackerel	*Trachurus trachurus*	267	0	0	0
		Atlantic bumper	*Chloroscombrus crysurus*	5587	2124	988	0
		Horse Mackerel	*Caranx hippos*	168	0	0	0
		Scad Mackerel	*Caranx rhonchus*	83	7	0	0
		Round scad	*Decapterus punctatus*	5	0	0	0
		Leer fish	*Lichia amia*	2	0	0	0
		Palometa	*Trachinotus glaucus*	5	2	0	0
		African moonfish	*Selene dorsalis*	169	70	0	16
		Doctorfish	*Elegatis bipinnulata*	0	21	0	0
	Sphyraenidae	Barracuda	*Sphyraena sphyraena*	282	242	312	0
Large Pelagic	Scombridae	Little tunny	*Euthynnus alletteratus*	1180	70	80	0
		Skipjack tuna	*Katsuwonus pelamis*	5687	674	180	0

		Bigeye Tuna	*Thunnus obesus*	+	0	0	0
		Yellow tuna	*Thunnus albacares*	37	35	12	0
		Tuna	Unspecified	196	0	0	0
	Istiophoridae	Atlantic sailfish	*Istiophorus albicans*	3284	223	87	0
		Blue marlin	*Makaira nigricans*	3380	535	53	0
	Xiphiidae	Swordfish	*Xiphias gladius*	85	42	2	0
	Elopidae	Ladyfish/Tenpounder	*Elops lacerta*	31	0	0	0
	Belonidae	Garfish	*Ablennes hians*	640	229	0	0
	Trichiuridae	Ribbonfish	*Trichiurus lepturus*	3042	101	0	0
	Exocoetidae	Flying fish	Unspecified	2309	2227	0	0
Demersal	Sparidae	Congo dentex	*Dentex congoensis*	412	10	79	0
		Angola dentex	*Dentex angolensis*	1926	0	0	0
		Pink dentex	*Dentex gibbosus*	1941	0	0	0
		Red pandora	*Pagellus bellottii*	2542	1	0	0
		Seabreams	Unspecified	53	0	186	0
		Bogue	*Boops boops*	13	0	0	0
	Haemulidae	Burrito	*Brachydeuterus auritus*	8914	1493	3315	0
		Black Burro	*Plectorhynchus mediterraneus*	18	12	0	0
	Sciaenidae	Croakers	*Pseudotolithus spp.*	1193	724	542	0
		Meagre	*Argyrosoma regius*	122	78	0	0
	Lutjanidae	Grey snapper	*Lethrinus atlanticus*	28	0	0	0
		Red snapper	*Lutjanus agennes*	346	0	0	0
		Snappers	Unspecified	13	0	0	0
	Serranidae	Groupers	Unspecified	471	0	0	0
	Labridae	Rainbow wrasse	*Coris juris*	4	0	0	0
	Dactylopteridae	Flying gurnards	*Dactylopterus volitans*	20	0	0	0
	Polynemidae	Threadfins	Unspecified	1209	448.62	0	0
	Stromateidae	Butterfishes	Unspecified	1	0	0	0
	Ephippidae	Spadefishes	Unspecified	1	2	0	0

	Cynoglossidae	Tongue sole	*Cynoglossus senegalensis*	155	49	112	0
	Mullidae	Red mullet	*Pseudupeneus prayensis*	1	0	0	0
	Merlucciidae	Benguela hake	*Merluccius polli*	0	43	0	0
	Ariidae	Sea catfishes	Unspecified	152	0	0	0
	Mobulidae	Manta ray	*Manta birostris*	1007	704	3	0
	Myliobatidae	Eagle whipray	*Myliobatis aquila*	7	1	0	0
	Dasyatidae	Sting ray	*Dasyatis margarita*	6	3	0	0
		Rays	Unspecified	8	299	0	0
		Sharks	Unspecified	1949	478	32	0
Shellfishes	Penaeidae	Shrimps	Unspecified	884	74	0	0
	Palinuridae	Royal Spiny Lobster	*Panulirus regius*	163	0	0	0
	Scyllaridae	Slipper/Rock lobster	*Scyllarides herklotsii*	1	0	0	0
	Mollusc	Snail	Unspecified	0	+	13	0
MISCELLANEOUS				457	20	26	+

APPENDIX 4 Percentage Composition of Marine Fish Landings from the Four Districts in the Western Region: 2007-2008

Resource	Family	Common name	Species	% Combined Catch (2007-2008)			
				Shama Ahanta	Ahanta West	Nzema East	Jomoro
Small Pelagic	Clupeidae	Round sardine	*Sardinella aurita*	18.7	25.7	28.5	0
		Flat sardine	*Sardinella madarensis*	5.8	8.2	5.6	0
		Sardinella	Unspecified	+	0	0	0
		Long-Finned Herring	*Ilisha africana*	8.6	0.7	11.0	97.4
		West African shad	*Ethmalosa fimbriata*	+	0	0	0
	Engraulidae	Anchovy	*Engraulis encrasicolus*	4.8	1.0	6.1	0
	Scombridae	Chub Mackerel	*Scomber japonicus*	0.6	3.0	6.4	0
		Kingfish	*Scomberomorus tritor*	0.9	1.9	0	0
		Frigate Mackerel	*Auxis thazard*	1.4	6.6	4.2	0
	Hemiramphidae	Half-beaks	*Hemirhamphus spp*	1.1	6.5	0	0
	Carangidae	Atlantic horse mackerel	*Trachurus trachurus*	0.3	0	0	0
		Atlantic bumper	*Chloroscombrus crysurus*	6.4	9.0	6.2	0
		Horse Mackerel	*Caranx hippos*	0.2	0	0	0
		Scad Mackerel	*Caranx rhonchus*	0.1	+	0	0
		Round scad	*Decapterus punctatus*	+	0	0	0
		Leer fish	*Lichia amia*	+	0	0	0
		Palometa	*Trachinotus glaucus*	+	0	0	0
		African moonfish	*Selene dorsalis*	0.2	0.3	0	2.6
		Doctorfish	*Elegatis bipinnulata*	0	0.1	0	0
	Sphyraenidae	Barracuda	*Sphyraena sphyraena*	0.3	1.0	2	0

Large Pelagic	Scombridae	Little tunny	*Euthynnus alletteratus*	1.4	0.3	0.5	0
		Skipjack tuna	*Katsuwonus pelamis*	6.5	2.8	1.1	0
		Bigeye Tuna	*Thunnus obesus*	+	0	0	0
		Yellowfin tuna	*Thunnus albacares*	+	0.1	0.1	0
		Tuna	Unspecified	0.2	0	0	0
	Istiophoridae	Atlantic sailfish	*Istiophorus albicans*	3.8	0.9	0.5	0
		Blue marlin	*Makaira nigricans*	3.9	2.3	0.3	0
	Xiphiidae	Swordfish	*Xiphias gladius*	0.1	0.2	+	0
	Elopidae	Ladyfish/Tenpounder	*Elops lacerta*	+	0	0	0
	Belonidae	Garfish	*Ablennes hians*	0.7	1.0	0	0
	Trichiuridae	Ribbonfish	*Trichiurus lepturus*	3.5	0.4	0	0
	Exocoetidae	Flying fish	Unspecified	2.7	9.4	0	0
Demersal	Sparidae	Congo dentex	*Dentex congoensis*	0.5	+	0.5	0
		Angola dentex	*Dentex angolensis*	2.2	0	0	0
		Pink dentex	*Dentex gibbosus*	2.2	0	0	0
		Red pandora	*Pagellus bellottii*	2.9	+	0	0
		Seabreams	Unspecified	0.1	0	1.2	0
		Bogue	*Boops boops*	+	0	0	0
	Haemulidae	Burrito	*Brachydeuterus auritus*	10.3	6.3	21.0	0
		Black Burro	*Plectorhynchus mediterraneus*	+	+	0	0
	Sciaenidae	Croakers	*Pseudotolithus spp.*	1.4	3.1	3.4	0
		Meagre	*Argyrosoma regius*	0.1	0.3	0	0
	Lutjanidae	Grey snapper	*Lethrinus atlanticus*	+	0	0	0
		Red snapper	*Lutjanus agennes*	0.4	0	0	0
		Snappers	Unspecified	+	0	0	0
	Serranidae	Groupers	Unspecified	0.5	0	0	0
	Labridae	Rainbow wrasse	*Coris juris*	+	0	0	0
	Dactylopteridae	Flying gurnards	*Dactylopterus volitans*	+	0	0	0

	Polynemidae	Threadfins	Unspecified	1.4	1.9	0	0
	Stromateidae	Butterfishes	Unspecified	+	0	0	0
	Ephippidae	Spadefishes	Unspecified	+	+	0	0
	Cynoglossidae	Tongue sole	*Cynoglossus senegalensis*	0.2	0.2	0.7	0
	Mullidae	Red mullet	*Pseudupeneus prayensis*	+	0	0	0
	Merlucciidae	Benguela hake	*Merluccius polli*	0	0.2	0	0
	Ariidae	Sea catfishes	Unspecified	0.2	0	0	0
	Mobulidae	Manta ray	*Manta birostris*	1.2	3.0	+	0
	Myliobatidae	Eagle whipray	*Myliobatis aquila*	+	0	0	0
	Dasyatidae	Sting ray	*Dasyatis margarita*	+	+	0	0
	Rajidae	Rays	Unspecified	+	1.3	0	0
	Unknown family	Sharks	Unspecified	2.2	2	0.2	0
Shellfish	Penaeidae	Shrimps	Unspecified	1.0	0.3	0	0
	Palinuridae	Royal Spiny Lobster	*Panulirus regius*	0.2	0	0	0
	Scyllaridae	Slipper/Rock lobster	*Scyllarides herklotsii*	+	0	0	0
	Mollusc	Snail	Unspecified	+	+	0.1	0
MISCELLANEOUS			Miscellaneous fish	0.5	0.1	0.2	+

(+, present but <0.1%)

APPENDIX 5 Summary of Fisheries Resource Catches from the Districts (2007-2008)

Resource	Catch (metric tons) 2007			
	Shama-Ahanta	**Ahanta West**	**Nzema East**	**Jomoro**
Small pelagics	27 823	13 134	8146	No data
Large pelagics	11 543	674	924	No data
Demersal	16 583	1657	3284	No data
Shellfish	804	0	0	No data
Others	414	6	22	No data
Resource	**Catch (metric tons) 2008**			
	Shama-Ahanta	**Ahanta West**	**Nzema East**	**Jomoro**
Small pelagics	15 223	2019	3545	622
Large pelagics	8329	3460	308	0
Demersal	5929	2643	1003	0
Shellfish	244	74	13	0
Others	43	14	3	0

APPENDIX 6 Summary of Percentage Catch of Fisheries Resources from the Districts (2007-2008)

Records on fish catches in the Western Region for 2007 and 2008 for the previous four coastal districts are shown in Tables 3 and 4. The 2007 data excluding Jomoro District indicates a total landing of about 85,015 metric tons of which 57,167 metric tons (67%) were contributed by Shama-Ahanta East. In 2008, production of the Region totaled 43,804.7 metric tons of which Shama-Ahanta East District's contribution was 29,766.26 metric tons (68%). The trend of fish production among the Districts is Shama-Ahanta East>Ahanta West>Nzema East>Jomoro.

Summary of fish catch (metric tons) from the Districts in 2007

Resource	Catch (tons) 2007			
	Shama-Ahanta	Ahanta West	Nzema East	Jomoro
Small pelagics	27,823	13,134	8,146	No data
Large pelagics	11,543	674	924	No data
Demersal	16,583	1,657	3,284	No data
Shellfish	804	0	0	No data
Others	414	6	22	No data
TOTAL	**57,167**	**15,471**	**12,376**	

Summary of fish catch (metric tons) from the Districts in 2008

Resource	Catch (tons) 2008			
	Shama-Ahanta	Ahanta West	Nzema East	Jomoro
Small pelagics	15,223	2,019	3,545	622
Large pelagics	8,329	3,460	308	0
Demersal	5,929	2,643	1,003	0
Shellfish	244	74	13	0
Others	43	14	3	0
TOTAL	**29,768**	**8,210**	**4,872**	**622**

Resource	Percent 2007- 2008			
	Shama-Ahanta	Ahanta West	Nzema East	Jomoro
Small pelagics	49.4	64	70	100
Large pelagics	22.8	17.4	2.5	0
Demersal	25.8	18.1	27	0
Shellfish	1.2	0.3	0.1	0
Others	0.5	0.1	0.2	0

APPENDIX 7 Institutions in Ghana Mandated to Implement Biodiversity Conservation Policies

1) Forestry Commission (FC) operates under the Ministry of Lands and Natural Resources (MLN). The FC focuses on the sustainable development and management of Ghana's forest and wildlife resources and their contribution to socio-economic development and environmental protection. The FC has three operational divisions:

a) Forest Services Division (FSD) implements forest policy, forest management strategies, and compliance with forest regulations. It ensures sustainable harvesting plans for private sector logging in Ghana's Forest Reserves (including fuel wood plantations). The FSD manages over 279 forest reserves in the country which covers about 25,594 km^2, and constitute 11% of Ghana's land area.

Description of the Forest Reserve System

Ghana's forests are found in the savanna woodland and the high forest. The high forests cover about seven percent of the total land area. Almost all of this forest is found in gazetted forest reserves with considerable forest resources also located outside forest reserves in small patches including sacred groves, burial grounds and trees on farms.

From the national forest inventory in 1986, forest reserves were classified into distinct areas based on their condition. The size of each forest reserve category (excluding GSBAs) is shown in the Table below. Intact closed canopy forest outside the permanent forest estate and available for timber production is about 374,000 hectares, whiles plantation forests cover about 50,000 hectares (FAO, 2003).

Forest Resources of Ghana

Forest type	Area (ha)	Percentage cover
Timber Production Area	762,400	41
Permanent Protection	352,500	17
Convalescence	122,000	6
Conversion	127,200	6
Not inventoried (conversion)	270,000	12
Intact closed forest, available for timber production	374,000	16
Plantation forests	50,000	3
Total Reserve Area	**1,634,100**	**100**

Source: Revised from FAO, Introduction and Status of the Forestry Sector in Ghana, 2003

Harvest levels are regulated by the Forest Services Division. Since 2002, the annual allowable cut (AAC) has been set at 1.4 million m^3, an increase of 400,000 m^3 over the previous figure, which mainly comes from off-reserve areas (Oliver and Fripp, 2005).

The 1996 Forestry Development Master Plan (FDMP) introduced Timber Utilization Contracts (TUCs), an auction process for allocating concessions which ensures transparent competitive bidding that replaced the old system of blanket concession allocation, which was largely viewed as supporting vested interests in the timber industry. Technical and political problems delayed the introduction of TUCs, but in late 2003, bidding began for TUCs in plantations, and in 2004 in natural forests. Most concessions, however, are yet to be transformed to TUCs.

Besides being transparent, there are other positive elements to the TUCs. They require that a forest management plan is developed including plans for minimizing impacts. Social Responsibility Agreements (SRA) are also required which aim to expand the benefits of forestry to local communities.

About 50 species of wood are exported. Wawa is the dominant export species and ceiba is the second largest export. Plantation timber species, such as teak, Cedrella, Gmelina, and Rose Wood have become more important in the export trade in recent years.

Currently, there are no certified forests or timber operations in Ghana. The EU has initiated a program, the Voluntary Partnership Agreement (VPA) wherein timber producing countries that have illegal logging problems can get assistance from the EU through the VPA if the country shows commitment of addressing these problems. Ghana has already shown commitment to negotiate a VPA with the EU to ensure the sustainability and legality of timber being exported to the EU.

The forestry sector (like the mining sector) is impacted by a dual land tenure system- the traditional and modern systems.In general, benefits that might accrue to communities from the use of their forests often end up in the hands of traditional authorities and this can derail CBNRM initiatives, which rely on equitable benefit sharing.

b) Wildlife Division (WD) manages wildlife Protected Areas (PAs), wetlands (Ramsar sites) and also has responsibility for wildlife outside protected areas. The Division's conservation mandate is embodied in the 14,695 km^2 of protected areas in different ecological zones of Ghana and made up of sixteen inland conservation areas (see fig. 12 and appendix). Two protected areas, Ankasa Conservation Area and Bia National Park, are located in the moist forest of the Western Region of Ghana. While Ankasa is rich in plant life including the endemic small ground plant, *Psychotra ankensis*, the Bia National Park has been designated as International Biosphere Reserve having global importance as areas of relatively undisturbed biodiversity. The Division also manages two zoological gardens, one each in Accra and Kumasi. The two zoos house some endangered species for education and recreational purposes. The influence of the Division outside Protected Areas is minimal given that the Division's effort is much concentrated in the Protected Areas.

In addition to its statutory mandate for wildlife protection within and outside the Protected Areas, the Wildlife Division is the national administrative authority for wetlands conservation programmes and manages one inland and five coastal Ramsar

Sites none of which is located in the Western Region. However, the Division is understaffed to adequately enforce the wetlands regulations even within Ramsar Sites.

In 2000, the Wildlife Division initiated a Community-Based Wildlife Management Policy which aims to devolve management authority to communities living adjacent to protected areas and encourage their participation in conservation and sustainable use of wildlife to provide a flow of benefits to society. This policy introduced the Community Resource Management Area (CREMA) approach. The CREMA approach is based on existing local decision-making structures and is consistent with local land tenure relationships. The approach started with two pilots among the adjecent communities at Ankasa Conservation Area and Bia National Park in the Western Region and now gaining support as a key approach to protecting wildlife and natural resources outside PAs in other areas.

Description of Ghana's Protected Area System

Ghana's Wildlife Protected Area system comprises National Parks (7), Resource Reserves (6), Wildlife Sanctuaries (2), Community Sanctuaries (2), a Strict Nature Reserve (1), and a Biosphere Reserve (1). Wildlife PAs (see list in Table below) cover 14,695 km² (five percent of Ghana's land area). Capture, hunting, or destruction of any animal is prohibited in wildlife PAs.

Ghana's Protected Area estate also encompasses Globally Significant Biodiversity Areas (GSBAs) managed by the Forestry Commission. In all, there are 34 GSBAs, covering over 120,000 hectares. These are areas designated as Forest Reserves but excluded from timber harvesting and other extractive uses due to their importance for biodiversity conservation. GSBAs are found in the high forest zone and in the southern dry forest. Community participation has been a key component of management of GSBAs and Community Biodiversity Advisory Groups have been formed in some of the adjacent communities as local representation in GSBA management.

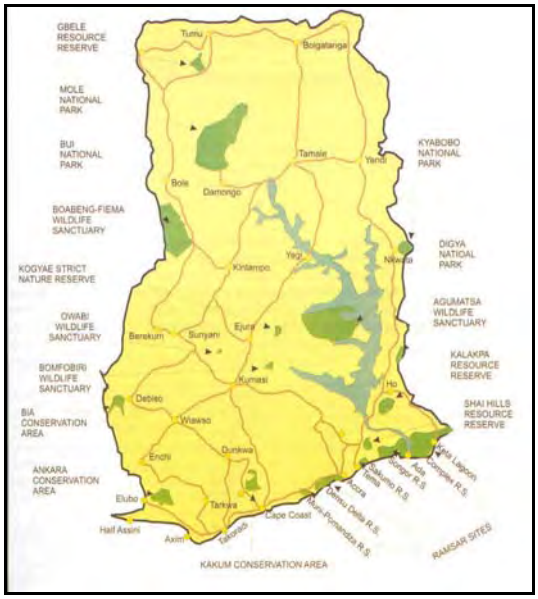

Figure 9: Wildlife Protected estates in Ghana
(Source: Wildlife Division, Ghana)

Protected Areas, Ramsar Wetlands, and Ex-situ Biodiversity Sites in Ghana

Protected Area	Region	Ecosystem Type	Gazetted	Size (km^2)
Mole National Park	Northern	Woodland savannah	1971	4,840
Digya National Park	Brong-Ahafo/ Eastern/Ashanti	Transition zone	1971	3,478
Bui National Park	Brong-Ahafo/Northern	Woodland savannah	1971	1,821
Gbele Resource Reserve	Upper West	Woodland savannah	1975	565
Ankasa Nini Suhien National Park	Western	Moist forest	1976	490
Kogyae Strict Nature Reserve	Ashanti	Moist forest	1971	360
Kyabobo National Park	Volta	Woodland savannah	2005/6	360
Kakum National Park/Assin Attandanso Reserve	Central	Moist forest	1991	350
Kalakpa Resource Reserve	Volta	Woodland savannah	1975	320
Bia National Park and Bia Resource Reserve	Western	Moist forest	1974/1977	300
Bomfobiri Wildlife Sanctuary	Ashanti	Forest	1975	53
Shai Hills Resource Reserve	Greater Accra	Coastal savannah	1971	49
Boabeng-Fiema Monkey Sanctuary	Brong-Ahafo	Woodland savannah	-	4
Ramsar coastal wetlands				
Densu Delta	Greater Accra	Coastal Ramsar wetland	1999	59
Keta Lagoon Complex	Volta	Coastal Ramsar wetland	1999	1,010
Muni-Pomadze	Central	Coastal Ramsar wetland	1999	95
Sakumo	Greater Accra	Coastal Ramsar wetland	1999	14
Songor	Greater Accra	Coastal Ramsar wetland	1999	511
Owabi Wildlife Sanctuary	Ashanti	Inland Ramsar wetland	1971	13

(Adapted from Pleydell, 2005)

c) Timber Industry Development Division (TIDD) promotes the values of the timber industry on both local and international levels based on long term sustainable harvests and efficient use of timber products. A number of timber processing industries are sited in the Western Region which use the Takoradi Port to export their produce.

2) Directorate of Fisheries and Fisheries Commission: The Directorate of Fisheries is responsible for policy formulation and implementation, management and control of the fishing industry under the general guidance of the Fisheries Commission. The Directorate exists to promote sustainable exploitation and responsible utilization of fishery resources through sound management practices, research, and appropriate technological development for culture and capture fisheries. It is also responsible for effective extension and provision of other support services to fish farmers, fishermen, fish processors and traders for improved income and fish food security. The Directorate has a number of operational divisions for marine fisheries management and inland fisheries management, marine fisheries research, monitoring, control and surveillance.

The regional Departments of Fisheries carry out and implement policies of the Directorate. The regional office for the Western Region is based in Takoradi and supervises most of the fishing activities in the coastal waters in the Region.

The Fisheries Act 625 (2002) established the Fisheries Commission as a body to regulate and manage the utilization of the fishery resources of Ghana and coordinate the related policies. The Commission also advises the sector Minister on all matters pertaining to the fishery industry. The Commission's functions are to ensure the proper conservation of the fishery resources through the prevention of over fishing, minimizing fishing gear conflicts among users, monitoring fishery waters, and promoting sub-regional, regional, and international cooperation in fisheries management. Others include conducting research and surveys, correlating fisheries with other water uses and environmental protection, and enforcing fishery laws in collaboration with Metropolitan, Municipal and District Assemblies.

3) Water Resources Commission (WRC) was set up in Ghana to coordinate and to monitor all water resources in the country. Until the WRC Act was passed in 1996, water agencies and institutions in the country were set up by legal instruments that only provided the legal framework, but there was little management of the resources.

4) National Development Planning Commission (NDPC) has overall responsibility of developing the national development framework within which all sectoral programmes, policies and attendant legislation have to converge.

5) Minerals Commission has overall responsibility for managing all aspects mining and mining related activities.

6) Environmental Protection Agency (EPA) is empowered by Act 490 to control pollution and to set environmental quality standards for regulating development activities. Under L.I 1652, the EPA is mandated to develop and implement environmental assessment procedures for regulating all undertakings. EPA's Environmental Impact Assessment (EIA) system a lot has been achieved in terms of regulating developments and its attendant pollution and degradation. The Agency also promotes studies, research, surveys, and analyses for the improvement and protection of the environment and maintenance of sound ecological systems and also regulates pesticide registration, sales and disposal in the country.

EPA has offices in the coastal regions and in most districts. However, considering the numerous environmental problems, EPA lacks the human and material capacity and is therefore less effective on the ground.

7) Ghana Maritime Authority

The Ghana Maritime Authority (GMA) falls under the Ministry of Transport. The GMA was established under the *Maritime Authority Act*, (Act 630 of 2002) and is responsible for, regulation, coordination and monitoring of all maritime activities in the country. The purpose of GMA is to ensure the provision of safe, secure and efficient shipping operations and the protection of the maritime environment from pollution from ships.

8) Ghana National Petroleum Corporation

Ghana National Petroleum Corporation (GNPC) was established in 1983 by the Ghana National Petroleum Corporation Law (PNDCL 64 of 1983). The GNPC is a corporate body established under the Ministry of Energy to promote, explore, develop and regulate Ghana's hydrocarbon resources. The GNPC is empowered to conduct petroleum exploration and partner with foreign investors to promote the economic development of Ghana. The GNPC is a joint venture partner to Jubilee Phase 1 project.

9) Attorney General's Department

The Attorney General's Department has a mandate to formulate, interprete, and disseminate laws and regulations governing the nation including those on environment and coastal biodiversity.

10) Ministry of Defence

The Ministry of Defence has ultimate authority to police Ghanaian waters and enforce Ghanaian legislation. The Ghana Airforce and Navy provide additional capacity to the Ghana Maritime Authority for marine search and rescue operations if required. They also provide assistance in the event of an emergency such as a major accident offshore including oil spill. The Ghana Navy further supports the Fisheries Directorate in its monitoring, control and surveillance activities.

11) Research Institutions

Institutions and agencies which have research responsibilities include:

- The Universities
- Various institutes under the Council for Scientific and Industrial Research (CSIR)
- Centre for African Wetlands
- Biotechnology and Nuclear Agricultural Research Institute of the Atomic Energy Commission.

12) The Metropolitan, Municipal and District Assemblies (MMDAs):

The development planning and administration of the MMDAs is fashioned by the Decentralization Policy and Local Government Act 462 (1993), introduced in 1988.The Policy mandates the Assemblies to enact byelaws that ensure good sanitation and to abate all nuisances within their jurisdiction. It also seeks to involve

local communities in the political, social and economic administration of their districts within the broad framework of the national economic, social and political objectives.

The District assemblies' work through committees and subcommittees, and in all cases has Environmental Management Committees (EMC) which handles issues related to the environment, including wetlands. Decentralized departmental heads serve as ex-officio members on specific committees of the assemblies and provide technical and professional inputs into the decision-making process. The Environmental Protection Agency (EPA) assists the EMCs to prepare Local Environmental Action Plans (LEAP), which are expected to guide environmental management in each district. The LEAPs provide the basis for incorporation of environmental concerns in the District planning. However, because of limited human resource capacity, lack of competency in natural environmental issues and budgetary constrains, most of the plans are not implemented. The few plans implemented usually focus on sanitation and issues other than those related to the biodiversity conservation.

13) Traditional Management Practices

A strong traditional base for protection of natural resources through indigenous management systems exists in Ghana. Depending on the beliefs of the traditional area that claims ownership, most wetlands, for example, and their resources are protected and regulated through varied traditional practices, which involve customary laws or taboos. There are sanctions for violation of such laws. Traditionally, every river, lagoon or special water body has a god or goddess with its set of unique regulations. Though these rules and regulations are steeped in traditional beliefs, their main effect is to control resource use, which is generally observed by local populations.

The traditional administration is not legally integrated with the district administrative structure though they provide viable and dependable structure through which development programmes are initiated and implemented. Chiefs and their elders perform executive, legislative and judicial functions at the village or community level.

Access to land and water resources are still much under the control of the traditional authorities in most local communities (Danso, 1998). Because the existing coastal Ramsar Sites are generally not government-acquired, determining land ownership and allocation rights in these areas remains a problem, and disputes over wetlands close to urban centers are therefore common. This has manifested in encroachment of designated Ramsar Sites usually for development in contravention of the law establishing these Sites.

14) Non-governmental Organizations:

Several local and International NGOs are involved in biodiversity conservation to complement the efforts of governmental agencies. They are engaged in environmental education and awareness creation in schools and communities, training, research, eco-tourism development and conservation projects. Some environmental NGOs currently working in the Western Region and their areas of interest are given in the Table below.

Some relevant NGOs and their focus

NGO	Focus
Conservation International	Biodiversity conservation
Nature Conservation Research Centre	Nature-based and cultural and eco-tourism development
CARE Ghana	Partnership, networking for environmental and social development
Ghana Wildlife Society	Education and Research, Biodiversity conservation - IBAs, Coastal Wetlands/ Ramsar sites, Threatened species
COSPE	Advocacy
Ricerca e Co-operazione (RC)	Nature conservation and community development
Friends of the Earth-Ghana	Sustainable forestry, gender equity; advocacy, education
West African Primate Conservation Action	Primate conservation
SNV (Ghana)	Conservation and tourism development
Friends of the Nation	Coastal Environmental Education and Advocacy
World Vision International	Community development

APPENDIX 8 LEGISLATIVE FRAMEWORK

The government of Ghana has instituted a number of important policies and legislations governing biodiversity conservation in the country.These include:

Forests

- Trees and Timber Decree, 1974 (NRCD) 273), continued the operation of the system of property marks and makes it criminal offence for a person to fell timber for export without a valid property mark;
- Forest Protection Decree, 1974 (NRCD 243), attempts to protect the integrity of forest reserves by prohibiting virtually any activity therein if done without the prior written permission of the Forestry Department;
- Timber Resources Management Act, No. 547 of 1996; introduced Timber Utilization Contracts for any timber harvesting and enhanced rights for landowners and farmers over harvesting of trees on their land;
- Timber Resources Management Regulations, 1998 (LI 1649), as amended by the Timber Resources Management Amendment Regulations, 2003 (LI 1721). The most recent attempt at legislative reform in the forest sector, aims to ensure that harvesting is consistent with the sustainable management and use of timber resources. This Act and its regulations describe marking of trees, logs, and timber products, registration of chainsaws and introduced timber utilization permits (TUP) and timber utilization contracts (TUC). This Act also provide incentives to encourage private sector participation in plantation development;
- Forestry Development Master Plan of 1996 guides the execution of the forestry policy to 2020;
- Forest and Wildlife Policy, 1974 aims at the "conservation and sustainable development of the nation's forest and wildlife resources for the maintenance of environmental quality and perpetual flow of benefits to all segments of society." The policy recognizes the role of local communities and indigenous knowledge in the conservation of forest and wildlife resources.

- Forestry Commission Act, (Act 453) established the present Forestry Commission. The Commission's mission is to provide services that guarantee the sustainable development and management of forests and wildlife and optimize their contribution to national socio-economic development.

Wildlife

- Wild Animal Preservation Act, 1961 (Act 43) was passed to protect wildlife by conserving representative samples of Ghana's ecosystems
- Wildlife Conservation Regulation, 1971 (LI 685) provides a system of permits and certificates for regulating international trade in line with CITES regulations. It is the main instrument under which endangered species are legally protected;
- Wildlife Reserves Regulations 1971 (LI 710) empowers the government to establish wildlife Protected Areas, including Ramsar Sites (and Marine Protected Areas) and also defines what could be done or not done within the Protected Area.

Fisheries, Wetlands, Coastal and Marine laws and regulations

- Fisheries Act, 2002 (Act 625) provides for the regulation and management of fisheries, the development of the fishing industry, and the sustainable exploitation of fishery resources;
- Wetland Management (Ramsar Site) Regulations 1999 (LI 1659) regulates management of Ramsar Sites in the country;
- National Wetlands Conservation Strategy, 1999 and its 2007 revised version, National Wetlands Conservation and Action Plan (2007-2016) comprise 12 programme areas, covering conservation and sustainable use of wetland resources;
- The Act establishing the Water Resources Commission, among others, deals with pollution on water;
- There are numerous laws and regulations covering protection of coastal and marine resources: Maritime Zones Law, 1986; Town and Country Planning Ordinance; The Towns Ordinance; National Building Regulations, 1996; EPA Act and regulations; Local Government Act, 1999; and Oil in Navigable Water Act, 1964.

Environmental Protection Agency (EPA)

Environmental Protection Agency Act, 1994 (Act 490), regulations and amendments: describe the responsibilities of the EPA, the creation of the National Environment Fund, and includes enforcement of regulations.

Environmental Assessment Regulations, 1999 (LI 1652), ensures impact assessment for all projects/developments likely to affect water resources.The EPA has developed sector specific guidelines for regulating the quality of effluent discharge into existing drainage and water systems.

Land

- Land Planning and Soil Conservation Act, 1957
- Town and Country Planning Ordinance 1945 (Cap 84)
- National Land Policy, 1999 aims to protect a variety of habitat types, and recognizes Forest reserves, National Parks and wildlife reserves and similar land categories as fully protected ecosystem for biodiversity conservation.

Local Government Law

Local Government Act, Act 462 gives local authorities the responsibility for overall development of their areas of jurisdiction, including improvement and management of human settlements, management of solid waste, and other environmental issues.

Mining

Thirteen laws and ten subsidiary legislations govern mining activities in the country. Article (6) of the Constitution of the Republic of Ghana, Section 1 of the Minerals and Mining Law (PNDC 153) states that every mineral in its natural state in, under, or upon any land in Ghana, rivers, streams, water courses throughout Ghana, the exclusive economic zone and any area covered by territorial waters or continental

shelf is the property of the Republic of Ghana and is vested in the Government for and on behalf of the people of Ghana.

Genetic Resources

Traditional Medicines Practices Act (Act 575 of 2000) legitimizes traditional medicines and healers. The law however, places more pressure on medicinal plants harvested from the wild since mechanisms for sustainable harvesting and cultivation have not been a significant focus in the law.

Act 307 of 1965 regulates the importation and exportation of plant genetic resources. This law established the Plant Protection and Regulatory Services Department within the Ministry of Food and Agriculture, which enforces quarantine regulations.

Oil and gas

The legal framework for oil and gas industry, include:

- Petroleum (Exploration and production) Law 1984 (PNDCL 84)
- Mineral (Offshore) Regulations 1963 (LI 257)
- Mineral (Oil and Gas) Regulations 1963 (LI 256)
- Oil and Mining Regulations 1957 (LI 221).

Tourism

The legal framework for tourism promotion (including coastal tourism):

- Ghana Investment Promotion Centre Act 1994 (Act 478)
- Companies Code 1963 (179)
- Free Zone Act 1995 (504)
- Ghana Tourism Board
- Ghana National Commission on Culture

Tourism Policy2006) aims at developing tourism as a leading socio-economic sector and making Ghana a competitive tourism destination within the framework of respect for the country’s cultural, historical, and environmental heritage.