

GHANA COASTAL WETLANDS MANAGEMENT PROJECT

**DEVELOPMENT OF A MANAGEMENT
PLAN FOR THE DENSU DELTA
RAMSAR SITE**

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LIST OF CONTENTS

| | |
|--|-----------|
| List of Tables | iv |
| List of Figures | iv |
| List of Appendices | iv |
| Acknowledgements..... | v |
| Executive Summary | vi |
| Terms of Reference | ix |
| 1.0 INTRODUCTION..... | 1 |
| 1.1 Physical Features of the Densu Delta Ramsar Site | 1 |
| 1.1.1 Relief and Drainage..... | 1 |
| 1.1.2 Climate | 2 |
| 1.1.3 Geology..... | 2 |
| 1.1.4 Hydrology..... | 3 |
| 1.1.5 Water Quality..... | 4 |
| 1.2 Biological Features of the Densu Delta Ramsar Site..... | 5 |
| 1.2.1 Floral Diversity | 5 |
| 1.2.1.1 Inshore..... | 6 |
| 1.2.1.2 Lagoons and Estuaries | 6 |
| 1.2.1.3 Salt Marshes and Mangrove | 6 |
| 1.2.1.4 Freshwater Marshes..... | 7 |
| 1.2.1.5 Flood Plains..... | 7 |
| 1.2.1.6 Strands..... | 7 |
| 1.2.1.7 The Scrub/Thicket..... | 7 |
| 1.2.2 Faunal Diversity | 7 |
| 1.2.2.1 Macro-invertebrates | |
| 1.2.2.2 Fishery Resources..... | 8 |
| 1.2.2.3 Avian Resources..... | 8 |
| 1.2.2.4 Mammal and Herpetofaunal Resources | 9 |
| 1.3. Socio-Economic Features of the Densu Delta Ramsar Site | 10 |
| 1.3.1 Demographic Profile | 10 |
| 1.3.2 | Tradit |
| ional Characteristics | 10 |
| 1.3.2.1..... | Water |
| Tenure..... | 10 |
| 1.3.2.2..... | Beliefs |
| | 11 |
| 1.4 | |
| Land Use and Economic Activities in the Wetland..... | 12 |
| 1.4.1 Salt Winning | 12 |
| 1.4.2 Housing Development..... | 13 |
| 1.4.3 Quarrying, Sand Winning and Clay Mining | 13 |
| 1.4.4 Mangrove Harvesting..... | 14 |
| 1.4.5 Crop Farming and Animal Grazing | 14 |
| 1.4.6 Fishing..... | 15 |

| | | |
|------------|--|-----------|
| 2.0 | <i>EVALUATION OF THE RAMSAR SITE</i> | 17 |
| 2.1 | Evaluation of the Densu Delta Ramsar Site | 17 |
| 2.1.1 | Naturalness | 17 |
| 2.1.2 | Rarity | 17 |
| 2.1.3 | Fragility | 17 |
| 2.1.4 | Typicalness | 17 |
| 2.1.5 | Aesthetic Value | 17 |
| 2.1.6 | Recreation | 18 |
| 2.1.7 | Research | 18 |
| 2.2 | The Stakeholders | 18 |
| 2.2.1 | A Functional Stakeholder Community | 19 |
| 2.2.2 | Membership of the Site Management Committee (SMC) | 19 |
| 2.3 | Education and Public Awareness | 19 |
| 3.0 | <i>OBJECTIVES FOR MANAGEMENT</i> | 20 |
| 3.1 | Long - Term Management Objectives | 20 |
| 3.2 | Factors Influencing The Achievement of the Long-Term Objectives | 20 |
| 3.2.1 | Human/Institutional | 20 |
| 3.2.2 | Economic | 23 |
| 3.2.3 | Natural | 23 |
| 3.3 | Personnel | 23 |
| 3.4 | Operational Objectives | 24 |
| 3.4.1 | Operational Objective for Long- term Objective (1) | 24 |
| 3.4.2 | Operational Objective for Long- term Objective (2) | |
| 4.0 | <i>ACTION PLAN</i> | 27 |
| 4.1. | Zoning | 27 |
| 4.2 | Management Strategies | 28 |
| 4.2.1 | Habitat/Species Management | 28 |
| 4.2.2 | Human Usage | 29 |
| 4.2.3 | Access, Public Use and Education/Demonstration | 31 |
| 4.2.4 | Research | 32 |
| 4.2.5 | Training of Personnel | 33 |
| 4.2.6 | Estate Management | 34 |
| 4.3 | Programmes For Densu Wetland Management | 34 |
| 4.3.1 | General Aspects | 34 |
| 4.3.2 | Education, Training and Capacity Building For Densu Delta Wetland Management | 35 |
| 4.3.2.1 | Time Frame | 36 |
| 4.3.2.2 | Implementation Arrangements | 36 |
| 4.3.3 | Wetland Research And Monitoring | 36 |
| 4.3.3.1 | Establishment of Mechanisms and Focal Points of Responsibility | 37 |
| 4.3.3.2 | The Establishment of Effective Partnerships | 37 |
| 4.3.3.3 | Improving the Development and Transfer of Technology | 38 |
| 4.3.3.4 | The Promotion of Research in Support of Sustainable Development | 38 |
| 4.3.3.5 | Time Frame | 38 |

| | | |
|-------------------|--|-----------|
| 4.3.3.6 | Implementation Arrangement | 38 |
| 4.3.4 | Enhancement of Conservation and Protection of the Wetland | 38 |
| 4.3.4.1 | Adoption of An Ecosystem-Based Approach to Resource Management | 39 |
| 4.3.4.2 | Steps to Protect Valuable Wetland Resources | 39 |
| 4.3.4.3 | Setting up of Standards to Reduce Environmental Contamination | 39 |
| 4.3.4.4 | Time Frame | 40 |
| 4.3.4.5 | Implementation Arrangements..... | 40 |
| 4.3.5 | Strengthening of Densu Delta Wetland Economies and Dealing Effectively with Poverty | 40 |
| 4.3.5.1 | Dealing Decisively with Poverty and Inequity..... | 40 |
| 4.3.5.2 | Ensuring Compatibility between Strategic Development Programmes and the Principle of Sustainable Development | 41 |
| 4.3.5.3 | Targeting Specific Resource Industries for Development..... | 41 |
| 4.3.5.4 | Time Frame | 42 |
| 4.3.5.5 | Implementation Arrangements..... | 42 |
| 4.3.6 | Data and Information Management and Exchange..... | 42 |
| 4.3.6.1 | Steps to Improve Availability of and Access to Data and Information..... | 43 |
| 4.3.6.2 | Ensuring Appropriate Data and Information Standards are in Place to Facilitate Data Sharing | 43 |
| 4.3.6.3 | Time Frame | 43 |
| 4.3.6.4 | Implementation Arrangement..... | 44 |
| 5.0 | MONITORING AND REVIEW | 48 |
| REFERENCES | | 57 |

LIST OF TABLES

| | | |
|-----------------|--|----|
| Table 1: | Personnel of Wildlife Division at Densu Delta Ramsar Site..... | 24 |
| Table 2: | Densu Delta Wetland Management Action Plan..... | 45 |

LIST OF FIGURES

| | | |
|------------------|--|----|
| Figure 1: | Map of Densu Delta Ramsar Site..... | 52 |
| Figure 2: | Soil Map: Densu Delta Wetland Catchment Area..... | 53 |
| Figure 3: | Land-Use/ Cover Map: Densu Delta Catchment Area..... | 54 |

LIST OF APPENDICES

| | | |
|---------------------|--|----|
| Appendix 1: | Mean Value of the Indicated Parameters of Wetland Water Bodies in dry (April) and Wet (July) Seasons in 1994..... | 55 |
| Appendix 2: | Flowering plants of the Densu Delta Ramsar Site..... | 56 |
| Appendix 3: | Ethobotanical Survey..... | 61 |
| Appendix 4: | List of Aquatic Invertebrate Fauna from the Densu Delta..... | 66 |
| Appendix 5: | Checklist of Fin and Shell Fishes Found in the Densu Delta, March-June 1994..... | 67 |
| Appendix 6: | Avian Species Riches in the Five Ramsar Sites..... | 68 |
| Appendix 7: | Materials Used in Building Houses..... | 70 |
| Appendix 8: | Population of Densu Ramsar Site..... | 71 |
| Appendix 9: | Occupations of People Living in the Densu Ramsar Site..... | 72 |
| Appendix 10: | Review of Involvement of the Major Stakeholders & Local Communities in the Management of the Densu Delta Ramsar Site and Strategies for Improvement to Ensure their Long-Term Participation..... | 73 |
| Appendix 11: | Measures for Addressing Identified Constraints..... | 79 |

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EXECUTIVE SUMMARY

- A management plan for the Densu Delta Ramsar Site has been developed along the wise-use concept of the international Ramsar Convention. In developing this management plan, reference has been made to a large body of information on various base line and other studies conducted in the area from 1993 under the auspices of the Ghana Coastal Wetlands Management Project (GCWMP)
- The Densu Delta and Wetlands take their source from the Densu River which originates from the Atewa Mountains in the East Akim Abuakwa District of Eastern Region. The river meanders through the Densu basin, bifurcating as it reaches the coastal area into a delta, wetlands and lagoon before emptying into the sea. Meanwhile upstream at Weija the river is dammed, thus trapping large amounts of sediments from upcountry behind the dam.
- The management plan has taken note of the general biophysical features of the Ramsar site, which is the area lying within the river valley formed by the Aplaku-Tukuse and Weija-Marthy Hills, west of Accra at Latitude 5°31'N and Longitude 0°20'W. The biophysical features referred to here include the relief and drainage, climate, geology, hydrology, water quality, floral and faunal diversity at the inshore, lagoon, estuary, salt and fresh water marsh, mangrove, flood plains, strand, scrub and thickets.
- The fishery, avian, mammalian and plant resources of the site have also been given priority attention. The socio-economic features noted in the site included the demographic profile, the traditional character involving water tenure, general belief systems, worship systems, land use and economic activities have been highlighted to inform proper strategic decisions.

- Concern has been expressed about the naturalness of the site, the fragility of the ecosystem and the rarity of a number of organisms that inhabit the ecosystem and the site.
- All of these expressions point to the uniqueness and therefore the typicalness of the site, in addition to its presentation as a natural scenic beauty to complement the planned green belt project for Greater Accra.
- The management plan has focussed on only two major long term objectives which when achieved will have very far reaching repercussions both for biodiversity, conservation and development; namely,
 - i) to ensure the ecological restoration and rehabilitation of the ecosystem within the Densu Delta Ramsar Site,
 - ii) to ensure the wise use and sound integrated management of the Densu Delta Ramsar Site for the socio-economic benefits of the inhabitants

For each of these management objectives are assigned a number of achievable operational objectives. To support these, a number of project proposals have been suggested.

- The stakeholder community at the site has been considered as an important component in achieving success in any management objective programmes. Their involvement is very paramount. Certain groups were found not to have been represented and a suggestion has been made to include representatives of GES and MOFA on the site management committee of the Ramsar Site.
- The roles of the stakeholders are also expected to be properly streamlined. Some attempts have been made to suggest the roles which fit each stakeholder in order to bring harmony in the management of the site.

An action plan under four major elements of zoning, management strategies, programmes and monitoring and review is recommended. Under the zoning, the site is expected to be properly demarcated to ward off intrusion. The management strategies involves habitat/species management, human usage, access, public use and education/ demonstration and research. Training of personnel and estate management are an important aspects of the management strategy and these are well documented.

A number of programmes including education, training and capacity building are emphasised with appropriate time schedules and implementation arrangements. Research, monitoring and review of the floral and faunal resources is expected to be on going and a large component of the action is ear marked for that. A number of sectors including the private and public will be expected to assist in the exercise.

It is to be expected that the goodwill that would have been established among the members of the stakeholder community, the researchers and the wildlife staff would have matured to the extent that the local people take over the job of monitoring themselves. This would have ensured to a large measure, the success of the action programme.

TERMS OF REFERENCE

The objective of the Consultancy Service is to develop a Revised Management Plan for the Densu Delta Ramsar Site.

Specifically the Consultant is to:

1. Collate and evaluate available biophysical information for the Densu Delta Ramsar Site;
2. Review the existing site management plan for the Densu Delta Ramsar Site with particular reference to:
 - a) staff strength, qualification and deployment.
 - b) job descriptions.
 - c) Implementation of management measures.
 - d) Public awareness and education.
 - e) Community participation in site management.
 - f) Community infrastructure development and
 - g) Management-stakeholder collaboration for sustainable wetland resource exploitation.
3. Review the current involvement of the Wildlife Division, District Assemblies, NGOs, traditional authorities, major stakeholders and local communities in the management of the Densu Delta Ramsar Site and formulate strategies for improvement to ensure their long-term participation.
4. Formulate long-term objectives for the sustainable management of the Densu Delta Ramsar Site according to the Ramsar wise use concept.

5. Identify factors influencing the attainment of the long-term objectives and outline measures for addressing them within a five-year implementation period. Particular attention should be given to reference 2 above.

6. Based on the review, develop a fully costed five-year integrated management plan for the Densu Delta Ramsar Site for donor support. In doing this, identify the specific time-bound outputs and indicators which would be used to evaluate the success of the interventions.

PART ONE

DESCRIPTION

1.0 INTRODUCTION

1.1 Physical Features of the Densu Delta Ramsar Site

The following general description of the Densu Delta Ramsar Site is based on the reports of the various baseline studies conducted in the area in 1993/94 under the auspices of the Ghana Coastal Wetlands Management Project.

The Densu Delta and wetlands lie in the river valley formed by the Aplaku-Tukuse and Weija-McCarthy Hills west of Accra, Latitude 5° 31' N and Longitude 0° 20' W. The main lagoons and Delta are located south of the Accra-Winneba/Cape Coast trunk road and bounded on the south by the Atlantic Ocean coastline between Bortianor and Gbegbeyise (Fig 1). The Aplaku-Bortianor road and the Lofa stream define the western and eastern boundaries respectively. According to Ntiamoa-Baidu and Hollis (1988), the Densu Delta covers some 34 km² of wetlands made up of 21 km² of lagoon and freshwater marsh, 11 km² of salt pans, 2.4 km² of scrub and coastal sand dune of 0.25 km². Each of these different areas has its own peculiar uses and environmental problems.

1.1.1 Relief and Drainage

The Densu Delta catchment area south of the Weija dam is rimmed on the north and west by the western extremity of the Akwapim-Togo range (Amatekpor (994). The Weija and Aplaku hills slope steeply onto the almost flat wetland. Densu is the main river that drains into the wetlands. The river takes its source from the Atewa mountain range near Kibi thus resulting in a very extensive catchment area. However, the Weija dam located 11 km upstream of the mouth of the river, has reduced the effective catchment area of the Delta and wetlands. The reservoir formed behind the dam is a source of potable water to some parts of the Accra Metropolis and is used also for irrigation and fishing.

Three short streams on the eastern slopes of the Aplaku-Bortianor hill also drain into the Densu Delta and wetlands. The eastern part of the wetland which borders on west Dansoman, also consists of a series of lagoon and marshes forming, a drain for the area

into the Densu river. The relief is undulating with the highest point at 76 m.

1.1.2 Climate

The Densu Delta Ramsar Site falls within the Coastal Savanna Zone of Ghana where the annual rainfall is low; totalling just about 672 mm per annum (Amatekpor, 1994). The rainfall pattern is bimodal with the main wet season occurring from mid-March to end-July, followed by the minor wet season from early September to end of November. About 75 % of the annual rainfall is in the major wet season. Maximum rainfall is in June and October for the two seasons respectively. The average annual temperature is around 26°C with highest temperatures occurring during the main dry season (February to March) and lowest during the short dry season (August). Average relative humidity at 1500 hours is 75-80 % during the greater part of the year but may drop to below 65 % during the Harmattan season (December to February).

1.1.3 Geology

The description given here generally follows Amatekpor (1994). The geology of the coastal area east of the Akwapim Range which includes the catchment area of the Densu Delta, is dominated by the formations of the Akwapim-Togo Range and its outliers, the Weija Hills. The range and hills are formed mostly of pre-Cambrian quartzite schist with smaller amounts of phyllite, sericite schist, sandstone and shale. The quartzites mostly form the hills overlooking the wetland with shale and phyllites in the valley floors. Recent alluvium occupies the Densu valley and the lagoons and marine sands are deposited in the narrow strip along the Atlantic coast. These geological formations constitute the parent materials in which the various soils in the catchment area south of the Weija dam develop. A soil map of the Densu wetland catchment area is shown in Figure 2.

Using a pedological method, Amatekpor (1994) gives a general assessment of the relative potential erodibility of the main soil series in the Densu Delta wetland and catchment area. Erodiability of soils which occur north of the Weija dam mainly affect sedimentation of the Weija lake whereas south of the dam, the erodibility of the soils.

directly affect the wetland. The Korle series (Fig. 2) was rated highly credible mainly because of its steep slope, high runoff rate, and current land use, whereas the Hacho and Nyigbenya series were rated moderately credible (Amatekpor, *ibid.*). From information presented in the reports of various studies, Amatekpor (*op. cit.*) estimated that the Hacho, Nyigbenya and Korle series could yield between 0.56 and 16.0 tons/ha/year of sediment into the Densu Delta wetland.

The Weija lake is the main trap for almost all the sediment yield and pollutants derived from the Densu catchment north of the Weija dam. The sediment of the Delta (below the dam) were composed of mainly sand and silt with varying incorporations of clay (Biney, 1995). They were slightly alkaline with a pH range of 6.8 - 8 (mean of 7.4) and their conductivity varied proportionally with salinity of the overlying waters. Organic matter concentrations in the sediment were low.

1.1.4 Hydrology

The Densu Delta can generally be described as a coastal water body located on a low lying flat land where run-off accumulates or groundwater possibly emerges. It lies behind a sand dune which was formed by strong longshore littoral drift characterising the coast of Ghana (Amatekpor, 1998). The dune is partially stabilised by coconut trees. The Densu Delta is covered all year round, by a pool of water of variable depth.

There are no records of inflows into the delta. However, flow records are available on the Densu River at Nsawam spanning the period 1967/68 to 1979/80. There are also periodic releases from the Weija dam from time to time into the Delta but these are not quantified. However, the spillway capacity of the Weija dam is 1,472 m³/s (Tumbulto *et al.*, 1995)

There is a large expanse of sand deposit along the banks of the Densu River north of the bridge on the Accra-Cape Coast trunk road through Oblogo up to Weija. This has appreciable permeability to act as a sink which absorbs substantial quantities of water during the rainy season when the river is in floods or whenever excess water is spilled over from the Weija dam. This water is slowly but continuously discharged during the

dry season to feed the lagoon. It is noted however that release of water from the aquifer will only be sustained if sand winning currently going on in the vicinity is prohibited.

The available data on the catchment that was of use included rainfall data for Accra, pan evaporation data for Accra and mean monthly flow data on the Densu River at Nsawam.

It was assumed that the runoff producing characteristics of the upper catchment is similar to the lower. On that basis, flow records were transferred from Nsawam gauging station to give an idea of the variation in flow with time.

The mean monthly rainfall for the lower catchment was taken as that available at Accra. The actual evaporation data for this part of the catchment was estimated from the pan evaporation data for Accra by applying a factor of 0.7 to take account of the fact that pan evaporation is normally higher than the actual evapotranspiration. The soil and groundwater storage was then estimated as the difference between the input and the output which amounted to 12.8% of the annual rainfall (Tumbulto *et al.*, 1995). Groundwater storage was observed to occur only in May and June

The hydrology of the Densu-Delta is influenced by the opening and closing of the sluice gates of the Weija dam and breaking of the sandbar near Tsokome. The opening of the sluice gates has become a periodic feature and so any management practice should take this into consideration. For example, it is advisable that prior notice be given to the local fishers before opening the gates.

1.1.5 Water Quality

Most of the activities which influence water quality occur outside the Delta because of the larger population living outside but close to it (Biney, 1995). Mean values of various properties of water in the wetland are given in Appendix 1. With the exception of parameters like pH, Hg and DO, large variations occur in the physical and chemical characteristics of the surface waters in the wetland between dry and wet seasons.

For example, total coliform counts at the south-eastern end of the wetland ("Congo" near Dansoman) reduced from 32,000 per 100 ml in April to 30 per 100 ml in July. Similarly, salinity reduced from 32.0 to 10.5 ‰ over the same time period.

Biney (*ibid.*) also gives marked differences between parameter values at the different ecological zones of the wetland. For example, while surface waters were fresh at Oblogo, very saline waters were encountered in some parts of the Panbros salt pans. The author also observed high organic contamination at Bortianor and Tsokomey which are areas of high human activity and concluded that on the whole, the Densu Delta may be characterised as slight to moderately contaminated with organic matter mainly from domestic sources.

Biney (1995) concludes also that on the basis of World Health Organisation (WHO) limits, the whole Densu Delta was suitable as a secondary contact water, i.e. for boating and fishing during both dry and wet seasons. Because of the increased inputs of contaminated land runoff, Aplaku, Tsokomey and Bortianor were not suitable for primary contact during the wet season. The author cautions, however, that generally there is need to expand and improve sanitary and waste disposal facilities within the Delta, especially in such areas as Bortianor, Tsokomey, Aplaku, Tetegbu and in immediate upstream areas including Oblogo and Weija. The Mpoase-Gbegebeyise lagoon, one of the Delta lagoons on the eastern side of the wetland is now completely silted up and polluted. This is because some houses close to this lagoon discharge their household waste water directly into the lagoon through PVC pipes (Biney *op. cit.*).

1.2 Biological Features of the Densu Delta Ramsar Site

1.2.1 Floral Diversity

Oteng-Yeboah (1994) identified a total of 136 plant species (belonging to 50 flowering plant families) in the flood plains and elevated ground of the Densu Delta (Appendix 2). The utilization of these plants by humans and animals is summarised in Appendix 3. Oteng-Yeboah (*ibid.*) also noted that the vegetation on the sand dunes and salt pans is thin. Towards the sea shoreline, typical strands species are the following, *Ipomoea pes-*

caprae, *Sporobolus virginicus* and *Cyperus maritimus*. *Sesuvium portulacastrum* beds are found along the banks of the salt pans (Gordon, 1995) and the eastern tributary of the Densu close to the salt pans (Oteng-Yeboah, *ibid.*). *Paspalum vaginatum* is also common in these areas. Coconut trees (*Cocos nucifera*) fringe the dunes and the scrubs are mainly of two mangrove species *Avicennia africana* and *Rhizophora racernosa*.

In the less saline areas, the vegetation is mainly *Imperata* and *Typha* stands. Also associated with the freshwater marsh are the thorny bush *Drepanocarpus lunatus* and *Nauclea latifolia* (Oteng-Yeboah, 1994). The vegetation found around the streams that feed the lagoon includes African Date Palm, *Azadirachta indica*, *Acacia sp.* and Cashew (Biney 1995). During some parts of the year the vegetation is burnt either from bush fires or land preparation for farming.

Further description of the vegetation present at various areas in the wetlands are given below:

1.2.1.1 Inshore

At the Littoral, eu-littoral and sub-littoral fringes various species of red, brown and green algae are likely to be found. Typical species are for red algae (*Bstrychia sp.* *Gracilaria sp.*); brown algae (*Sargassum sp.*, *Dictyota sp.* *Ecotcarpus sp.*) and green algae (*Ulva sp.*, *Enteromorpha sp.*) (Oteng-Yeboah et. al., 1998).

1.2.1.2 Lagoons and Estuaries

The algal species found here are mostly from the blue-greens, green and red (Oteng-Yeboah eL al, 1998). The blue-greens especially *Microcoleus sp.*, *Anacystis sp.* found on cracked surfaces of mud and *Coccochloris sp.* and *Spirulina sp.* occur in salt pans. The green algae have mostly been *Enteromorpha flexuosa*, *Cladophora sp.* etc. The planktomic green alga *Dunaliella saline* is known to cause turbidity of most saline ponds. The red algae have mostly been *Bostrychia radicans* and *Polysiphonia sp.*

1.2.1.3 Salt Marshes and Mangrove

There is zonation of the vegetation on the lagoon fringes. Mangrove stands typically of

Rhizophora sp. and *Laguncularia* sp. occur on the sea ward side of the lagoon while *Avicennia* sp. occur on the land ward side of the swamp. At some places the fern *Acrostichum aureum* the grasses *Paspalum vaginatum* and *Sporobolus virginicus* and the succulent *Sesuvium portulacastrum* accompany the mangrove and form a zone of their own.

1.2.1.4 Freshwater Marshes

Typical plants are the cattail *Typha domingensis*, and the mat reed *Cyperus articulatus*.

The thorny bush *Drepanocarpus lunatus* is very typical here.

1.2.1.5 Flood Plains

The typical species are grasses *Vetiveria fulvibarbis* *Andropogon gayanus*, *Imperata cylindrica* and *Sporobolus pyramidally*. The African date palm *Phoenix reclinata* is quite common.

1.2.1.6 Strands

The typical species are *Ipomoea pes-casprae*, *Canavalia rosea*, *Cyperus maritima*, *Opuntia vulgaris* and coconut *Cocos nucifera*.

1.2.1.7 The Scrub/Thicket

The typical species are *Adansonia digitata*, *Azadirachta indica*, *Elaeophorbia drupifera*, *Baphia nitida*, *Zanthoxylum xanthoxyloides* and *Byrsocarpus coccineus*

1.2.2 Faunal Diversity

1.2.2.1 Macro-invertebrates

Gordon (1995) lists representatives of Crustacea, Mollusca, Insecta and Oligochaeta as constituting the main macro-invertebrate population of the Densu Delta (Appendix 4). Ameyaw-Akumfi et al. (1998) add Annelida, Nematoda, Hydracarina and other organisms which represent the juvenile forms of certain faunal groups. The urgent need to do taxonomic studies of the more commonly occurring groups such as the Ephemeroptera, Chironomidae and Coleoptera was emphasised to enable proper identification. These organisms constitute the zooplankton, aufwuchs, benthos the tidal mud flats and marshy

communities of the Densu Delta.

1.2.2.2 Fishery Resources

Koranteng (1995) found a total of 15 fish species belonging to 14 genera and 9 families in the Densu Delta (Appendix 5). Ameyaw-Akumfi *et. al* (1998) indicate twelve fish species belonging to six groups including the Clupeidae, Ciclidae, Gerridae etc. as common in the delta and lagoons.

In an experimental fishing (Koranteng, 1995), *Sarotherodon melanotheron* made up about 86% (by weight) of the total catch. Some other freshwater fishes (e.g. *Tilapia zillii*, *Clarias* spp) and marine fishes (e.g. *Ethmalosa fimbriata*, *Scyacium micrurum* (sole), *Liza falcipinnis* (mullet)) are caught in the lagoons. Some marine species like *Lutjanus fulgens* (snapper), *Caranx hippos*, and *Epinephelus aeneus* (groupers) only make short incursion into the lagoon.

Koranteng (*op. cit.*) also recorded ten species of shellfishes in the Densu Delta, These include the lagoon land crab (*Cardiosoma armatum*), the swimming crab (*Callinectes latimanus*) and shrimps *Penaeus notialis*. The shrimps have their post larvae washed into the lagoon after the rainy period, spend some time in the mangroves which is their juvenile feeding ground, and leave the lagoon at the onset of the rainy period.

Juvenile forms of freshwater fishes endemic to the Weija reservoir which could reach the estuary are heavily exploited by the fishers operating just below the dam. This does not augur well for the fishery in the Densu Delta because removal of these juveniles from this important source would obviously affect recruitment into the Delta.

1.2.2.3 Avian Resources

The Densu Delta has a record of 57 species of birds with an estimated population of 35,000 (Gordon, 1998). The Densu Delta is one of eight sites on the Ghanaian coast that are most important for waterbirds. Five of these sites (including Densu Delta) provide refuge for about 5% of all waterbirds using the East Atlantic Flyway at some

point during the annual migration of the birds (Ghana Wildlife Society, 1999). Between March 1998 and February 1999, 38 species of waterbirds were sighted in the Delta. These included 21 waders, 7 terns, and 10 others (Appendix 6). The total bird count for the period March 1998-February 1999 was 126,863 (Ghana Wildlife Society, 1999). Peak sightings were between October 1998 and January 1999.

Appendix 6 also places the importance of the Densu Ramsar sites in the context of the four other declared Ramsar sites in Ghana. The Densu Delta is the most important site in Ghana for terns. The most important species of terns that visit the Delta include Black tern (*Chlidonias niger*), Common tern (*Sterna hirundo*), Sandwich tern (*Sterna sandvicencis*) and Royal tern (*Sterna maxima*). The rare Roseate tern (*Sterna dougallii*) contributed 1.8% of the tern population in the Delta; this represents 55% of the total sightings of individuals of the species in the five important coastal wetlands in Ghana (Ghana Wildlife Society, *ibid.*). With ample roosting areas, the Densu Delta was also found to be the most productive site in Ghana in terms of tern population. The site is not attractive to waders mainly because of the depths of the water there. The waders recorded there (mainly Greenshank; *Tringa nebularia*, Blackwinged stilt; *Himantopus himantopus* and five other species) were restricted to the shallow disused salt pans.

Other waterbirds recorded at the Densu Delta were mainly fish-eating species like egrets, herons and cormorant with the Little egret (*Egretta garzetta*) and the Long-tailed cormorant (*Phalacrocorax africanus*) as being the most dominant.

1.2.2.4 Mammal and Herpetofaunal Resources

The Densu Delta wetlands are home to a number of small mammals such as rodents (rats of all kinds and sizes including the giant rat (*Cricetomys gambianus*) and grasscutter (*Thryonomys swinderianus*). Reptiles such as lizards of various forms including Agama lizard (*Agama agama*), Nile monitor (*Varanus niloticus*), orange flanked skink (*Mabuya perotettii*) chameleon (*Chamaeleo gracilis*) and snakes such as the green mamba (*Dendroaspis viridis*) marsh snake (*Natriciteres fuliginosus*) and grass snake (*Dromophis lineatus*).

A final list of mammals and reptiles is required for the site, as this does not appear to be available.

1.3. Socio-Economic Features of the Densu Delta Ramsar Site

1.3.1 Demographic Profile

Dadson (1995) gives an elaborate socio-economic profile of the Densu Delta. The author reports that most of the houses in the nearby villages are built of local materials (mud, wood, thatch) (Appendix 7). Most homes have access to pipe-borne water, have kitchens and bathrooms but no toilets. The land is privately or communally owned and migrants have access to land on easy terms. Of 43 allotments covered in an enquiry conducted by Dadson (1995), 23 (or 53.5%) were family land, 8 (or 18.6%) were stool lands and 12 (27.9%) were under other kinds of ownership

From examination of 101 households, Dadson (*op. cit.*) noted that the residents in the Delta area are mostly Gas (58.4%), but there are also Ewes (32.7%) and people from other ethnic backgrounds (8%)

According to Sam (1991), the population of the Densu catchment in the Greater Accra Metropolitan Area in 1984 was approximately 108,000. Using a growth rate of 3.6%, Biney (1995) extrapolated the population to be around 200,000 in 1995. Dadson (1995) on the other hand gave the population of the Delta area as 20,000, growing at 6.4% (Appendix 8) and the larger Densu basin as about 500,000. Dadson (*op. cit.*) gives the literacy rate as 60% and notes that most communities have at least a primary school. Many people in the area have access to clinics although traditional health facilities predominate.

Main and secondary occupations of the inhabitants of the Densu Delta Ramsar site are summarised in Appendix 9.

1.3.2 Traditional Characteristics

1.3.2.1 Water Tenure

Dadson (1995) noted that the lagoons of the Densu Delta area belong to the people of James Town and are under the control of the Ga traditional authorities (Wulomei) and the Accra Metropolitan Assembly. Koranteng (1995) noted that the Wulome of Accra is the main custodian of the Densu Delta which includes the Sakumo I lagoon. The shrine is in Accra. Klemensu, the chief priest at Bortianor is only the representative of the Accra Wulome around the delta. He always consults the Accra Wulome in the performance of his traditional functions.

Access to fishing is free and subject only to observance of taboos and other customs (Dadson, 1995). According to Koranteng (1995), fishing in the Densu delta is not governed by many taboos and that whatever taboos exist are not obeyed. Urbanisation appears to be the major cause of the breakdown of traditional norms with regard to exploitation of the resources of the Densu delta.

1.3.2.2 Beliefs

There are a number of belief systems on ownership and use of the resources (Dadson, 1995). These are channelled through deities who are considered as the owners of the resources and therefore must be revered and/or worshipped. Respect to the deities comes in the form of avoiding contact with the resource at certain times of the week or year (to avoid meeting the gods) or performing sacrifices and rituals in their honour. There are sanctions prescribed for non observance. Some of the 'wishes' of the various 'gods' as recorded by Dadson (*op. cit.*) are summarised below

Land Gods

Communities believe in the existence of land gods who take stock of the activities of the land after every six days. On such days, the members of the community rest for the rituals (Dadson 1995). Saturday is the day for Ablekuma and Friday for most of the other settlements within the Densu Delta. At Dantsera, a section observes the day on Tuesdays, and in some parts of Domeabra, it falls on Sundays.

Sea Gods

The sea gods need one day in the week for their activities just like the land gods. This day falls on Tuesdays, and there should be no fishing in the sea.

River Gods

For the river gods like for land and sea gods there should be no fishing on Fridays.

Lagoon Gods

Friday is set aside for the lagoon gods.

Forest Gods

These stay in the forest (groves), and on their day which may be a Friday or Saturday or Sunday (depending on the location), no tree cutting (where cutting is allowed) or entry is allowed. There are about 10 of such sacred forests at Aplaku in the Densu Delta area whose entry is restricted to the Fetish Priests (Wulomei) and his elders only. For example the Okudja (Densu River) Fetish is located at Korle Klala (the place where Okudja meets Sakumo I lagoon) and this is where libation is poured. In these systems, the chiefs, elders and the Wulomei work together as principal administrators in the traditional management of the land and water bodies.

1.4 Land Use and Economic Activities in the Wetland

Activities in the wetlands include salt winning, sand winning, stone quarrying, clay mining, crop farming, mangrove harvesting, animal grazing, fishing and fish processing. Figure 3 (adapted from Amatekpor, 1994) shows the general land use categories in the Densu wetland and catchment area. The map depicts broad categories of land use, including built-up areas, or land cover in the catchment area.

1.4.1 Salt Winning

Large scale commercial salt winning by Panbros Salt Company is an important economic activity in the wetlands and is famous within the Accra-Winneba area for its salt production. The total area of the company's concession is about 1130 ha of which

784 ha have been developed into salt pans (Amatekpor, 1994). Panbros produces salt by pumping seawater into the salt pans to be evaporated. Because salt pans are dehydrated through the natural processes of evaporation and crystallisation, peak salt production takes place during the dry season. Panbros often dredges an estuary to the sea anytime that water is spilled from the Weija reservoir into the lagoon. Thus the level of water in the lagoon, especially between Glefe and Bortianor, seems to be fairly well regulated most of the time (Amatekpor, *op. cit.*). Some new salt pans are also being developed by a private individual in a small area along the Aplaku-Bortianor road.

Amatekpor (*ibid.*) reckons that the salt winning activities generally seem quite compatible with the wetland ecosystem. This is because, from the commencement of its operations, Panbros has been very much aware of environment and possible effects of the company's operations on it (the environment).

1.4.2 Housing Development

The rate at which housing development projects are taking place in the vicinity of the wetlands is rather alarming. This includes those by individuals and large-scale estate/property developers like Vanderpuye-Orgle Estates Ltd. Many of the new houses have encroached on the wetland and some are almost adjacent to the salt pans. The housing development along the slopes of McCarthy Hill have caused serious devegetation, erosion and considerable sediment yield to the wetland.

1.4.3 Quarrying, Sand Winning and Clay Mining

The Weija-Aplaku-Bortianor Hills around the Densu wetland are a good source of quartzites and phyllites for the building construction industry (Amatekpor, 1994) but reckless quarrying of these rocks has been going on at many locations along the slopes of the hills. This is a major source of destruction of the primary vegetation on the hills. Sand winning, of the Hacho series, takes place close to the banks of the Densu river causing severe river bank erosion and sedimentation of the wetland. This (Hacho) series of sandy soils are suitable for concrete block making and with the escalation in housing developments in and around Accra, the soils are being extensively mined.

The sandy Keta series along the coast are also being mined at many locations between Glefe and Faana, a practice that could accelerate sea erosion of the coastline south of the Densu Delta and wetland. The beauty of the sandy beach is also being destroyed.

Clay deposits are mined near Tetegbu and Oblogo to feed a brick and tile factory at Abelempe which is outside the Densu catchment area. According to Amatekpor (1994), the excavated clay pits do not pose any erosion and sedimentation problems. Rather, the abandoned pits serve as sediment traps

1.4.4 Mangrove Harvesting

Mangroves in the wetland are harvested for fuel wood or used as building and fishing materials. Mangrove is a preferred fuel wood for fish smoking in many coastal fishing communities. It is believed that the smoke from mangroves gives the smoked fish a characteristic taste. For the 'acadja' fishing method practised in the Delta area, branches of mangroves are used (Koranteng 1995). In this method of fishing (actually an aquaculture practice), several branches of trees are dumped in the water to serve as a fish aggregating device. Fish that are attracted to the device either to spawn or to feed are harvested by the fishers.

1.4.5 Crop Farming and Animal Grazing

Large scale farming in the demarcated catchment area of the Densu Delta is carried out mainly in the zone north of the Weija dam (Amatekpor, 1994). South of the dam, Oteng-Yeboah (1994) noted three forms of cultivation, namely sugar cane plantations, oil palm plantation and ordinary food crop cultivation. The sugar cane plantations are located within the freshwater swamp. There is a small oil palm plantation (about 1 ha) near Tsokomey but the food crop farms are many and scattered. Between Aplaku and Bortianor, cassava, corn and vegetables (tomato, pepper, garden eggs) are cultivated mainly on subsistence scale. Occasionally, plantain and banana trees are located on some farms.

The estimated agricultural land (both cultivated and fallow) calculated from aerial photographs and topographical maps is 8,900ha (Amatekpor, 1994). Amatekpor (*op. cit.*) states, however, that very little or no fertilizers or other agro-chemicals are used in the farming activity. Hence, pollution of the wetland from these sources is negligible at the moment. However, the traditional land rotation method of farming is practised and simple farm tools like cutlass and hoe are used. Fire is used to aid land clearing prior to cultivation. Farming activities on the slopes of the Aplaku-Bortianor hills has caused serious destruction of the area's primary forest vegetation (Amatekpor, 1994). According to the author, only the small 'Solo' sacred grove near Bortianor, where farming or fuel wood collection is not allowed, still has the primary vegetation. Accelerated erosion of the soils on the hill slopes is now taking place and conservation measures are required to minimise sediment yield from this source into the lagoon.

Amatekpor (1994) also states that although the grassland to the west and north of the Aplaku-Tetegbu-Oblogo area carries some cattle population, presently their number is too small to pose any problems with over-grazing. However, the threat could become serious if the cattle population is allowed to increase.

1.4.6 Fishing

Fishing is an important activity in the Densu Delta and lagoons. The mainly artisanal fishers come from Faana, Gbegbeyise, Mpoase and other areas west of Accra. The Densu Delta is a complex area in terms of fishing and every known fishing method used in lagoons in Ghana may be found here. The most popular fishing gears and methods found are: castnet, seine (or drag) nets, various crab traps, bottle, acadja, hand fishing, hook and line, and trawl nets (Koranteng, 1995). Fishing at many areas of the Delta becomes impossible but not prohibited, when the floodgates at the Weija dam are opened.

Koranteng (*op. cit.*) estimated that the average daily catch from the Densu Delta, excluding crab trapping, was about 450 - 650kg. This leads to an estimated total

production of about 260 tonnes per annum or 130 kg/ha (using an area of 20km²). Compared to corresponding values of 343kg/ha for the Sakumo 2 lagoon near Tema and 1 90kg/ha for the Muni lagoon near Winneba, it is clear that the yield in the Densu Delta is rather low. This is mainly due to the fact that the Delta is over-exploited. The elderly among the fishers agree that catches in recent years are lower and the fish are smaller in size, than in the past.

A major cause of the over-exploitation in the Delta is the non-adherence to taboos and other cultural practices that are important tenets of traditional management of lagoon fisheries in Ghana. Although the Wulomo of Accra is the main custodian of the Densu Delta and lagoons (which includes Sakumo I) it appears that whatever taboos exist these are not obeyed as compared, for example, to the Muni and Sakumo lagoons. The fishers consider fishing in the Delta as free for all and many do not know of any taboos or cultural practices with regard to fishing in the Delta. Fishing in the Delta goes on all week and throughout the year except for a few days during the annual Homowo festival of the Ga people. The virtually open access and apparently uncontrolled fishing in the Densu Delta also do not augur well for the sustenance of fishery resources in the Delta.

Urbanisation is the major cause of the breakdown of the traditional norms with regard to the exploitation of the resources of the Densu Delta. To limit fishing effort in the Densu Delta as a management tool, it would be desirable to institute some traditional regulations or to enforce existing but moribund ones with regard to fishing.

Koranteng (1995) estimated that the daily earning of the fishers ranged between 0864 (for those who fish with bottles) to 04,200 (for 'acadja' fishers). These were considerably higher than the government minimum wage at the time. It was also noted that although the average daily earning of a marine artisanal fisher in the Greater Accra Region was 04,500 at the time of the study, the corresponding income for marine fishers in villages close to the Delta was below 01,000. The author also estimated that the value of the annual catch from the Densu Delta was over 80 million cedis in 1994.

PART TWO
EVALUATION

2.0 EVALUATION OF THE RAMSAR SITE

2.1 Evaluation of the Densu Delta Ramsar Site

2.1.1 Naturalness

Available information indicate that as a result of the siting of building projects, though illegal, the natural appeal of the site is being lost. Several buildings have occupied places that used to be study sites during the baseline studies of the 1993/1995.

2.1.2 Rarity

The area is a refuge for a number of organisms both plant, animal and microbial. With the current disturbance, particularly at building sites, species yet to be identified and are at such sites are lost to mankind forever.

2.1.3 Fragility

The different ecological systems operating in the area are influenced and or regulated by both natural and anthropogenic factors. The equilibrium in each of the systems would be irreversibly and permanently altered if the current man-made adverse effects are not stemmed. This means that the ecosystem is fragile and need to be protected. The marsh-mangrove ecosystem is an example of such fragile ecosystem but is very important for fishery and avian resources. They must by all means be protected.

2.1.4 Typicalness

The habitats referred to above which provide for the sustenance of the numerous organisms that live there can be described as typical. Being typical, every effort must be made to ensure that they are maintained so that they do not disappear or are not destroyed.

2.1.5 Aesthetic Value

There is a scenic beauty of the Delta into the sea and also from the air. This aesthetic beauty which the Delta and its surrounding hills provide is still highly valued despite the urbanisation around. This can be enhanced and given a big boost when the proposed green belt project being undertaken by the Ministry of Environment. Science and

Technology through its agency the Town and Country Planning Department (TCPD) takes off.

2.1.6 Recreation

Abundant opportunities are available for recreational facilities on the shores and water ways of the Delta and the Lagoons. Ecological tourism of wetlands is probably at its infancy in Ghana, and perhaps it is not necessary to push it at this stage until the conservation programmes are firmly in place.

2.1.7 Research

Aquatic plant and animal life in the wetlands are far from being comprehensively understood. Several gaps exist and this calls for more researches in the wetlands. Already partnerships have emerged between the Universities, the Research Institutions and the Wildlife Division of the Forestry Commission. This is a healthy development which should be fully supported financially.

2.2 The Stakeholders

The list of stakeholders of the Densu Delta Ramsar Site includes both government, non-government, community and traditional groups, private individuals and companies. For government groups the following are currently considered as stakeholders: the Ministry of Lands and Forestry (MLF), the Wildlife Division (WD) of the Ghana Forestry Commission, the Forestry Service Division (FSD) also of the Ghana Forestry Commission, the Ga District Assembly (GDA), Town and Country Planning Department (TCPD), Environmental Protection Agency (EPA) and the Ghana Water Company (GWC). Others are the Ghana Education Service (GES) and the Ministry of Food and Agriculture (MOFA). For the non-government groups, there is the Ghana Wildlife Society (GWS). The community groups, are beneficiaries of the Community Investment Support Fund (CISF), the Assemblymen and Unit Committee Members. For the traditional groups, there is the Sempe stool custodians of the Ga Traditional Council.

PART THREE

OBJECTIVES

2.2.1 A Functional Stakeholder Community

Following the current review of the state of involvement of the stakeholder community in the site, it has been possible to suggest new and additional roles for their active and long-term, participation in the management of the site. The GES and the MOFA which are not members of the SMC are respectively given specific roles of educating the youth and teaching farmers correct agricultural practices. The full description of the involvement of the major stakeholders is provided in the Appendix 10.

2.2.2 Membership of the Site Management Committee (SMC)

Current membership of the she management committee is drawn from the various stakeholders listed above. For the government groups, only GES and MOFA are not represented on the committee. The Wildlife Division has roles including liaising with the site management committees and disbursing the CISF.

The general observation is that the roles of the SMC have not been well defined Also other very vital stakeholders who can contribute immensely to the management of the site have been ignored. As a consequence, land litigation is a major problem that easily threatens the smooth functioning of the committee.

2.3 Education and Public Awareness

As a result of the influx of different ethnic groups finding houses within and around the wetlands, thus diluting the influence of traditional norms and belief systems educational campaigns are needed. The traditional authority is gradually and Patently losing its grip on the area. The taboo and belief systems are gradually erodmg. Education would help to create awareness of the functions of wetlands and the sustainable exploitation of its resources.

3.0 OBJECTIVES FOR MANAGEMENT

3.1 Long - Term Management Objectives

The Densu Delta Ramsar Site forms an integral part of the Accra peri-urban environment and its management must be pursued in the context of an interaction between conservation or wise use -and the Ga District Assembly (GDA) development strategies and activities. Consequently, the long-term management objectives and proposed actions follow closely with the previous management plan (Ntiamoah-Baidu and Gordon, 1991) and also opportunities and constraints in implementing them. The long-term management objectives being advocated for the management of Densu Delta Ramsar Site are as follows:

- To ensure the ecological restoration and rehabilitation of the ecosystem within the Densu Delta Ramsar.
- To ensure the wise use and sound integrated management of the Densu Delta Ramsar Site for the socio-economic benefits of the inhabitants.

3.2 Factors Influencing The Achievement of the Long-Term Objectives.

Factors influencing the attainment of the long-term objectives identified can be grouped into human/institutional, economic and natural factors.

3.2.1 Human/Institutional

- The apparent rapid urbanisation and land encroachment spreading into the wetland pose great danger to the stability of the ecosystems of the wetland. This trend has disturbed the hydrology of the area by increasing run-off and decreasing percolation of water into the underground water aquifer in the wetland. (Dept.of Zoology, 1998) With the passing of the Wetland Management (Ramsar Sites) Regulations 1999, LI 1659, authority has been vested in the Minister of Lands and Forestry to demarcate the core area of the site. Furthermore, LI 1659 allows the Minister, GDA and the Wildlife Division to regulate physical development outside the core area but within the site. Consequently, the site has to be properly demarcated and zoned to provide adequate protection against pollution and degradation.

- The fresh water and estuarine marshes of the wetlands serve as bird roosting, nesting and feeding areas as well as providing habitat for different organisms including some invertebrates and mangrove plants. Any extension in the salt pans by Panbros Company may therefore adversely affect the wetland. Though it is noted that the management of Panbros has indicated that it has no plans for further expansion of the salt production area, still, the Wildlife Division would have to find a way of getting a firm commitment from the company, perhaps through a Memorandum of Agreement (MOU).
- The intermittent water spillage by Ghana Water Company (GWC) and the occasional flooding of the wetlands after a heavy down pour of rains, though good for the wetland ecosystem is destructive for some settlements and properties. The current practice of opening the Delta to the sea when spilling starts at the Weija Dam should continue.
- Over-exploitation of the Densu Delta wetland resources by both inhabitants of the area and outsiders from Accra also adversely affect conservation efforts. The natural thicket vegetation and mangroves as well as isolated colonies of reeds and sedges which covered an area of 11,684.4 ha. (Amatekpor, 1994) have been over-exploited for fuel, 'acadja' fishing and building materials. In addition there is over-exploitation of fish and crabs leading to lower and smaller sized catches over the years in the Densu Delta and lagoons. A major cause of the over-exploitation of fish is the non-adherence to taboos and other cultural practices. As the LI 1659 is now in force, GDA could in consultation with the Minister of Lands and Forestry make bye laws to empower the local communities and the Assembly to regulate wetland resources. Already, the Wildlife Division has initiated the process by forwarding the draft bye laws to District Assemblies that have jurisdiction over the Ramsar Sites including GDA. It is noted that the Site has a rich and diverse fauna and flora and also there exist some limited mature stands of mangrove, which provide fish spawning and nursery grounds.

Conservation and restoration programmes are therefore required for both flora and fauna within the Site.

Quarrying at the Weija- Aplaku- Bortianor Hills around the Densu Ramsar Site for the building construction industry (Ametakpor, 1994) destroy primary vegetation on the hills. Large expanse of sand deposit along the banks of the Densu River north of the bridge on the Accra-Cape Coast road acts as an aquifer which absorbs excess water when water is spilled from the dam and discharges this into the lagoon in the dry season. (NRI, 1998). The release of the water could only continue, if sand winning along the banks is stopped. It has been established that sand winning along the beaches could also accelerate sea erosion (NRI, *ibid*). Clay mining pits near Tetegbu and Oblogo and are also noted for trapping sediments. The by laws could be used to regulate these activities.

The inadequacy of funds provided by the central government for the Wildlife Division to carry out biodiversity conservation activities could affect the attainment of the objectives, in the absence of donor support. As some donors have expressed interest in supporting conservation programmes for the Ramsar Sites, the Wildlife Division has to initiate moves to obtain support for the Second Phase of the Coastal Wetlands Management Project.

Destruction of vegetation, especially in riverine forests around the hills and along the streams has accelerated soil erosion and consequently, increased sediment yield into the lagoon. As noted, farming activities and fuel wood collection on the slopes of Aplaku-Bortianor hills have caused serious destruction to the area's primary forest vegetation. The Directorate of Agricultural Extension Services of the Ministry of Food and Agriculture should be contacted for farmers to be educated on the appropriate farming practices compatible with the wetland ecosystem. Fuel wood collection should also be regulated to conserve the remaining vegetation.

3 2.2 Economic

- The population around the lagoon and in the wetlands is estimated at about 20,000 and projected to over 27,000 (growing at 6.4% p.a.) in the year 2000 (see section 1.3.1). The basic occupations of the local people are farming and fishing. With such a high growing population, vis-a-vis limited job opportunities/options, inhabitants have no alternative but to over-depend on the resources of Densu Delta wetland for their livelihood. This puts pressure on the wetland and contributes to the over-exploitation of the resources. The problem has been compounded by the limited and high cost of land available for farming and woodlots establishment. The Community Investment Support Fund (CISF) supported groups and individuals within some communities to undertake small scale economic ventures and biodiversity conservation programmes. The expansion of CISF to cover more groups and communities could stimulate the growth of the local economy.
- Though there are other secondary occupations which local people are engaged in like food processing, animal husbandry, trading, hunting and sand winning, employment offered by Panbros Salt Company for the local communities needs to be mentioned. It is roughly estimated that 3,600 people are engaged in salt mining in the Densu Delta Ramsar site (NRI, 1998). However, because of the seasonality of salt production few of the people have permanent job positions. Potential for aquaculture, eco-tourism, small scale irrigation schemes and market gardening have been identified within the site (NRI, 1998). Further studies and research may have to be done in order to promote these economic activities.

3 2.3 Natural

- Flooding of the wetland area after a heavy down pour of rain poses great danger to life and property.

3.3 Personnel

As Table 1 depicts the Densu Delta Ramsar Site is managed by five personnel of the Wildlife Division with the following ranks (i) Assistant Wildlife Officer (in charge of

the site and also Sakumo Ramsar site), (ii) Technical Assistant, (iii) 2 Wildlife Guards (iv) Driver. Though the staff strength is below what was proposed by the previous management plan, they had managed the site well. It is proposed that when the education/visitor centre is established a Conservation Education Assistant should be added to the staff to manage the site.

Table 1:

Personnel of Wildlife Division at Densu Delta Ramsar Site

| Rank | Qualification | Responsibilities |
|-------------------------------|-------------------------------------|--|
| 1 .Assistant Wildlife Officer | B.Sc. (Natural Resource Management) | <ul style="list-style-type: none"> • General management of the Ramsar site • Preparation of work programme and facilitation of implementation • Conservation education of resource users • Facilitation of community development • Habitat improvement • Monitoring of the environmental health indicators • Community/stakeholder consultation |
| 2. Technical Assistant | G.C.E. (Advanced Level) | <ul style="list-style-type: none"> • Enforcement of Wildlife Laws and Ramsar site regulations • Reports to Wildlife Division and the GDA • Field assistance • Undertaking regular patrols of the core area of the site • Report to Officer- in-charge |
| 3. Wildlife Guard (2) | G.C.E. (Ordinary Level) | <ul style="list-style-type: none"> • Enforcement of Wildlife Laws and Ramsar site regulations • Field assistance • Undertaking regular patrols of the core area of the site • Report to Officer- in-charge |
| 4. Driver | M.S.L.C | Driving and maintenance of station vehicle |

3.4 Operational Objectives

The operational objectives are measurable indicators for achieving measures/actions specified within a five- year period. To attain the long -term objectives over the next five years, as stated above the following Operational Objectives are required.

3.4.1 Operational Objective for Long- term Objective (1)

- i) *Restore Mangrove stands and coconut trees to about 30% of the original area in*

five years. This would involve the following:

- Clear and plant coconut and mangrove trees for two years on trial basis;
- Evaluate the regeneration of the coconut and the mangrove trees during the trial period;
- Use the conclusions drawn from the evaluation to replant the remaining areas.

ii) *Enhance the value of the Densu Delta Ramsar Wetland as a conservation area.* This would involve the following:

- Improve bunds for birds to use as nesting and roosting sites;
- Regulate sand wining, fuel wood harvesting, clay mining and quarrying within the Ramsar site;
- Identify and provide support for the implementation of traditional conservation norms to promote the wise use of wetland resources.

iii) *Provide alternative economic avenues for income generation and poverty reduction support measures for communities depending on wetland resources for their livelihood through:*

- Identification of environmentally friendly alternative sources of livelihood for local communities to alleviate poverty;

3.4.2 Operational Objective for Long-terra Objective (2)

i) *Encourage active and informed participation of the private sector and local communities in conservation and wise use of the Densu Delta Wetland.* The following measures are recommended for the attainment of the operational objective:

- Constitute the wetland resource users into co-operatives so as to regulate their activities;
- Carry out public awareness campaigns on environmental and conservation issues and the formation of wildlife clubs to ensure community participation in biodiversity conservation initiatives;
- Organise workshops, tours, seminars and training programmes on conservation for the GDA, traditional authorities and identifiable groups in the communities to

build their capacity for wetlands conservation.

ii) *Regulate the land use practices so as to prevent encroachment and disturbance of the wetland ecosystem.* This would involve the following:

- Zonation of the site into core and transition areas, through internal pillaring, sign posts and the strict enforcement of zoning regulations (on-going);
- Use the bye laws to regulate physical development within the site;
- Enhance the growth of thorny bush *Drepanocarpus lunatus* to spread around all the area where the Densu River bifurcates into its Delta tributaries to discourage builders from looking for sites for development

iii) *Establish the levels of wise-use or sustainable use of wetland resources such as fish, crabs and fuel wood in five years.* Measures/strategies to be undertaken are as follows:

- Carry out ecological monitoring to determine impacts of human use on wetland resources;
- Monitor the long term dynamics in productivity and occurrence of species of the flood plains, dunes, thickets (mosaic and continuous);
- Investigate and implement wise-use limit or sustainable levels of wetland resources.

iv) *Establish education/ visitor centre at the Densu Delta Ramsar Site.* This would involve the following:

- Construct a visitor centre with an exhibition room, lecture/audio visual hall;
- Furnish the centre with books, slide, film projector, binoculars and telescopes;
- Engage a Conservation Education Assistant permanently at site, if the level of visitor use requires this.

PART FOUR

ACTION PLAN

4.0 ACTION PLAN

The action plan is discussed under four major elements:

- Zoning;
- Management strategies;
- Programmes;
- Monitoring and review.

4.1. Zoning

The Densu Delta Wetland comprises sand dunes, lagoons, salt pans, marsh and scrub, lying in the river valley formed by the Aplaku-Tukuse and Weija Mc.Carthy Hills. Although the wetland features and characteristics are known, the areas and orientation of the zones and habitats have not been completely demarcated and mapped. As an initial action, prior to zoning of the Densu Delta Ramsar Site and its catchment area and settlements should be thoroughly surveyed, pillared and detailed boundary description provided. The Survey Department or any reputable land surveying consultant may be engaged to carry out the boundary descriptions. The Wildlife Division will be responsible for ensuring that the boundary description is properly done.

Zoning should be effected to facilitate the protection of identified habitats, and other wetland resources such as water, land, fish and birds which are under severe threat. The Densu Delta is particularly important for terns and is a home to approximately 20% of the European breeding population of Roseate terns, a rare and threatened species. Other water birds occur in significant numbers on the site and from May to August the site is known to be important for a number of resident breeding birds (NRI, 1998). The Densu Delta has ecologically sensitive areas and these must be zoned and protected to preserve mangroves, shell fish, Crustacea, shore and terrestrial birds whose lives cycle depend on the site.

Further justification for zoning of the Densu Delta is the fact that the wetland is being threatened by residential sprawls to the extent that there are illegal settlements within the Panbros Salt concession whose salt pans are used as feeding and roosting areas by

waders and terns (shore birds). The site has a potential for eco-tourism, and areas such as the beaches and mangroves must be well zoned out for adequate protection against pollution and degradation. Another area which needs to be zoned is the flood prone areas for the proper protection since the floods cause major problem for the people at the Densu Delta and its surrounding villages.

4.2 Management Strategies

The Densu Delta is a valuable area with respect to being a habitat for birds of different species, socio-economic benefit (human usage) and housing. In ensuring that integrity of the Ramsar Site is sustained, appropriate management strategies must be adopted, recognising the need to:

- empower the local communities to participate in management;
- strengthen the coastal economies to benefit the community;
- recognise the rights and interest of the community;
- integrate traditional knowledge with conventional science.

The management strategies are categorised under the following:

- habitat/species management;
- Access, public use, education/demonstration;
- Research (facilities, opportunities);
- Training of personnel;
- Estate management (maintenance of buildings roads dam etc).

4.2.1 Habitat/Species Management

The Densu Delta has precious flora and fauna which need to be preserved. Five main habitat types are recognizable in Densu Delta Wetland:- sand dunes, salt pans, brackish lagoon, freshwater marsh, coastal savanna grassland and thickets. The site is particularly important for terns, being the second most important tern site (after Songor) on the Ghana Coast. The importance of the Densu Delta is further enhanced by its population of Roseate terns, a threatened species. Realizing the importance of the Delta for the survival of identified species, there is a need for appropriate management

strategies to preserve the habitat and the species.

In order to achieve genuine progress in preserving the valuable species of the Delta, efforts must be intensified to maintain the habitat of the species. The management strategy must feature the avoidance of the danger of destroying the habitats of the species by ensuring the proper demarcation and conservation of the identified sites.

The sites should be properly mapped and sign posts provided to ensure that encroachment is avoided. Furthermore, the community residents must be well educated on the reasons for the preservation of the sites and if possible watchdog committees established in the settlements within the wetland to protect the habitats.

4.2.2 Human Usage

In the lower reaches of the Delta, there is little sedimentation possibly because most of the inhabitants are fishermen who carry out little or no farming activity. Also the Weija dam acts as a trap for sediments coming from upstream. However, construction works for housing in the upper parts of the catchment contribute sediments to the Delta. The restricted land use, proper education and legislation are advocated to control sediment volumes in the Delta. It is recommended that as a management strategy data and information should be obtained at regular intervals on the sediment load in the Delta.

Other human activities which affect water quality in the Densu Delta are related to socio-economic activities in the catchment area. The catchment area is made up of different areas with their own peculiar uses and environmental problems. Current land usage in the area comprises large scale commercial salt mining, lagoon fisheries, quarrying, arable agriculture and settlement and infrastructural development. All these land use activities impact on the stability of the wetland in various ways and consequently need mitigative development actions.

Since the salt industry which occupies an area of 784.4ha (Amatekpor, 1994) is already developed and the civil structures are all in place the development and management

strategies should relate to the effective maintenance of these structures and erection of bird sanctuaries, observation and roosting sites.

Subsistence cultivation of cassava, maize and vegetables takes place in the wetland in the neighbourhoods of Akplaku, Bortianor and Tetegbu. The use of chemical and organic fertilisers, herbicides and other forms of chemicals especially for vegetable farming pose threats to the stability of the wetland ecosystem through pollution. Management strategies may be directed at the promotion of organic farming and controlled small scale irrigation to avoid pollution of the wetland ecosystem.

Although fishing in the lagoon does not pose any threat to the stability of the wetland a possible management option which may contribute to the enhancement of the integrity of the wetland is the construction of fish ponds at suitable locations for aquaculture development. Because the abandoned clay pits hold water very well, Amatekpor (1994) believes that these could be developed into fish ponds. Fish processing and preservation techniques and poor disposal of wastes are sources of pollution. Promotion of better fish processing and preservation techniques and provision of waste disposal points may be a management option to control pollution in the wetland.

The natural thicket vegetation and mangroves as well as isolated colonies of reeds and sedges cover an area of 11,684.4ha (Amatekpor, 1994). This area has been over-exploited through harvesting for domestic cooking and heating. The introduction of liquefied petroleum gas (LPG) has tended to reduce the pressure on the remaining tree vegetation for use as fuel wood. As a management strategy, the supply of LPG should be guaranteed for the residents who can afford it and well-managed woodlots are to be developed to provide fuel wood requirements of the very poor residents and these would sustain the biodiversity of the wetland ecosystem.

Quarrying of stones, mining of clay and sand winning are carried out in the Densu Delta to support building and construction activities in the Accra Metropolitan Area. The area under stone quarrying is estimated to be 81.3ha. The danger of erosion is increased by the quarrying since the landscape is defaced by huge craters. Threats to

the wetland ecosystem may be the resultant sedimentation of the lagoon. The management strategy to avert resultant erosion of the ecosystem and sedimentation of the lagoon will be the enforcement of compliance to national environmental legislation (Act 490) regarding gravel and pit rehabilitation.

4.2.3 Access, Public Use and Education/Demonstration

"Environmental issues are best handled with the participation of all concerned citizens at the relevant level ...(and that) each individual shall have the opportunity to participate in decision making process (Principle 10 of the Rio Declaration)". Also Chapter 17 of Agenda 21 emphasises that concerned individuals, groups and organisations must be provided access, as far as possible, to relevant information and opportunities for consultations and participation in planning and decision making at appropriate levels.

Effective management requires an 'interest-based' decision-making process that recognises the central role of wetland communities and involves all stakeholder groups. Thus, the equitable allocation of wetland resources, recognizing competing but legitimate uses and interests, must be achieved within the framework of sustainable development. Cognisance must be taken of community values with respect to long-term management and wetland stewardship programmes so as to establish sustainable wetland/Ramsar Site communities.

As a management strategy, provisions must be made for full stakeholder participation at the community level in decision making, and ensuring integration with broader national resource management initiatives. Capacity building among community stakeholders is therefore essential for effective management. Furthermore, the Densu Delta should have an established long-term strategic plans, based on the identification of local strengths, weaknesses, opportunities and constraints. Another useful management strategy is the promotion of successful examples or demonstrations of community-based resource management through educational activities such as conferences,

networks, exchanges and training courses. The communities in the Densu Delta will have to be encouraged to develop community-led remedial action programmes and they should also be encouraged to take responsibility for resolving pollution issues and resource depletion problems in the wetland.

4.2.4 Research

A strong scientific data and information would be required for effective management of the Ramsar Site. As an effective management strategy, there is the need to promote the knowledge base of the ecological processes and sociological forces operating in the wetland through research.

The Wildlife Division is the lead agency to co-ordinate research activities in the wetland. The Division would therefore be responsible for the provision of the identified infrastructure and facilities for research in the wetland. In executing the relevant research programmes, the lead agency is to explore the possibility of forming partnership with research institutes, NGOs, consultants and wetland community residents to assist in varied ways. The management strategy should be that working relationships are to be established to foster trust between all interested parties in the Ramsar Site. Opportunities should be developed for education and training where local community residents and scientists can engage in dialogue about the management of the wetland.

Another important strategy for the effective research management in the Ramsar Site would be to equip all the stakeholders with accurate and understandable information as well as traditional knowledge. Scientists should be encouraged to communicate more effectively with local community groups, and to act on the ideas expressed through public participation. Scientific research efforts should utilise local community input in identifying and understanding the functioning of the wetland ecosystem. Scientists should develop ways of incorporating traditional knowledge in scientific models along with scientific knowledge. Research should be promoted to determine the relationship between habitat, water circulation and sedimentary processes as well as to assess the

economic, social and environmental impacts of human usage of the wetland.

4.2.5 Training of Personnel

Principle 10 of the Rio Declaration advocates that, at the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, and information on activities in the communities. Nations are expected to facilitate and encourage public awareness and participation by making information widely available. Education and training is critical to successful implementation of bottom up/top down approach to integrated wetland management.

Management, development, as well as environmental protection concerns and local planning issues should be incorporated in educational curricula and public awareness campaigns, with due regard to traditional ecological knowledge and socio-cultural values. An effective management option regarding training of personnel is the development of outreach programmes that teach and promote appreciation for resources and alternative sustainable practices.

The lead agency, the Wildlife Division should sponsor and develop education and training programmes including scientific programmes, emphasising that renewable resources would disappear if mismanaged; for all stakeholders operating in the Densu Delta.

Scientists should make research findings available in simple language that can be understood easily and communicated to the local people. Managers in the wetland should be equipped with public communication skills in order to develop more effective cooperative relationships with community leaders to facilitate the transfer of scientific research results to enhance the development and sustainability of the wetland ecosystem at the Densu Delta. Wetland management among others should be included in the curricula of elementary and secondary schools.

4.2.6 Estate Management

The total built-up area in the Densu Ramsar Site is estimated to be 2,237.5ha (Amatekpor, 1994). Active settlement development of the residential units and associated roads have been going on within the immediate vicinity of the lagoon in Dansoman and North and South Odokor Estates, MaCarthy Hill and Weija (NRI, 1998). The layout of the government residential estates are well harmonised to minimise potential threats to the stability of the wetland ecosystem.

Building construction by several private individuals, however, have often strayed and encroached into the wetland, thereby posing considerable pollution from household and human waste. The waste volume generated through human activities was estimated to be 143,182m³/yr (Biney, 1995).

As a development option the local communities in the wetland should be assisted to construct additional public places of convenience and waste disposal sites to avoid pollution of the wetland ecosystem. The Wildlife Division should seek the assistance of the Town and Country Planning Department in planning the physical layout of the wetland to forestall the threats posed by the haphazard housing and infrastructure development. Community groups in the wetland are to be trained to enforce the required building regulations to ensure that encroachers especially the private estate developers do not flout the building codes and regulations.

4.3 Programmes For Densu Wetland Management

4.3.1 General Aspects

Following the review of the status of Densu Delta wetland and the effectiveness of the conservation efforts, the long term management objectives have been established as indicated this section 3.1 of the report. Actions to be taken to achieve the stated management objectives include the following programmes:

- Education, Training and Capacity Building for Densu Delta Management;
- Wetland Research and Monitoring;
- Enhancement of Conservation and Protection of the Densu Delta Wetland;

- Strengthening of Densu Delta Wetland Economies and Dealing Effectively with Poverty;
- Data and Information Management and Exchange for Management of the Densu Delta Wetland. A fully costed 5-year integrated management plan is provided in Table 2.

4.3.2 Education, Training And Capacity Building For Densu Delta Wetland Management

Since the inception of the Coastal Wetland Management Project, efforts have been put into education, training and capacity building of the stakeholders to ensure an effective integrated management of the Densu Delta Ramsar Site

Nonetheless, the human use of the site for socio-economic benefits have created adverse effects which undermine the sustainable use of the site. It is obvious that there is a need to strengthen the efforts aimed at educating, training and building the required capacities to ensure the conservation and protection of the Densu Delta. Efforts should be made to involve all stakeholders including government agencies, NGOs, local groups with special emphasis on women groups, District Assembly, Unit Committees, chiefs, opinion leaders and school children in capacity building exercise to conserve and protect the Densu Wetland.

For the purpose, the following activities would be undertaken:

- Identification of all stakeholders of the Densu site;
- Review of previous educational activities and analysis of priorities;
- Identification of special training needs of categorised groups such as women groups, NGOs, school children, chiefs, elders and opinion leaders, government agencies and other stakeholders;
- Setting up the goals and objectives of training of each group through participatory approaches;
- Organising study material for appropriate learning;
- Design of training;
- location of training;
 - course content;

- timing/timetable;
 - no. of participants;
 - cost of training;
 - evaluation of training.
- Planning appropriate teaching methods and aids;
 - Development of educational materials;

Introduction of wetland management in school curricula (at all levels); Involvement of the media in wetland management issues to foster public awareness for wetland management. There should be a cooperation with the media to encourage effective communication on the need to conserve and protect the wetland ecosystem.

4.3.2.1 Time Frame

These activities will be carried out over a period of five years.

4.3.2.2 Implementation Arrangements

The line ministry, MLF through the Co-ordinating Committee would be responsible for the training, education and public awareness programmes on wetland management. The Ministry of Education, local communities/groups and other relevant national institutions would be involved in the programme.

4.3.3 Wetland Research And Monitoring

This is a basic requirement to improve the knowledge and understanding of the functioning and mechanisms of the wetland ecosystem. Scientific and technological research, which are ecosystem based, have significant roles to play in wetland management. It is important that elements in science and technology be mobilised in the support of sustainable management of the wetland. The elements of science and technology include:

- the development of the basic research capacities;
- more interaction between science and technology community and front line users;

- mobilise a number of sectors (private, government, NGOs and academic) in the research and monitoring of the processes of the wetland ecosystem and ensure that a balance is maintained in carrying out strategic and basic research.

A number of researches and monitoring had been conducted in the Densu Delta Wetland, there is a need to continue with the efforts and develop new mechanisms to sustain the research and monitoring efforts in the wetland. The following activities would be carried out.

- The establishment of mechanisms and focal points of responsibility;
- The establishment of effective partnerships;
- Improving the development and transfer of technology;
- The promotion of research in support of sustainable development.

4.3.3.1 Establishment of Mechanisms and Focal Points of Responsibility

It is important to redefine the mission, set attainable goals and develop a strategy for science and technology for the management of the wetland, based on principles that recognise:

- total quality management;
- pro-action versus reaction;
- client driven, quality-based approaches;
- community empowerment and key stakeholders.

It should be ensured that adequate research and monitoring and review and modification processes are established within strategic research plans in order to ensure that conservation objectives are achieved.

4.3.3.2 The Establishment of Effective Partnerships

Establish and or improve cooperation with international science organisations and encourage interdisciplinary approaches to scientific research, technology development and technology transfer. Also, there is a need to develop initiatives that establish partnerships between public and private organisations for the purpose of sustainable

development.

4.3.3.3 Improving the Development and Transfer of Technology

Use local wetland management issues as a basis for developing technology. The development of technology should be carried out at a cost appropriate to its use. Provide for transfer of technology, information and expertise from relevant institutions in more effective ways.

4.3.3.4 The Promotion of Research in Support of Sustainable Development

There is a need to promote research to determine the relationship between habitat, water flows and sedimentary processes. Furthermore, research to assess the economic, social and environmental impacts of human activities in the wetland need to be promoted. It is also important to adopt broad ecosystem approaches to the wetland management that take into account the interactions among all biological elements as well as the relationships to physical and chemical processes in the Densu Delta. Research should be promoted to develop indicators for gauging ecosystem health and the degree of success of the imposed management systems.

4.3.3.5 Time Frame

Some of the research activities will be designed to be carried out within 1-2 years (short term). Other activities will be implemented over a long period of time (5 years and above). The research outputs would be used to improve programmes directed at sustaining the wetland.

4.3.3.6 Implementation Arrangement

The co-ordination of wetland research would be the responsibility of a lead agency in partnership with an accredited research/academic institute. However, other research and academic institutions, NGOs, local communities and key stakeholders will be major contributors to the wetland research

4.3.4 Enhancement of Conservation and Protection of the Wetland

The conservation and protection of the Densu Delta ecosystem and landscape would be significantly enhanced by the establishment of carefully designed wetland conservation and protection areas. Emphasis should be placed on the conservation of the biodiversity of the wetland, sustainable use of biological resources and maintenance of ecological systems.

The following activities would be carried out:

- Adoption of an ecosystem-based approach to resource management;
- Steps to protect valuable wetland resources;
- Setting of standards to reduce environmental contamination.

4.3.4.1 Adoption of An Ecosystem-Based Approach to Resource Management

The conservation and protection practices in the wetland should focus on ecosystems and habitat protection as opposed to stock protection. There is a need to develop models for ecosystem and habitat needs of bird and fish populations. The Wildlife Division (WD) should co-ordinate the maintenance of enough habitat to sustain or restore natural biotic populations using ecosystem studies and modelling. Also the WD should incorporate appropriate human activity controls, (e.g. enforcement of bye laws) to minimize direct loss of habitat or encroachment into habitat.

4.3.4.2 Steps to Protect Valuable Wetland Resources

The necessary laws or regulations should be enforced to stop destructive fishing methods and develop sustainable fisheries practices. At the local level, a wetland conservancy group should be established to speak for the values of the Densu Delta wetland and to assist with the preservation of natural wetland areas.

The Wildlife Division should also incorporate local support in planning and management of the Ramsar Site.

4.3.4.3 Setting up of Standards to Reduce Environmental Contamination

Stronger measures are to be adopted to control the introduction of exotic species to the

wetland. Risk assessment is to be improved by reducing uncertainty through research, engaging in long-term statistical monitoring programmes for the prediction of progressive and extreme events and quantifying uncertainties and explaining their ramifications. The vulnerability of the Densu Delta to floods should be decreased by developing wetland emergency response plans and developing methods for managing extreme events when they occur.

4.3.4.4 Time Frame

The activities outlined are to be carried out on long term basis to ensure the sustainable management of the Densu Delta.

4.3.4.5 Implementation Arrangements

Wildlife Division should establish partnerships with relevant institutions to carry out researches to establish environmental pollution standards and establish a local group to ensure that the standards are respected by all.

4.3.5 Strengthening of Densu Delta Wetland Economies and Dealing Effectively with Poverty

Poverty is a fundamental constraint to sustainable economic development in the Densu Delta wetland. The residents of the wetland and its catchment areas have resorted to economic activities for survival without due regard to implications of resource depletion and maintenance of biodiversity. Mangroves in the wetland have been seriously invaded for fuelwood. The methods of fishing in the lagoon have been unfavourable for the survival of species of fish. The use of dangerous chemicals and inappropriate fishing nets have caused unforeseen damages to the population of fish. Crop production methods involving the use of fertilizers and other agro-chemicals have caused pollution problems in the wetland. It is therefore necessary to carry out the following activities to protect wetland ecosystem balance:

- Dealing decisively with poverty and inequity;
- Ensuring compatibility between strategic development programmes and the principles of sustainable development:

- Targeting specific resource industries for development.

4.3.5.1 Dealing Decisively with Poverty and Inequity

There is a need to develop practical solutions to poverty issues through the cooperative efforts of economists, scientists and community representatives. The recommendations of the study on development options for the coastal wetlands (Ghana) carried out by National Resources International are of relevance in finding solutions to the poverty within the Densu Delta. The necessary mechanisms should be established to assist the local communities in the wetland and its environ to address poverty issues where these constrain their ability to meet environmental obligations. For instance, the government should strike a partnership with Panbros Salt Company to address their problems so that the industry can create more jobs for the local community residents. Special training should be offered the farmers on irrigated farming so that more farmers are gainfully engaged and to take the pressure on the limited land within the Ramsar site.

4.3.5.2 Ensuring Compatibility between Strategic Development Programmes and the Principle of Sustainable Development

Within the Densu Delta, a number of development programmes have been sponsored by the government to improve the livelihood of the community residents. It is important that these programmes and future ones are thoroughly evaluated and redirected to ensure that they are contributing to the advancement of sustainable development of the wetland. In this regard, there will be a need to devise innovative methods of equipping communities in the wetland for action, e.g. local taxation capabilities to provide a revenue base for local action.

The Ga District Assembly would have to allocate funds towards sustainable development in the wetland. Community watchdog groups would have to be empowered to ensure that all developments within the wetland abide with the regulations to ensure environmental integrity and sustainable development.

4.3.5.3 Targeting Specific Resource Industries for Development

Opportunities for alternative resource development should be identified in the Densu Delta wetland. For example, encouragement of the communities to develop the eco-tourism potential for the Densu Delta. Also the possibility of developing aqua-culture should be explored by the communities with the support of the government. The mangrove rehabilitation and woodlot development should be undertaken by the residents of the wetland with the assistance of the relevant government institutions and NGOs. The benefits of mangroves and woodlots are numerous and the economic gains would go a long way to deal effectively with poverty among the local communities. In assessing agricultural, urban and industrial development in the wetland, the value of current land use should be assessed and compared to the value to be derived from converting the wetland to other uses.

4.3.5.4 Time Frame

Most of the activities outlined, would take over five years however within three years enough grounds would have been broken to sustain the programme.

4.3.5.5 Implementation Arrangements

The co-ordination of the various activities outlined will be the responsibility of the Wildlife Division with assistance from relevant NGOs and other government institutions. The activities are mainly in the domain of the local communities, and they need to be well guided and empowered.

4.3.6 Data and Information Management and Exchange

The effective planning and management of the Densu Delta depends largely on the availability of reliable data and information. In this regard, efforts should be directed at upgrading and updating of data collection methods, storage, analysis and interpretation. Also opportunities should be sought out and promoted for exchange of information and transfer of technology in wetland conservation and management. Adequate training should be provided to field staff and identified community residents in the collection of reliable data.

Information on Densu Delta wetland which is of high national and international importance should subsequently be made available to government and development agencies so that they might better take account of these priorities in planning their development investment. The following priority activities are identified:

- Taking steps to improve availability of and access to data and information;
- Ensuring that appropriate data and information standards are in place to facilitate data sharing.

4.3.6.1 Steps to Improve Availability of and Access to Data and Information

Data collection is expensive. Regardless of high cost of data collection, the government should invest in data collection and information availability, since communities cannot afford to pay for information from the private sector. More often than not, scientists are reluctant to share scientific and technical data and information with communities. There is therefore a need to establish effective mechanisms for improving access to, as well as sharing of data and information. Also there may be a need to improve the reward system for scientists, agencies and organisations to encourage the transfer of data, information and knowledge. Networking among the Ramsar Site managers in the country and outside must be facilitated. The inventories of resources and -environmental data should be compiled and made available to the communities, government agencies, NGOs and other stakeholders. NGOs must be encouraged and supported to work with schools and colleges and with the general public through campaigns and media events in the dissemination of information of wetland conservation and protection

4.3.6.2 Ensuring Appropriate Data and Information Standards are in Place to Facilitate Data Sharing

Efforts must be made to establish standards for data collection, methods, analysis and interpretation so that data and information sharing would be of value. The availability of data and information in an understandable form and at a reasonable cost should be worked out through the development of the appropriate national science and technology information policy. The various users of data and information must be considered

when making available data and information for planning and management of the wetland. For example, data and information for use by the local community groups would have to be transformed to facilitate its usefulness.

4.3.6.3 Time Frame

Data collection is a continuous process however within 3-5 years the basis would have been established for the collection of standardized data and information.

4.3.6.4 Implementation Arrangement

Data collection and information generation are carried out by various government agencies and NGOs, thus, there is a need for Wildlife Department to co-ordinate the efforts of the agencies, institutions and NGOs to ensure that the appropriate standards are respected.

Table 2: DENSU DELTA WETLAND MANAGEMENT ACTION PLAN

| Programme | Activities | Time Schedule-yr | | | | | Estimated cost US\$ | Implem. Agencies | |
|--|---|------------------|---|---|---|---|---------------------|------------------|--|
| | | 1 | 2 | 3 | 4 | 5 | | Lead | Collaborators |
| 1) Education, Training and Capacity Building for Densu Delta Wetland Management | • Identification of all stockholders; | ■ | | | | | | | WD, Wetland Coordinating Committee Min. of Education, Wildlife Society and Other NGOs, and Media Commission |
| | • Review of previous educational activities and analysis of priorities; | ■ | | | | | | | |
| | • Identification of special training needs of categorized groups; | ■ | ■ | | | | | | |
| | • Setting up the goals and objectives of training; | ■ | ■ | | | | | | |
| | • Organizing the study material and design of training; | ■ | ■ | | | | | | |
| | • Planning of appropriate teaching methods and aids; | | | ■ | | | | | |
| | • Development of educational materials; | | | ■ | ■ | | | | |
| | • Introduction of Wetland management in school curricula; | | | | ■ | ■ | | | |
| | • Involvement of the media in Wetland management. | | | | ■ | ■ | | | |

| | | | | | |
|---|--|--|---------|-----|--|
| 2) Wetland Research and Monitoring | <ul style="list-style-type: none"> Establishment of mechanisms and focal points of responsibility; Establishment of effective partnerships; Improving the development and transfer of technology; Promotion of research in support of sustainable development. | | 26,715 | WD | MLF, CSIR-WRI, Univ. of Ghana-Zoology, Botany and Oceanography & Fisheries Depts., Volta Basin Research. Project, Marine. Fisheries Research. Division-MOFA, EPA, and NGOs |
| 3) Enhancement of Conservation and Protection of the Wetland | <ul style="list-style-type: none"> Adoption of an ecosystem-based approach to resource management; Taking steps to protect valuable Wetland resources; Setting up standards to reduce environmental contamination. | | 52,045 | WD | MLF GDA, VIP, T & C P. D., Panbros Salt Co. Ltd., Site Management Committee, EPA WRI, GWC, IDA-MOFA and CBOs |
| 4) Strengthening of Densu Delta Wetland Economies and Dealing Effectively with Poverty. | <ul style="list-style-type: none"> Dealing with poverty and inequity; Ensuring compatibility between strategic development programmes and the principle of sustainable development; Targeting specific resource industries for development. | | 450,000 | MLF | WD, Site Management Committee, CBOs, NGOs, Panbros Salt Co. Ltd., Min. of Trade & Industry and Min. of Finance |

| | | | | | | | | | | |
|---|--|--|--|--|--|--|--|-----------------------|------------------|---|
| <p>5) Data and Information Management and Exchange</p> | <ul style="list-style-type: none"> • Taking steps to improve availability of and access to data and information; • Ensuring appropriate data and information standards are in place to facilitate data sharing | | | | | | | <p>100,000</p> | <p>WD</p> | <p>CSIR/WRI, Univ. of Ghana: Zoology, Botany, and Oceanography & Fisheries Depts., Volta Basin Research. Project., Marine Fisheries Research Division/MOFA, EPA, CBOs and NGO</p> |
|---|--|--|--|--|--|--|--|-----------------------|------------------|---|

For the first three programmes the cost estimates were based on the earlier estimates provided in the management plan of 1991 and multiplying by a factor 10% to take care of inflation. In determining the cost of the programme dealing with poverty, it was assumed that 30% of the population would be assisted with US\$50 each.. For the programme on data and minimal ion management and exchange, US\$20,000 is to be spent each year of a period of five years.

PART FIVE

MONITORING AND REVIEW

5.0 MONITORING AND REVIEW

Monitoring and review are part of the process of project management. Monitoring is an internal project activity that calls for diagnostic studies as part of its function of aiding management decision making. Monitoring is a continuous assessment both of the functioning of the project activities in the context of implementation schedules and of the use of project inputs by targeted populations in the context of design expectations.

From these diagnostic studies the relevant aspects of the project plan is reviewed. The review reports cover the periodic assessment of a project's relevance, performance, efficiency and impact on the target population and area. Often times, reviews advocate for change in objectives, concepts, design and methodologies of a project.

For the effective management of the proposed projects in the Densu Delta, the Wildlife Division would be expected to strengthen its monitoring unit. The monitoring unit would have the role of assisting management in establishing and maintaining the required information system and to use it in a timely fashion. The monitoring staff would assist in the operation of a management information system in the following ways:

- Identify, in cooperation with management, the targets for project implementation and the indicators to measure progress against these targets;
- Collate, summarise, and disseminate the information flowing from the various agencies and staff engaged in implementing the project;
- Collect and analyse data from the intended beneficiaries of the project to supplement the available records and reports;
- Identify problems encountered by the project and conduct diagnostic studies bearing on the problems;
- Maintain in a retrieval format, the various data series over time as an aid to later evaluation and review;
- Prepare reports that highlight the findings of the various analyses and, to the extent appropriate, present a range of logical options requiring decisions by management.

It must be realised that the projects proposed for the development of Densu Delta Ramsar site are people-centred projects as opposed to physical delivery projects. One of the tasks of managing people-centred projects, in many cases is to give the intended beneficiaries an increased awareness of the constraints on their lives so as to stimulate the demand for the services that the projects have to offer.

In a physical delivery project, monitoring is almost synonymous with the maintenance of records of physical and financial progress, but in people-centred projects, the routine need for physical and financial information is supplemented by a considerable requirement for data relating linkages between the project's infrastructure and personnel and target population.

The review or evaluation is usually carried out for the purpose of drawing lessons from experience in order to adjust the intervention strategy of the existing project, to alter other ongoing projects, or to improve the design of ones to follow. In the case of the Densu Delta, it is recommended a review should be carried out every five years as a way of learning from the development efforts so as to improve the development process. The review process should focus on three important areas namely; performance, output, effects and impact and economic and financial efficiency.

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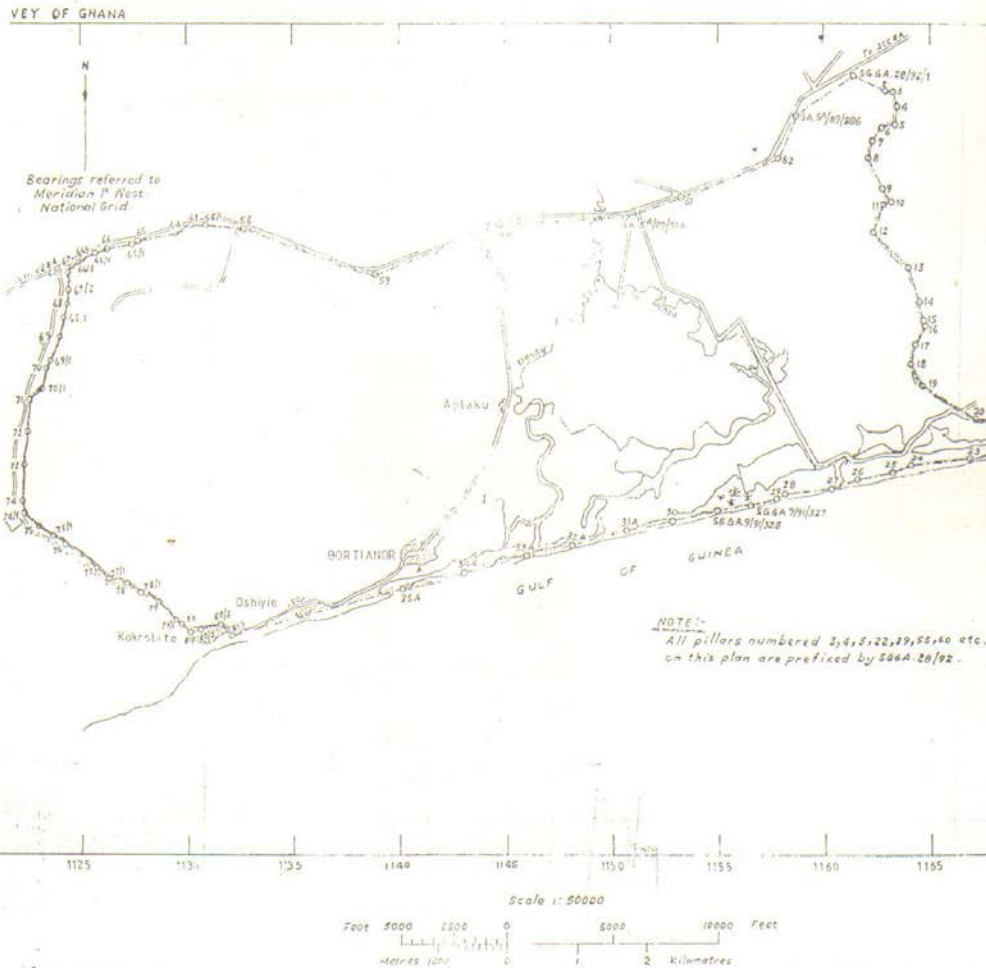
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FIGURES

FIG. 1

DENSU DELTA RAMSAR SITE
SHOWN EDGED PINK
AREA = 14561.897 ACRES
OR 5892.996 HECTARES $\approx 60 \text{ km}^2$



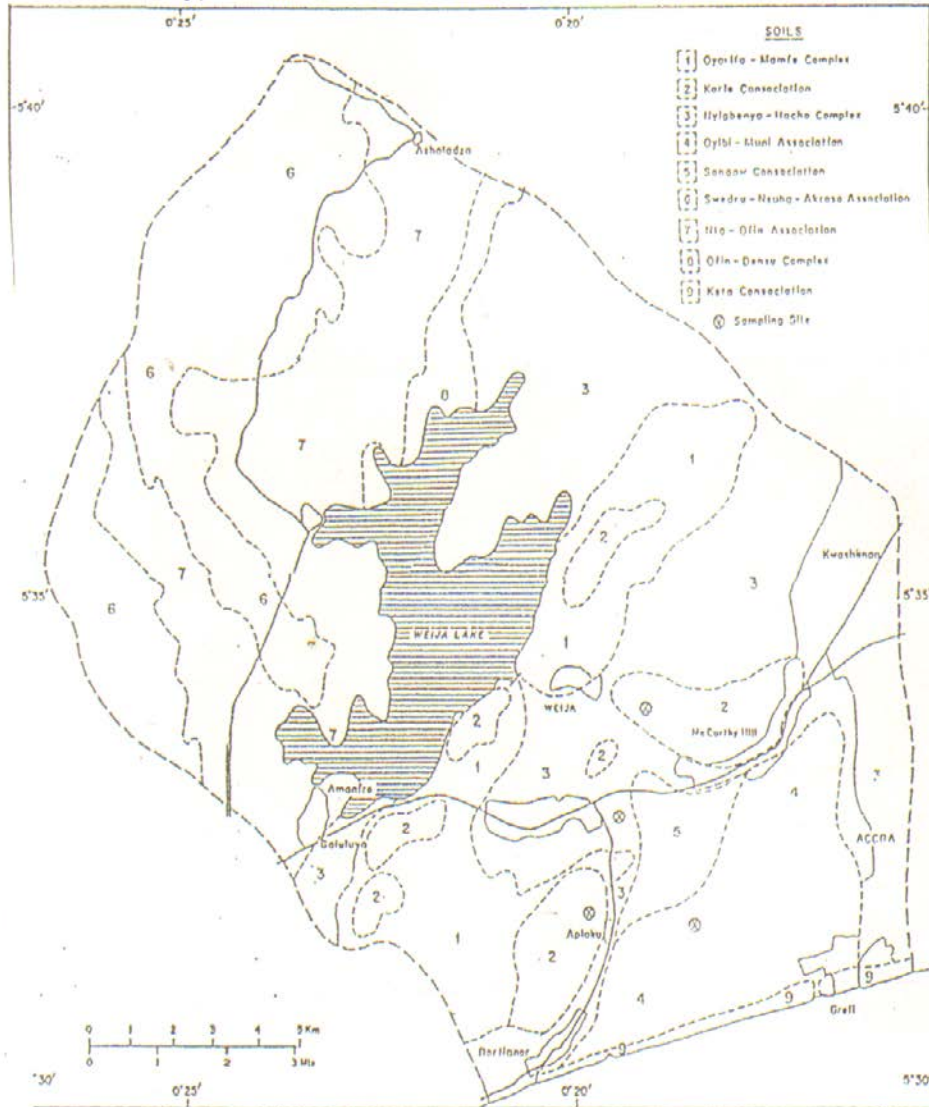
(Sgd.) Iddrisu Abu
DIRECTOR OF SURVEYS
2.9.75

REGIONAL No GA.28/92 CC
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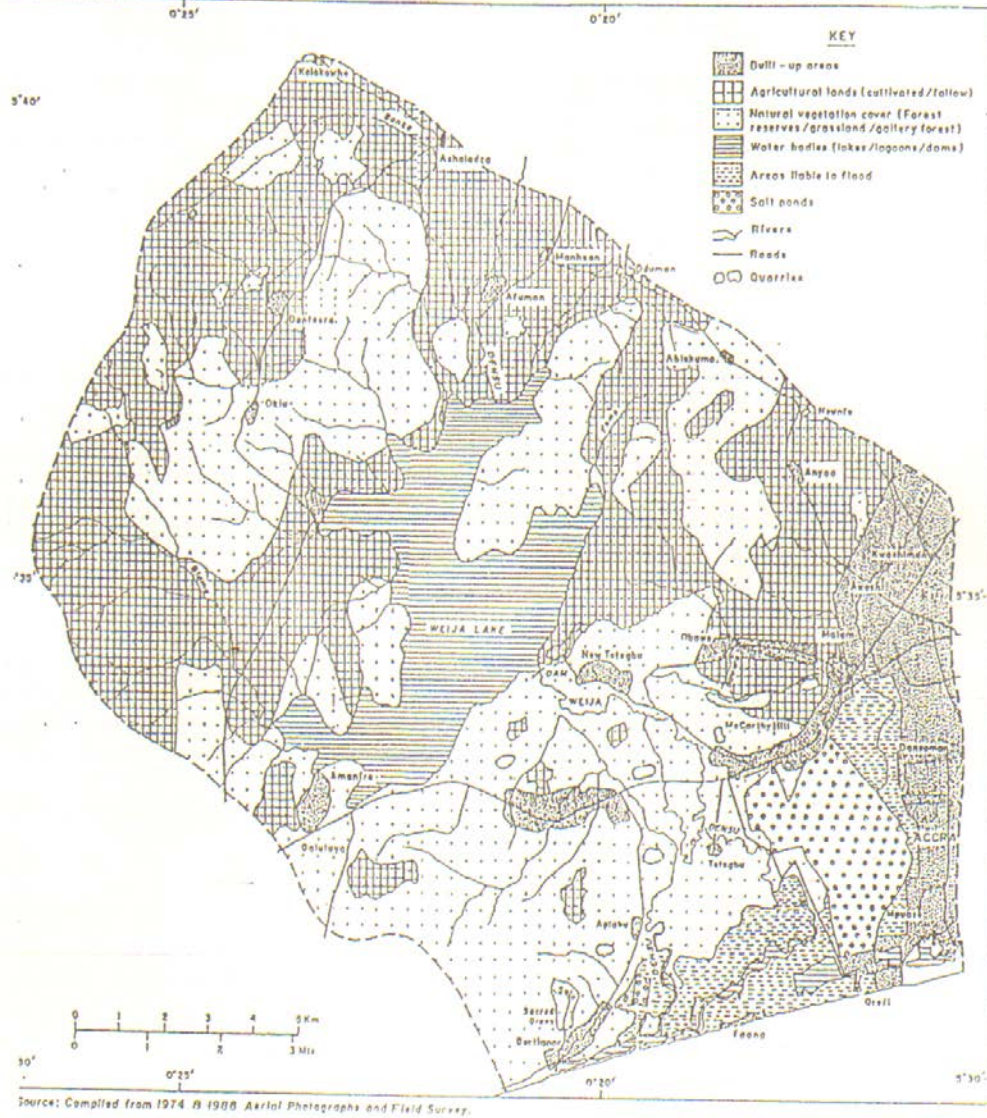
Source: Wildlife Division

Fig.2 SOIL MAP: DENSU DELTA WETLAND CATCHMENT AREA



Source: Amatekpor (1994)

Fig. 3 LAND-USE/COVER MAP; DENSU DELTA WETLAND CATCHMENT AREA



Source: Amatekpor (1994)

**Appendix 1: Mean Values of the Indicated Parameters of Wetland Waterbodies Dry (April)
and Wet (July) Seasons in 1994 Compiled from Biney(1995)**

| Mean of Parameter | Dry Season | Wet season |
|---|------------|------------|
| Temperature (°C) | 33 | 28.4 |
| pH | 7.7 | 7.9 |
| Salinity (‰) | 32.0 | 10.5 |
| TDS (mg l ⁻¹) | 37,543 | 14,325 |
| Na (mg l ⁻¹) | 22,865 | 10,770 |
| K (mg l ⁻¹) | 651 | 399 |
| DO (mg l ⁻¹) | 7.2 | 7.0 |
| Nh ₃ -N (mg l ⁻¹) | 0.01 | 0.01 |
| PO ₄ P (mg l ⁻¹) | 0.05 | 0.02 |
| Biochemical Oxygen Demand (mg l ⁻¹) | 6.1 | 5.6 |
| Chemical Oxygen Demand (mg l ⁻¹) | 1,031 | 1,329 |
| Pb (mg l ⁻¹) | 0.34 | 0.58 |
| Hg (mg l ⁻¹) | <0.001 | <0.001 |
| Total coliform (counts/100ml) * | 32,000 | 30 |
| Faecal coliform (counts/100ml) * | 2,000 | 20 |

* measured at the south-eastern part of the wetland

APPENDICES

Appendix 2 Flowering Plants of Densu Delta Ramsar Site

| | | | | | | | | | | |
|----|--|---|--------------------|---|--------------|----|--------------------|-------|---------------|-----|
| * | Life Form | : | T | = | Tree, | Sh | = | Shrub | | |
| | H | = | Herb (ordinary), | | Hcl | = | Herb climber | | | |
| | HGeo | = | Herb geophyte, | | HSuc | = | Herb succulent | | | |
| | Her | = | Herb creeper, | | Hw | = | Herb woody at base | | | |
| | Gr | = | Grass, Se = Sedge, | | Wcl | = | Woody climber | | | |
| | Hhy | = | Herb hydrophyte | | | | | | | |
| ** | Angiosperm group: | | D | = | Dicotyledon; | | M | = | Monocotyledon | |
| | | | | | | | | | * | * * |
| 1. | AGAVACEAE | | | | | | | | | |
| | <u>Agave sisalana</u> Perrine ex Enqelm. | | | | | | | | H | M |
| | <u>Sansevieria liberica</u> Ger. & Labr. | | | | | | | | H | M |
| 2. | AMARANTHACEAE | | | | | | | | | |
| | <u>Alternanthera maritima</u> (Mart) St. Hill. | | | | | | | | HCr | D |
| | <u>Philoxerus vermicularis</u> (Linn.) P. Beauv. | | | | | | | | HCr | D |
| | <u>Pupalia lappacea</u> (Linn.) Juss | | | | | | | | H | D |
| 3. | AMARYLLIDACEAE | | | | | | | | | |
| | <u>Crinum ornatum</u> (Ait.) Bury | | | | | | | | HGeo | M |
| 4. | ANACARDIACEAE | | | | | | | | | |
| | <u>Mangifera indica</u> Linn | | | | | | | | T | D |
| 5. | APOCYNACEAE | | | | | | | | | |
| | <u>Carissa edulis</u> Vahl | | | | | | | | Sh | D |
| | <u>Catharanthus roseus</u> (Linn) G. Don | | | | | | | | H | D |
| 6. | ARECACEAE | | | | | | | | | |
| | <u>Borassus aethiopicum</u> Mart | | | | | | | | T | M |
| | <u>Cocos nucifera</u> Linn. | | | | | | | | T | M |
| | <u>Elaeis guineensis</u> Jacq. | | | | | | | | T | M |
| | <u>Phoenix reclinata</u> Jacq. | | | | | | | | T' | M |
| 7. | ASCLEPIADACEAE | | | | | | | | | |
| | <u>Leptadaenia hastata</u> (Pers.) Becne | | | | | | | | Wcl | D |
| | <u>Pergularia daemia</u> (Forsk.) Chiov. | | | | | | | | Hcl | D |
| | <u>Calotropis procera</u> (Ait.) Ait, f. | | | | | | | | Hw | D |
| 8. | ASTERACEAE | | | | | | | | | |
| | <u>Aspilia africana</u> (Pers.) C. D. Adams | | | | | | | | H | D |
| | <u>Launaea taraxacifolia</u> (Willd.) Amin ex C. Jeffrey | | | | | | | | H | D |
| | <u>Vernonia cinerea</u> (Linn.) Drake | | | | | | | | H | D |
| | <u>V. colorata</u> (Willd.) Drake | | | | | | | | Sh | D |
| | <u>Pluchea ovalis</u> (Pers.) DC | | | | | | | | Hw | D |

Source: Oteng-Yebaoh (1994)

| | | | | |
|-----|---|-----|----------------------------|-----------------------|
| 9. | AVICENNIACEAE <u>Avicennia africana</u> P. Beauv | | T/Sh | D |
| 10. | BOMBACACEAE <u>Adansonia digitata</u> Linn. <u>Ceiba pentandra</u> (Linn.) Gaertn. | T | T | D |
| 11. | BORAGINACEAE <u>Ehretia cymosa</u> Thonning | | Sh | D |
| 12. | CACTACEAE <u>Opuntia vulqaris</u> Mill | | Hsuc | D |
| 13. | CAESALPiNIACEAE <u>Cassia mimosoides</u> Linn. <u>C. occidentalis</u> Linn. <u>C. rotundifolia</u> Pers <u>C. siamea</u> Lam <u>Griffonia simplicifolia</u> (Vahl ex DC) Baill <u>Parkinsonia aculeate</u> Linn | T | H H H D Sh/Wcl | D D D D D |
| 14. | CAPPARIDACEAE <u>Cleome viscosa</u> Linn | | H | D |
| 15. | CHAILLETIACEAE <u>Dichapetalum</u> sp. | | Sh | D |
| 16. | COMBRETACEAE <u>Combretum</u> sp. | Wcl | | D |
| 17. | COMMELINACEAE <u>Commelina africana</u> Linn. | | H | M |
| 18. | CONNARACEAE <u>Byrsocarpus coccineus</u> Schum & Thonn. | | Sh | D |
| 19. | CONVOLVULACEAE <u>Aniseia martinicensis</u> (Jacq.) Choisy <u>Evolvulus alsinoides</u> (Linn.) Linn. <u>Ipomoea asarifolia</u> (Desr.) Roem & Schult <u>I pes-caprae</u> (Linn.) Sweet <u>I. stolonifera</u> (Cyrill) J. F. Gmei | Hcr | Hcr H Hcr Hcr | D D D D D |
| 20. | CYPERACEAE <u>Cyperus articulatus</u> Linn. <u>C. maritimus</u> Poir <u>C. rotundus</u> Linn. <u>Fimbrisiylis dichotoma</u> (Linn.) Vahl <u>Kyllinqa squamulata</u> Thonn. ex Vahl | | Se Se Se Se Se | M M M M M |

Source: Oteng-Yeboah (1994)

| | | | | |
|-----|---|------|-------|---|
| | <u>Pycreus polystachyos</u> (Rottb.) P. Beauv. | Se | M | |
| | <u>Remirea maritima</u> Aubl. | | Se | M |
| 21. | EUPHORBIACEAE | | | |
| | <u>Croton lobatus</u> Linn. | | H | D |
| | <u>Euphorbia hirta</u> Linn. | | H | D |
| | <u>E. polycnemoides</u> Hochst. ex Boiss. | | H | D |
| | <u>E. prostrata</u> Ait. | | H | D |
| | <u>Jatropha gossypifolia</u> Linn. | | Hw | D |
| | <u>Mallotus oppositifolius</u> (Geisel.) Mull. Arg. | | Sh | D |
| | <u>Phyllanthus pentandrus</u> Schum & Thonn. | | H | D |
| | <u>Ricinus communis</u> Linn. | Hw | | D |
| | <u>Securinega virosa</u> (Roxb. x Willd.) Baill. | | Sh | D |
| 22. | FICOIDACEAE | | | |
| | <u>Sesuvium portulacastrum</u> (Linn.) Linn. | Hsuc | | D |
| 23. | FLACOURTIACEAE | | | |
| | <u>Flacourtia flavescens</u> Willd. | | Sh | D |
| 24. | FLAGELLARIACEAE | | | |
| | <u>Flagellaria guineensis</u> Schumach | Hcl | | D |
| 25. | LAMIACEAE (=LABIATAE) | | | |
| | <u>Hoslundia opposita</u> Vahl | | Sh/Hw | D |
| | <u>Orthosiphon incisus</u> A. Chev. | | H | D |
| 26. | LAURACEAE | | | |
| | <u>Cassytha filiformis</u> Linn. | | Hcl | D |
| 27. | LILIACEAE | | | |
| | <u>Gloriosa superba</u> Linn. | Hcl | | D |
| 28. | MALVACEAE | | | |
| | <u>Abutilon mauritianum</u> (Jacq.) Medic | | H | D |
| | <u>Gossypium arboreum</u> Linn. | | Hw | D |
| | <u>Hibiscus surattensis</u> Linn. | | Hw | D |
| | <u>Sida acuta</u> Burm. f. | | H | D |
| | <u>S. alba</u> Linn. | | H | D |
| | <u>S. cordifolia</u> Linn. | | H | D |
| | <u>S. rhombifolia</u> Linn. | | Hw | D |
| | <u>Thespesia populnea</u> (Linn.) Soland ex Corr. | | Sh/T | D |
| | <u>Wissadula amplissima</u> (Linn.) R. E. Fries | | H | D |
| 29. | MELIACEAE | | | |
| | <u>Azadirachta indica</u> A. Juss | | T/Sh | D |
| 30. | MIMOSACEAE | | | |
| | <u>Dichrostachys glomerata</u> (Forsk.) Chiov. | | Sh | D |
| | <u>Schrankia leptocarpa</u> DC | | Hcl | D |

Source: Oteng-Yeboah (1994)

| | | | |
|-----|---|------|---|
| | <u>Acacia nilotica</u> (Linn.) Willd. ex Del. | T | D |
| | <u>Pithecellobium dulce</u> | T | D |
| 31. | MORACEAE | | |
| | <u>Ficus platyphylla</u> Del | T | D |
| 32. | MUSACEAE | | |
| | <u>Musa acuminata</u> Colla | T | M |
| | <u>Musa x paradisiaca</u> Linn. | T | M |
| 33. | NYCTAGINACEAE | | |
| | <u>Boerhavia coccinea</u> Mill | H | D |
| | <u>B. diffusa</u> Linn. | H | D |
| 34. | OLEACEAE | | |
| | <u>Jasminium dichotomum</u> Vahl | Sh | D |
| 35. | ONAGRACEAE | | |
| | <u>Ludwigia erecta</u> (Linn.) Hara | H | D |
| 36. | PAPILIONACEAE | | |
| | <u>Baphia nitida</u> Lodd. | Sh | D |
| | <u>Canavalia rosea</u> (Sw) DC | HCI | D |
| | <u>Centrosema plumieri</u> (Turp.) Benth | HCI | D |
| | <u>Clitoria ternatea</u> Linn. | HCI | D |
| | <u>Crotalaria retusa</u> Linn. | H | D |
| | <u>Drepanocarpus lunatus</u> (Linn, f.) G F W Mey | Sh | D |
| | <u>Igdisofera hirsuta</u> Linn. | H | D |
| | <u>Milletia thonningia</u> Schum & Thonn.) Bak | Sh/T | D |
| | <u>Sesbania sesban</u> (Linn.) Merrill. | H | D |
| | <u>Tephrosia purpurea</u> (Linn.) Pers. | H | D |
| | <u>Uraria picta</u> (Jacq.) DC | H | D |
| 37. | PASSIFLORACEAE | | |
| | <u>Passiflora foetida</u> Linn. | HCI | D |
| 38. | POACEAE (=Gramineae) | | |
| | <u>Andropogon gayanus</u> Kunth | Gr | M |
| | <u>Aristida adscensionis</u> Linn. | Gr | M |
| | <u>Bothriochloa bladhii</u> (Retz) S.T. Blake | Gr | M |
| | <u>Brachiaria</u> sp. | Gr | M |
| | <u>Cenchrus ciliaris</u> Linn. | Gr | M |
| | <u>C. echinatus</u> Linn. | Gr | M |
| | <u>Chloris barbata</u> Sw. | Gr | M |
| | <u>Dactyloctenium aegyptium</u> (Linn.) P. Beauv. | Gr | M |
| | <u>Echinochloa stagnina</u> (Retz) P. Beauv. | Gr | M |
| | <u>Eragrostis ciliaris</u> (Linn.) R. Br. | Gr | M |
| | <u>Heteropogon contortus</u> (Linn.) P. Beauv. ex R. & S. | Gr | M |
| | <u>Hyperthelia dissoluta</u> (Nees ex Steud) W.D. Clayton | Gr | M |
| | <u>Imperata cylindrica</u> (Linn.) P. Beauv. | Gr | M |

| | | | |
|-----|---|--------|---|
| | <u>Panicum laxum</u> Sw | Gr | M |
| | <u>Paspalum orbiculare</u> Forst. | Gr | M |
| | <u>P. vaginatum</u> Sw. | Gr | M |
| | <u>Pennisetum purpureum</u> Schumach | Gr | M |
| | <u>Rhynchelytrum repens</u> (Willd.) C. E.Hubbard | Gr | M |
| | <u>Saccharum officinarum</u> Linn. | Gr | M |
| | <u>Setaria anceps</u> Stapf ex Massey | Gr | M |
| | <u>Sporobolus pyramidalis</u> P. Beauv. | Gr | M |
| | <u>S. robustus</u> Kunth | Gr | M |
| | <u>S. yirginicus</u> (Linn.) Kunth | | |
| 39. | PORTULACACEAE | | |
| | <u>Portulaca auadrifida</u> Linn. | Hsuc | D |
| | <u>Talinum trianquulare</u> (Jacq.) Willd. | Hsuc | D |
| 40. | RHIZOPHORACEAE | | |
| | <u>Rhizophora racemosa</u> GFWMey | Sh/T | D |
| 41. | RUBIACEAE | | |
| | <u>Mitraqyna inermis</u> (Willd.) O. ktze | Sh | D |
| | <u>Nauclea latifolia</u> Sm | Sh | D |
| | <u>Oldenlandia coryrnbose</u> Linn. | H | D |
| 42. | RUTACEAE | | |
| | <u>Faqara zantnoxyloides</u> Lam | Sh/T | D |
| 43. | SAPINDACEAE | | |
| | <u>Paullinia pinnata</u> Linn. | WCI | D |
| 44. | SCROPHULARIACEAE | | |
| | <u>Scoparia dulcis</u> Linn. | H | D |
| 45. | SOLANACEAE | | |
| | <u>Physalis anqulata</u> Linn. | H | D |
| | <u>Schwenkia americana</u> Linn. | H | D |
| 46. | STERCULIACEAE | | |
| | <u>Waltheria indica</u> Linn. | H | D |
| 47. | TILIACEAE | | |
| | <u>Grewia carpinifolia</u> Juss | Sh/WCI | D |
| | <u>Triumfetta rhomboides</u> Jacq. | Hw | D |
| 48. | TYPHACEAE | | |
| | <u>Typha australis</u> Schum & Thonn. | H/Hhy | M |
| 49. | VERBENACEAE | | |
| | <u>Lantana camara</u> Linn. | Hw | D |
| 50. | ZYGOPHYLLACEAE | | |
| | <u>Tribulus terrestris</u> Linn | H | D |

Appendix 3 Ethnobotanical Survey

A. HUMAN REQUIREMENTS

1. FOOD SOURCE

| | |
|------------------------------|---|
| <u>Adansonia digitata</u> | young leaves as vegetable source |
| “ “ | pulp from seed edible |
| <u>Elaeis guineensis</u> | fruit for soup |
| “ “ | oil from seed and fruit for frying food |
| <u>Mangifera indica</u> | fruit edible |
| <u>Cocos nucifera</u> | fruit with edible mesocarp |
| “ “ | copra oil for cooking |
| <u>Phoenix reclinata</u> | fruit edible |
| <u>Musa spp.</u> | provide edible fruits |
| <u>Lantana camara</u> | fruit edible |
| <u>Talinum triangulare</u> | leafy vegetable |
| <u>Saccharum officinarum</u> | sugary juice |
| <u>Passiflora foetida</u> | edible fruit |

2. MEDICINE SOURCE

| | |
|------------------------------|--------------------------------|
| <u>Azadirachta indica</u> | leaves for febrifuge |
| <u>Securineqa virosa</u> | aphrodisiac, analgesic |
| <u>Clausena anisata</u> | insect repellent |
| <u>Typha australis</u> | pollen source |
| <u>Hoslundia pposita</u> | leaves for febrifuge |
| <u>Launaea taraxacifolia</u> | high blood pressure |
| <u>Cassia occidentalis</u> | high blood pressure, febrifuge |
| <u>Saccharum officinarum</u> | jaundice |

TEETH CLEANERS

Baphia nitida

Azadirachta indica

Griffonia simplicifolia

Ehretia cymosa

FUEL WOOD SOURCE

Manqifera indica

stem, branch

Borassus aethiopicum

leaf, rachis

- Cocos nucifera

husks, leaf rachis

Elaeis guineensis

leaf rachis

Phoenix reclinata

leaf rachis

Avicennia Africana

stem, branch

- Cassia siamea

stem, branch

Dichapetalum sp.

stem, branch

- Combretum sp.

stem

Byrsocarpus coccineus

stem, branch

Securinega virosa

stem

Flacourtia flavescens

stem

Thespesia populnea

stem, branch

- Azadirachta indica

stem, branch

- Dichrostachys glomerata

stem

- Baphia nitida

stem

Milletia thonningia

stem, branch

Fagara zanthoxyloides

stem, branches

Rhizophora racemosa

stem, branches

Pennisetum purpureum

shoot

- Mitragyna inermis

stem, branches

- Nauclea latifolia

stem, branches

Ceiba pentandra

stem, branches

Grewia carpinifolia

stem

Most commonly used species.

Source: Oteng-Yeboah (1994)

CRAFT/RAFTER SOURCE

| | |
|--------------------------------|-------------------------------------|
| <u>Cocos nucifera</u> | fronds for broom, mat |
| <u>Elaeis guineensis</u> | fronds for broom, mat, basket |
| <u>Borassus aethiopium</u> | stem for rafters, fronds for basket |
| <u>Phoenix reclinata</u> | stem for rafters |
| <u>Flagellaria guineensis</u> | stem for rafters |
| <u>Cyperus articulatus</u> | culm for mats, basket |
| <u>Andropogon gayanus</u> | stem for thatching |
| <u>Pennisetum purpureum</u> | stem for rafters/thatching |
| <u>Hyperthelia dissolute</u> | stem for thatching |
| <u>Imperata cylindrical</u> | leaf for thatching, mat |
| <u>Panicum laxum</u> | stem for thatching, mat |
| <u>Sporobolus pyramidalis</u> | shoot for broom, thatching |
| <u>Dichrostachys glomerata</u> | stem/branch for basketry |
| <u>Typha australis</u> | stem for building, thatching |
| <u>Combretum sp.</u> | stem for rafters |
| <u>Griffonia simplicifolia</u> | stem for rafters |
| <u>Baphia nitida</u> | stem for rafters |

OTHERS

| | |
|------------------------------|--|
| <u>Cyperus articulatus</u> | aromatic root stock |
| „ „ | essential oil source |
| <u>Hoslundia opposita</u> | essential oil source |
| <u>Fagara zanthoxyloides</u> | essential oil source |
| <u>Clausena anisata</u> | essential oil source |
| <u>Gloriosa superba</u> | colchicine source |
| <u>Avicennia africana</u> | tannin source |
| <u>Rhizophora racemosa</u> | tannin source |
| <u>Typha australis</u> | pollen source for industry and research |
| <u>Cassytha filiformis</u> | decorative plant |

Source: Oteng-Yeboah (1994)

B. NON-HUMAN REQUIREMENTS

1. COVER PLANTS

- a) All flood plain plants - habitat for salt/brackish marsh, fresh water marsh and mangrove animals (both vertebrate and invertebrates).
- b) All strand/sand dune plants - habitat for reptiles, crabs and insects of the dune area.
- c) All thicket (mosaic and continuous) plants - habitat for small and large mammals, birds, reptiles, insects and other animals.

2. AS ANIMAL FODDER

| | |
|----------------------------------|----------|
| * <u>Aspilia Africana</u> | shoot |
| * <u>Ceiba pentandra</u> | leaves |
| * <u>Ehretia cymosa</u> | branches |
| * <u>Cassia siamea</u> | branches |
| * <u>Griffonia simplicifolia</u> | branch |
| * <u>Commelina Africana</u> | shoot |
| * <u>Byrsocarpus coccineus</u> | branch |
| * <u>Mallotus ppositifolius</u> | branch |
| * <u>Securinega virosa</u> | branch |
| * <u>Sida spp.</u> | shoot |
| * <u>Wissadula amplissima</u> | shoot |
| * <u>Azadirachta indica</u> | branch |
| * <u>Dichrostachys glomerata</u> | branch |
| * <u>Ficus platyphylla</u> | branch |
| * <u>Musa spp.</u> | leaves |
| * <u>Baphia nitida</u> | branch |
| * <u>Centrosema plumier</u> | shoot |
| * <u>Clitoria ternatea</u> | shoot |
| * <u>Milletia thonningia</u> | branch |
| * <u>Andropogon gayanus</u> | shoot |
| * <u>Bothriochloa biadhii</u> | shoot |

Source: Oteng-Yeboah (1994)

- * *Brachiaria* sp. Shoot
- * *Panicum laxum* Shoot
- * *Paspalum orbiculare* Shoot
- * *P. vaginatum* Shoot
- * *Pennisetum purpureum* Shoot
- * *Sporobolus pyramidalis* Shoot
- * *S. virginicus* Shoot
- * *Physalis anquilata* Shoot
- * *Grewia carpinifolia* branch, leaves

- * Most commonly used species.

Source: Oteng-Yeboah (1994)

Appendix 4

List of aquatic invertebrate fauna from Dcnsu Delta

Crustacea

| | |
|--|------------------------------------|
| <i>Callinectes amnicola</i> (= <i>C. lalimannx</i>) | Copepod 1 - 10* |
| <i>Cardisoma armatum</i> | |
| <i>Acartia</i> sp. | |
| <i>Mesopodopsis</i> * ? | Cladocera (<i>Penilia</i> sp. ?)* |
| <i>Nematopalaemon hastatns</i> | Ostracod (<i>Pyrocypris</i> sp. ? |
| <i>Ocypode Africana</i> | <i>Sesarma huzardi</i> |
| <i>Penaeus kerathurus</i> | <i>Uca tangeri</i> |
| <i>Penaeus notialis</i> | Amphipod 1 |
| <i>Parapenaeopsis allanlica</i> | Amphipod 2 |

Isopod

Mollusca

| | |
|---------------------------|------------------------------|
| <i>Crassostrea tulipa</i> | <i>Tympanotonus fuscatus</i> |
| <i>Tivela triplet</i> | <i>Littorina</i> sp. |
| <i>Twilella meta</i> | <i>Pinna rudis</i> |

Insecta

| | |
|-------------------|---------------|
| Chironomids | Culex 1 |
| <i>Ceriargion</i> | Culex 2 |
| <i>Erislalis</i> | Baetidae |
| <i>Orthetrum</i> | Leptophlebiae |
| Coleoptera 1 | Dytiscus |

Others

| | |
|-------------|--------------------------|
| Fish Fry | <i>Glycera convulata</i> |
| Tilapia | <i>Dipsio Africana</i> |
| Pipe fish | Oligochaete 1 |
| Tadpole | Oligochaete 2 |
| Hydracarina | Nematode |

* Material sent for identification

Source: Gordon (1995)

Appendix 5: Checklist of Fin and Shell Fishes Found in the Densu Delta, March - June 1994

| Finfish | Species |
|---------------------|-----------------------------------|
| 1. Cichlidae | <i>Sarotherodon melanotheron</i> |
| 2. Cichlidae | <i>Tilapia zillii</i> |
| 3. Mugilidae | <i>Mugil curerna</i> |
| 4. Mugilidae | <i>Mugil sp</i> |
| 5. Mugilidae | <i>Liza falcipinnis</i> |
| 6. Gobidae | <i>Gobioides ansorgii</i> |
| 7. Gobidae | <i>Porogobius schlegeli</i> |
| 8. Gobidae | <i>Gobius spp</i> |
| 9. Periophthalmidae | <i>Periophthalmus koelreuteri</i> |
| 10. Clariidae | <i>Glorias anguillaris</i> |
| 11. Lutjanidae | <i>Lutjanus fulgens</i> |
| 12. Liognathidae | <i>Scyacium micrurum</i> |
| 13. Carangidae | <i>Caranx hippos</i> |
| 14. Clupeidae | <i>Ethmalosa fimbriata</i> |
| 15. Serranidae | <i>Epinephelus aeneus</i> |
| Shellfish | <u>Species</u> |
| 1. Portunidae | <i>Callinectes latimanus</i> |
| 2. Ocypodidae | <i>Uca tangeri</i> |
| 3. Gecarcinidae | <i>Cardiosoma armalum</i> |
| 4. Potamididae | <i>Tympanoton us fuse at us</i> |
| 5. Turritellidae | <i>Turitella meta</i> |
| 6. Veneridae | <i>Tivela triplet</i> |
| 7. Grapsidae | <i>Sesarma Africana</i> |
| 8. Penaeidae | <i>Parapenaeopsis atlantica</i> |
| 9. Penaeidae | <i>Paenus notialis</i> |
| 10. Ostreidae | <i>Crassostrea tulipa</i> |

Source: Koranteng (1995)

Appendix 6

Avian Species Richness in Five Ramsar Sites

| No. | Species / Sites | Keta | Songor | Densu delta | Sakumo | Muni-Pomadze |
|-----|---------------------------|-----------|-----------|-------------|-----------|--------------|
| | <i>Waders</i> | | | | | |
| 1 | Painted snipe | | | | | |
| 2 | Eurasian oyster catcher | | | | | |
| 3 | Black-winged stilt | * | * | * | * | * |
| 4 | Avocet | | | * | * | * |
| 5 | Senegal thick knee | | | | | |
| 6 | Collared pratincole | | | | | |
| 7 | Pratincole | * | * | * | * | * |
| 8 | Little ringed plover | | | | | |
| 9 | Ringed plover | * | * | * | * | * |
| 10 | White fronted sand plover | * | * | * | * | * |
| 11 | Kitlitz's sand plover | * | * | * | * | * |
| 12 | Kentish plover | | | | | |
| 13 | Golden plover | | | | * | |
| 14 | Grey plover | * | * | * | * | * |
| 15 | Senegal-wattled plover | | * | * | * | * |
| 16 | Knot | * | * | * | * | * |
| 17 | Sanderling | * | * | * | * | * |
| 18 | Little stint | * | * | * | * | * |
| 19 | Temminck's stint | | | | | |
| 20 | White-rumped sand piper | | | | | |
| 21 | Curlew sand piper | * | * | * | * | * |
| 22 | Dunlin | | * | | | |
| 23 | Buff-breasted sand piper | | | | | |
| 24 | Ruff | * | | | * | |
| 25 | Common snipe | | | | | |
| 26 | Black-tailed godwit | * | * | | * | |
| 27 | Bar-tailed godwit | * | * | * | * | * |
| 28 | Whimbrel | * | * | * | * | * |
| 29 | Curlew | * | | * | * | |
| 30 | Spotted redshank | * | * | * | * | * |
| 31 | Redshank | * | * | * | * | * |
| 32 | Marsh sand piper | * | * | * | * | * |
| 33 | Greenshank | * | * | | * | * |
| 34 | Lesser yellow legs | | | | | |
| 35 | Green sand piper | | | | | |
| 36 | Wood sand piper | * | * | | * | * |
| 37 | Common sand piper | * | * | | * | * |
| 38 | Terek sand piper | | | | | |
| 39 | Turnstone | * | * | | * | * |
| 40 | Jacana | * | | | * | |
| 41 | Spur-winged | * | * | | * | * |
| | Total | 24 | 24 | 21 | 26 | 21 |

Source: Ghana Wildlife Society (1995)

| No. | Species / Sites | Keta | Songor | Densu delta | Sakumo | Muni-Pomadze |
|-----|--------------------------|-----------|-----------|-------------|-----------|--------------|
| 1 | Gull-billed tern | | | | | |
| 2 | Caspian tern | * | * | | | |
| 3 | Royal tern | * | * | * | * | * |
| 4 | Lesser crested tern | | | | | |
| 5 | Sandwich tern | * | * | * | * | * |
| 6 | Roseate tern | * | * | * | * | * |
| 7 | Common tern | * | * | * | * | * |
| 8 | Little tern | * | * | * | * | * |
| 9 | Whiskered tern | * | | | | |
| 10 | Black tern | * | * | * | * | * |
| 11 | White-winged black tern | * | | | | |
| 12 | Noddy | | * | | | |
| 13 | Sooty tern | | * | * | | |
| | Total | 9 | 9 | 6 | 6 | 6 |
| | Others | | | | | |
| 1 | Pomarine skua | | | | | |
| 2 | Artie skua | | | | | |
| 3 | Little gull | * | | | | |
| 4 | Black-headed gull | * | | | * | |
| 5 | Grey-headed gull | | | | | |
| 6 | Lesser black backed gull | * | * | * | | |
| 7 | Little grebe | | | | | |
| 8 | Long-tailed cormorant | * | * | * | * | * |
| 9 | Pink-backed pelican | * | | | | |
| 10 | White pelican | * | | | | |
| 11 | Little bittern | * | | | | |
| 12 | Dwarf bittern | | | | * | |
| 13 | Squacco heron | * | | | | |
| 14 | Cattle egret | | | | | |
| 15 | Green-backed heron | * | * | * | * | |
| 16 | Black heron | * | | * | * | * |
| 17 | Night heron | * | | | * | |
| 18 | Western reef heron | * | * | * | * | * |
| 19 | Little egret | * | * | * | * | * |
| 20 | Yellow-billed egret | * | | | * | |
| 21 | Great white egret | * | * | * | * | * |
| 22 | Purple heron | * | | * | * | |
| 23 | Grey heron | * | * | * | * | * |
| 24 | White-necked stork | | | | | |
| 25 | Glossy ibis | * | | | * | |
| 26 | Sacred ibis | | | | | |
| 27 | White-faced tree duck | * | * | * | * | * |
| 28 | Fulvous tree duck | * | | | * | |
| 29 | Common shelduck | | | | | |
| 30 | Northern Pintail | | | | | |
| 31 | Garganey | * | | | | |
| 32 | Common pochard | | | | | |
| 33 | African spoonbill | * | | | * | |
| 34 | Pygmy goose | | | | | |
| 35 | African skimmer | | * | | * | |
| | Total | 22 | 8 | 11 | 16 | 6 |
| | Grand total | 55 | 41 | 38 | 48 | 33 |

Appendix 7 Materials Used in Building Houses

| Part of Building | Material | Respondents | Percentage |
|------------------|---------------------------|-------------|------------|
| Wall | Mud only | 40 | 39.6 |
| | Block/cement only | 30 | 29.7 |
| | Coconut branches/grass | 13 | 12.9 |
| | Wood only | 9 | 8.9 |
| | Brick only | 3 | 3.0 |
| | Partly block; partly wood | 2 | 2.0 |
| | Block + mud | 2 | 2.0 |
| | Mud + wood + block | 1 | 1.0 |
| | Wood + mud | 1 | 1.0 |
| | Total | 101 | 100.0 |
| Roof | Thatch | 41 | 36.6 |
| | Aluminum/iron sheet | 28 | 25.7 |
| | Slate | 26 | 23.8 |
| | Coconut branches/grass | 6 | 5.0 |
| | Total | 101 | 100.0 |
| Door | Wood | 96 | 95.1 |
| | Coconut branches/grass | 4 | 4.0 |
| | Cloth | 1 | 1.0 |
| | Total | 101 | 100.1 |
| Window | Wood | 88 | 87.1 |
| | Coconut branches/grass | 1 | 1.0 |
| | None | 12 | .11.9 |
| | Total | 101 | 100.0 |

Source: Dadson (1995)

Appendix 8

Population of Densu Site

| Settlement | Total Population | | Growth Rate (%) | Projected Population | | |
|--------------|------------------|-------------|-----------------|----------------------|--------------------------|--------------------------|
| | 1970 | 1984 | | 1995 | 2000 | 2010 |
| Ablekuma | 101 | 174 | 3.9 | 267 | 325 | 480 |
| Afuaman | 109 | 306 | 7.5 | 685 | 1016 | 2041 |
| Agbon | 50 | 322 | -3.2 | 26 | NP | NP |
| Amanfro | 112 | 93 | 6.9 | 626 | 884 | 1762 |
| Aplaku | 243 | 327 | 2.1 | 412 | 458 | 565 |
| Asabaham | 73 | 154 | 0.5 | 163 | 167 | 175 |
| Ashaaladza | 24 | 15 | -3.4 | 10 | 9 | 6 |
| Bortianor | 2088 | 3298 | 3.3 | 4741 | 5592 | 7778 |
| Chokomey | 441 | 700 | 3.3 | 1006 | 1187 | 1651 |
| Dantsera | 212 | 299 | 0.2 | 224 | 309 | 230 |
| Domeabra | 272 | 497 | 4.3 | 798 | 989 | 1520 |
| Dzoma 1 | 72 | 117 | 3.4 | 170 | 202 | 283 |
| Dzoma 11 | NA | NA | * | * | * | * |
| Paana | NA | 1043 | * | 2000 ¹ | * | 4846 ² |
| Glefe | NA | NA | * | 250 ¹ | 2681 ³ | * |
| Kwamianum | 130 | 185 | 2.5 | 244 | * | 354 |
| Manhcan | 412 | 697 | 3.8 | 1059 | 276 | 1872 |
| Mpoase | NA | NA | * | 5000 ¹ | 1280 | * |
| Oduman | 80 | 146 | 4.3 | 234 | 291 | 447 |
| Tetegbu | 440 | 938 | 5.4 | 1699 | 2226 | 3818 |
| Total | 4859 | 9221 | 6.9 | 19614 | 27695⁴ | 27828³ |

- Sources:
- I. Ghana Statistical Service: Files data for 1970 and 1984.
 2. U.G./PIP (LEGON).

Notes:

NP = No Population

NA= Not Available

* = No data from census for projections

2 = Survey figures (estimated)

3 = Based on rate estimated from 1984 census and 1994 survey data

4 = Projected figure for 2000 at growth rate of 6.9%.

Appendix 9

Main Occupations

| Occupation | Respondents | Percentage |
|-------------------------|-------------|------------|
| Trading | 10 | 9.9 |
| Food Processing | 9 | 8.9 |
| Handicraft/Artisan | 6 | 5.9 |
| Crop Farming | 26 | 25.7 |
| Fishing | 34 | 33.7 |
| Salary Worker | 11 | 10.9 |
| Manual/Unskilled Labour | 3 | 3.0 |
| Other | 2 | 2.0 |
| Total | 101 | 100.0 |

Secondary Occupations

| Occupation | Respondents | Percentage |
|-------------------------|-------------|------------|
| Trading | 2 | 5.1 |
| Food Processing | 3 | 7.7 |
| Handicraft/Artisan | 1 | 2.6 |
| Crop Farming | 14 | 35.9 |
| Fishing | 9 | 23.1 |
| Manual/Unskilled Labour | 2 | 5.1 |
| Student | 1 | 2.6 |
| Driver | 3 | 7.7 |
| Lotto Receiver | 2 | 5.1 |
| Corn Miller | 1 | 2.6 |
| Local Gin Distiller | 1 | 2.6 |
| Total | 39 | 100.0 |

Source: Dadson (1995)

Appendix 10

REVIEW OF INVOLVEMENT OF THE MAJOR STAKEHOLDERS & LOCAL COMMUNITIES IN THE MANAGEMENT OF THE DENSU DELTA RAMSAR SITE AND STRATEGIES FOR IMPROVEMENT TO ENSURE LONG-TERM PARTICIPATION

| Stakeholder | Current Role | Expected New Role |
|-------------------|---|--|
| Wildlife Division | <p>Day to day administration</p> <ul style="list-style-type: none"> • Provision of sanitation facilities and equipment through the District Assemblies • Provision of roosting sites/nesting boxes • Provision of technical direction • Assistant Wildlife Officer in charge • Assisted by 3 field staff often involved in monitoring of bird species and fisheries resources with GWS and other research teams respectively • Liase with other stakeholders (SMC) and implementation of CISF • Awareness creation within the site in conjunction with the education officer <p>Training of staff and stakeholders</p> | <ul style="list-style-type: none"> • Continue with day to day administration; technical direction and enforcement of Ramsar Site regulations • increase size/capacity of field staff for effective monitoring of birds/fisheries/other resources and activities of local people within the core area • work out arrangement (MOU) with Panbros Salts Limited for easy yet controllable access to the site for birdwatching • ensure zonation of core area is effected and possibly identify means of lease or holding in trust of such areas for a minimum period 100 years so that land owners can earn regular income and avoid indiscriminate selling of their lands to developers; this could be done or undertaken jointly with the DAs using part of their Common Fund • intensify education of the local people and all other stakeholders for maintenance of cordial relationships and healthy environment • liase with GES on the development of educational materials for promotion of wetland studies by basic schools • identify and promote other income generating means compatible with the tenets of the site such as to promote and sustain local communities acceptance of Ramsar Site objectives |

| Stakeholder | Current Role | Expected New Role |
|--|--|--|
| Ministry of Lads and Forestry (MLF) | <ul style="list-style-type: none"> • provides technical direction • administration of entire funding of the project • legislation of all the Ramsar Site and enactment of Wetland Regulations (LI). | <ul style="list-style-type: none"> • Should continue with role and seek other sources of funding for future activities of the entire project, also to include Densu Delta Ramsar Site |
| Ghana Wildlife Society (GWS) | <ul style="list-style-type: none"> • membership of Site Management Committee (SMC) • Undertakes research and monitoring of bird species • Co-ordinates wildlife clubs and their activities • Promotes birdwatching at various places including R.S | <ul style="list-style-type: none"> • Continue with same activities • Promote formation and sustenance of wildlife clubs in all schools within Ramsar.Site. |
| District Assemblies (Ga District Assembly, Amasaman) | <ul style="list-style-type: none"> • membership of SMC and vetting applications for CISF • receives from WD all sanitation facilities and equipment • provision of by-laws for conservation of wetland resources and beneficial traditional rites | <ul style="list-style-type: none"> • see to resolve all existing chieftaincy issues that promote land litigation within the sites • effectively coordinate all government groups (i.e. T&CP/EPA/FD etc.) to assist the WD with the zonation of core areas and possibly find ways of controlling development of residential areas within the site • endeavour to the resolution of all land litigation and chieftaincy issues within the site to allow for full co-operation of the local communities in wetlands conservation |

| Stakeholder | Current Role | Expected New Role |
|-------------------------------------|---|--|
| Town & Country Planning Department | Membership of the SMC responsible for provision of land layouts, issue of land development permits; ensuring that all wrongly sited structure are demolished | <ul style="list-style-type: none"> • ensure that proper layout of areas for constructional development so that the area which also serves as the flood plains of the Densu river and Weija dam is secured to continue providing half of Accra with its treated water • identify possible sources of compatible economic ventures that would benefit the local people and increase the Assembly's tax income • undertake study and promotion of possible means of long lease of the site especially core area through the payment of a yearly rent to local landowners/communities (directly or indirectly) to prevent the sale/development of the entire area • identify and promote the development of recreational activities by the local people that could promote income generation |
| Environmental Protection Agency | <ul style="list-style-type: none"> • membership of the SMC and formerly responsible for financial administration and procurement of all CWMP logistics • oversees the provision of EIA on all infrastructure developments | <ul style="list-style-type: none"> • should be more concerned with safe environmental development (i.e. EIA for all projects) • should liase with other agencies under the Assembly e.g. T&CP/WD on zonation and advocate for conservation of the site • should use its power of prosecution to ensure that only compatible landuse development is allowed within the site |
| Ghana Water Company (formerly GWSC) | • membership of the SMC and advises on spillage of water from the Weija Dam and related issues | • provide support and sponsor the education of the public on the need of protecting the area as flood control area of the Weija Dam |

| Stakeholder | Current Role | Expected New Role |
|---------------------------------------|--|--|
| Forestry Division | <ul style="list-style-type: none"> • membership of the SMC and advise on planting of tree species within the site | <ul style="list-style-type: none"> • continue and promote tree planting along the catchment area of the Densu river outside the site |
| Ministry of Food & Agriculture | <ul style="list-style-type: none"> • Not on SMC | <ul style="list-style-type: none"> • Be represented on SMC and advise on the correct agricultural practices especially in relation to chemical fertilizer and pest control usage |
| Panbros Salts Company Limited | <ul style="list-style-type: none"> • ownership of would-be core area and membership of the SMC, very conservation conscious • involved in commercial production of salt with full control of entry into the site for bird watching and fishing • provides security for salt business and bird roosting site | <ul style="list-style-type: none"> • continue with all positive conservation moves • with approval of the SMC be made to keep record of those who enter to birdwatch and possibly collect entry fees through ticketing both for monitoring and generating income that can be used to support conservation of the site |
| Traditional Authorities (Sempe stool) | <ul style="list-style-type: none"> • membership of SMC • unfortunately had not been very effective in controlling/reducing encroachment by private developers | <ul style="list-style-type: none"> • should press for long lease of lands under its stool rather than outright sale to all persons including the government • should negotiate for government holding in trust the area as both green belt for Accra and alternate wise use that will guarantee a regular income to both the stool and individual land owners • should come out with traditional/cultural taboos that protect the Ga Sakumo Lagoon (Densu floodplain) for incorporation in the District bye-law |

| Stakeholder | Current Role | Expected New Role |
|---|---|--|
| At the local community level represented by Assemblyman/Unit Committee member | <ul style="list-style-type: none"> • due to litigation had not been able to mobilize subjects for community work especially sanitation and other environmental development activities • apparent lack of control/authority over the people living within area of jurisdiction | <ul style="list-style-type: none"> • should ensure high sanitation through organisation of communal labour • should also monitor and encourage local CISF groups to pay promptly all funding received and ensure that others can access funding in future • identify local sources of generating income or projects for improving the living standards of local people • every effort should be made to resolve all land litigation for all meaningful development |
| Ghana Education Service | <ul style="list-style-type: none"> • not on the SMC; despite education in the schools, response had been very slow, also poverty and lack of motivation restricts active participation of both pupils and teachers in taking up the challenge of wildlife club membership | <ul style="list-style-type: none"> • should take up membership of SMC to ensure opportunities for promoting wetland education in schools within the site. • educational visits to immediate natural environment should be made part of schools obligation • develop educational materials in consultation with WD and other agencies • more effort to be made to win especially, teachers interest and thereby promote wildlife club formation in local schools |

| Stakeholder | Current Role | Expected New Role |
|---|--|--|
| Beneficiaries Community Investment Support Fund (CISF) | <ul style="list-style-type: none"> • recipients of financial support under the project • represented on the SMC • ready to undertake biodiversity activity through they have no land of their own • willing to undertake mangrove regeneration within the core area even beyond period of receiving financial support and sanitation | <ul style="list-style-type: none"> • use properly funding received and pay back promptly to ensure that others can also access funds for the general improvement of all within the site • actively participate in all community improvement activities especially biodiversity • seek to enforce all wetland regulations and byelaws • promote awareness creation among their communities and assist the education officer in identifying and promoting conservation education within the site |
| Department of Co-operatives | <ul style="list-style-type: none"> • not on SMC but just brought in to assist with beneficiaries of CISF ad to identify their training needs | <ul style="list-style-type: none"> • should take up membership of SMC • should be assisted by WD to perform co-operate role of mobilising and assisting local economic groups in wise use of CISF loans. • should identify other groups needing financial assistance and help them secure loans that would sustain the conservation of the Ramsar Site even if outside the CISF |
| Local communities at large | <ul style="list-style-type: none"> • direct and indirect beneficiaries of all infrastructure facilities as well as improved environment and conservation education | <ul style="list-style-type: none"> • should go beyond willing "passive" recipients into action oriented role e.g. enforce byelaws • undertake regular/scheduled communal clean up programmes • maintain sanitation facilities provided by the project |
| Researchers | <ul style="list-style-type: none"> • not OP SMC • monitor and collect information on various wetland resources | <ul style="list-style-type: none"> • continue with monitoring of resources availability and use within the site • make available findings/recommendations in simple everyday language for dissemination to the public |

Appendix 11

MEASURES FOR ADDRESSING IDENTIFIED CONSTRAINTS

| CONSTRAINTS | ACTIONS | INSTITUTION |
|---|--|--|
| <ul style="list-style-type: none"> • Urbanisation and land encroachment • No zoning of the site • No authority over land sales by the Ga District Assembly | <ul style="list-style-type: none"> • Implement and enforce the Ramsar LI 1659 • Enhance the growth of thorny bush <i>Drepanocarpus lunatus</i> to spread to around all the area where the Densu River bifurcates into its Delta tributaries. This will discourage builders from looking for sites for development | <p>MLF, WD, EPA, T&CP, GDA</p> |
| <ul style="list-style-type: none"> • Weak presence of the Ga District Assembly in the wetland area • Panbros salt pans reduce the availability of habitats for wetland wildlife | <ul style="list-style-type: none"> • Continue dialogue with GDA and use CISF/VTP to whip up interest in wetlands conservation. • Ensure that Bye laws are implemented for resource conservation • Improve bunds for birds to use as roosting and nesting sites • Collaboration with Panbros management to stop further addition to the salt pans | <p>MLF, WD, GDA and VIP</p> <ul style="list-style-type: none"> • WD, Panbros Salt Co. Ltd., Site Management Committee |
| <ul style="list-style-type: none"> • Destruction of life and properties through intermittent water spillage by Water Company and flooding after heavy down pour of rains | <ul style="list-style-type: none"> • Consultation with stakeholders before spillage • Open the Delta to the sea when spilling starts. • Check human activities in the Densu River catchment area that impede water runoff in the area e.g. farming along the banks | <p>MLF, GWC, WD, GDA, WRI, GWS, EPA</p> |

| CONSTRAINTS | ACTIONS | INSTITUTION |
|--|--|--------------------------------------|
| Over-exploitation of the wetland resources | <ul style="list-style-type: none"> • Continue ecological monitoring to determine impacts of human use on wetland • Monitor the long term dynamics in productivity and occurrence of species of the flood plains, dunes, thickets (mosaic and continuous) and the aquatic ecosystem • Replant coconut along the beaches of the site to stabilise the sand dunes • Check sandwinning along the beaches and along the banks of the Densu River in order to sustain the discharge of water from aquifer during dry season • Mangrove regeneration should be enhanced • Continuation of biodiversity investment programme | WD, WR1 EPA, MLF and the Communities |
| <ul style="list-style-type: none"> • Pollution, illegal sand wining, clay mining and quarrying • No fishing gears regulation | <ul style="list-style-type: none"> • Regulate through implementation of Ramsar LI 1659 and District Assembly's bye laws • Support for traditional system of conservation. | |

| CONSTRAINTS | ACTIONS | INSTITUTION |
|--|---|-----------------------------|
| <ul style="list-style-type: none"> • Cutting of trees, branches for acadja system of fishing • Woodlot establishment hampered by Availability • Further expansion in the number of salt pans by Panbros • Watershed encroachment • Disturbance from Accra | <p>Urge Panbros to stop extension of salt pans.</p> | <p>WD, EPA, GDA, MLF</p> |
| <ul style="list-style-type: none"> • Firewood gathering for fish smoking from wetland area • Use of chemical fertilizers and herbicides by farmers pose threat to the stability of wetland ecosystem | <ul style="list-style-type: none"> • Farmers should be educated to use the appropriate fertiliser | <p>MOFA, GDA, WD</p> |
| <ul style="list-style-type: none"> • No enforcement of traditional laws for wetlands resource conservation • Weak Site Management Committee • Communities involved in land and other litigations • Weak traditional administration within the site | <ul style="list-style-type: none"> • Increase conservation education • Involve traditional authority in conservation efforts <p>Involve traditional authorities in all activities</p> | <p>WD, EPA, GDA NGO/CBO</p> |

| CONSTRAINTS | ACTIONS | INSTITUTION |
|--|--|--------------------|
| <ul style="list-style-type: none"> Inadequate collaboration of institutions involved in the management of the wetland | <ul style="list-style-type: none"> Establish proper collaboration between institutions | WD, GDA, EPA, TCPD |
| <ul style="list-style-type: none"> Limited land available for economic ventures Limited availability of job options Seasonal nature of salt production limits jobs created by Panbros Salt Co. High cost of land Inadequate research in economic options for livelihood | <ul style="list-style-type: none"> Support market gardening, small scale irrigation, food processing, fish smoking and other cottage industries through investment support fund and research. Explore possibility for shrimp culture | WD, GDA, NGOs |
| <ul style="list-style-type: none"> _____ Inadequate training for field staff in data collection and analysis WD reliance on other institutions for ecological data collection, analysis and interpretation | <ul style="list-style-type: none"> Seek support for training Continue relying on the institutions as capacity is lacking at WD and/ or provide opportunities for training at WD | |