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**COASTAL WETLANDS MANAGEMENT**

**PLANS: GHANA**

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## SYNOPSIS

Ghana's coastal wetlands form an ecologically important unit, providing feeding, roosting and nesting sites for thousands of migratory and resident birds. Eight of the coastal wetlands: Keta lagoon, Songor lagoon, Sakumo lagoon, Korle lagoon, Densu delta, Muni lagoon, Elmina Salt Pans and Esiama beach, qualify as internationally important wetlands under the Ramsar\* criteria of supporting 20,000 waterfowls or 1% of the population of a waterfowl species. Keta and Songor each holds over 100,000 seashore birds, and supports internationally important numbers of seven species of waders. Sakumo, Densu delta, Korle and Muni each holds 23,000 - 35,000 birds and supports internationally important populations of up to 6 wader species.

The Ghana coast is also important for marine turtles, providing nesting grounds for at least three species of turtles, all of which are listed on the IUCN Red Data list of Threatened Animals.

Coastal wetlands provide nutrient rich habitats which are used for spawning and as nursery grounds by many species of fish. These wetlands therefore form a vital link for the survival of Ghana's declining marine fishery resource.

More importantly, Ghana's coastal wetlands provide resources such as, shell, salt, thatch and wood, which are major sources of income and play a significant role in the socio-economic and cultural life of the coastal communities.

All the important coastal wetlands are threatened by pollution from both solid and liquid wastes from domestic and industrial sources and/or proposed urban/industrial developments. All the wetlands are situated in densely populated areas, and as human population in the country increases, the demands for wetland resources and the threats to these valuable ecosystems should be expected to increase.

In the past, traditional strategies associated with lagoon fetishes and cultural beliefs protected some coastal wetland habitats and regulated the exploitation of wetland resources. Unfortunately most of the traditional controls are no longer respected. There is, therefore, an urgent need to develop a more effective management scheme for these coastal ecosystems.

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\* The Ramsar Convention is The Convention on Wetlands of International Importance, especially as Waterfowl Habitat.

The management strategy advocated aims at maintaining the ecological integrity of the wetlands, while ensuring the optimization of wetland resources and the improvement of the quality of life for the coastal communities, through sustainable development. It recommends the establishment of the six most important coastal wetlands: Keta, Songor, Sakumo, Korle, Densu delta and Muni, as Ramsar sites. In designating and protecting these wetlands as Ramsar sites, Ghana will be fulfilling her international obligation under the Ramsar Convention, which she is signatory to. The Ramsar designation is preferred to other protected area categories (eg. National Parks) because Ramsar advocates a multiple use approach to management, and allows sustainable utilization and compatible developments within the sites.

The management actions advocated include:

- boundary demarcation and legal designation of the sites;
- provision of necessary resources, infrastructure and facilities (funds, buildings, roads, equipment, vehicles) required for the implementation of the management of the sites;
- establishment of a zonation system, to provide sanctuaries for adequate protection of birds and other fauna, while allowing sound land use practices and sustainable development in other parts of the wetland;
- initiation of appropriate research and monitoring programs which would provide the requisite data for formulation of wetland policies and form the basis for management actions;
- institution of appropriate habitat and faunal management programs;
- establishment of conservation education and public awareness programs to ensure local understanding of the project's objectives and elicit local participation in the conservation actions advocated;
- provision of conditions and initiation of campaigns aimed at improving sanitation, water supply, and the general health of the coastal communities and environment.

In defining institutional arrangements for the implementation of the program, the multi-sectoral nature of the activities and problems associated with the coastal wetlands is emphasized. A National Wetlands Expert Committee, comprising high level representation of all the institutions whose activities affect the coastal zone, is advocated to advise on policy matters. The committee would have a direct link with the government. Policy decisions would be communicated to the implementing agencies through a secretariat provided within the Environmental Protection Council (EPC). The Department of Game and Wildlife

is recommended to be the lead implementing agency, who would work with other relevant agencies, and with site management committees made up of relevant local organs, to ensure local participation.

Provisions have been made for the training of required personnel. Technical assistance and consultancy needs for the areas where expertise may not be available within the Department of Game and Wildlife have also been identified. Implementation of the program is phased out over a 5-year period to ensure efficient execution of the actions advocated.

Three of the proposed sites have specific problems which must be addressed to ensure successful implementation of the Ghana coastal wetlands conservation program:

**Sakumo lagoon**, situated on the outskirts of Tema is already heavily polluted from human and domestic waste. Plans for the Tema Sewage Treatment Plant being undertaken under the World Bank Urban II Project, proposes the discharge of treated effluent into the lagoon. The lagoon, which is connected to the sea by only a narrow non-operational sluice, is already suffering from nutrient over-load. Any input of additional waste will seriously affect the ecological integrity of the lagoon, and there is a need for critical environmental impact assessment before any developments take place.

**Songor lagoon** area currently sustains a large number of people who earn their livelihood from traditional salt winning. Some improvement in technology could increase salt productivity without destroying the immense wildlife value of the site. Plans by the Minerals Commission proposes the development of a large scale salt industry in the area, with an estimated production capacity of 1.2 million tons per yr. The proposed scale of operation could undoubtedly cause major changes in the ecological integrity of the lagoon and the social/traditional structures in the area; and calls for critical evaluation of development options which would minimize any adverse effects.

**Keta lagoon** is a special case. The communities living in the vicinity of this important wetland face severe problems of coastal erosion and periodic flooding, which has resulted in serious social problems. Any attempts at conserving the Keta wetland for its immense ornithological value, will not succeed, unless it first addresses the socio-ecological problems. The establishment of the Anlo-Keta Ramsar site should, therefore, aim at using conservation to improve the quality of life for the people in the area, whose very existence, cultural identity, and whole environment is seriously threatened. The management strategy for this site should therefore include detailed study of the socio-ecological problems and incorporate measures to address the needs of the local communities.

## GENERAL INTRODUCTION

### BACKGROUND

The Coastal Wetlands Management Plan was prepared as part of the Environmental Resource Management Project (ERMP), which is being prepared by the Ghana Government for consideration by the World Bank and other donors. A major component of the ERMP is the conservation of a number of sites of particular importance because of their biological diversity, or because they are of international importance as habitats for sea- and shore- birds and/or marine turtles. The objective of the assignment was to prepare an inventory of the biological resources of the selected sites, in order to demonstrate their national and international importance as biological reserves, and to prepare proposals for their conservation under the biodiversity component of the ERMP.

### TERMS OF REFERENCE

- (a) Review the Indicative Coastal Zone Management Plan prepared for the EPC and identify those actions that should be included in the biodiversity component of the project.
- (b) Review all published data on the flora and fauna of the identified sites and undertake rapid inventory to update existing data.
- (c) Prepare detailed management plans for two coastal sites and outline management plans for three other coastal sites.
- (d) Identify the various institutions that may be involved in the implementation of the proposed actions, their responsibilities and present mandates.
- (e) Consult with communities involved in the protection of the priority sites in the coastal zone in order to develop detailed management plans for implementation under the project.
- (f) Prepare detailed implementation programs for the selected sites including infrastructure, equipment and staffing requirements.
- (g) Describe appropriate arrangements for the management of the proposed programs, following critical review of the proposals in the Indicative Coastal Zone Management Plan, clearly identifying the responsibilities of the various agencies involved.
- (h) Identify data requirements for the planning and environmental monitoring of proposed programs and linkages to future data management systems in EPC or elsewhere.
- (i) Identify training needs for agency staff or community leaders



(j) Identify any consultancy or technical assistance requirements.

(k) Identify the investment and recurrent costs of the anticipated program of work over a five-year period including investments in new equipment, vehicles and civil works, recurrent costs of staff salaries and the operation and maintenance of vehicles and equipment.

#### **THE INDICATIVE COASTAL ZONE MANAGEMENT PLAN**

The Indicative Coastal Zone Management Plan was prepared by a team of consultants at the request of the Environmental Protection Council in 1990. The main objective was to produce a synthesis document which would help guide future development in the coastal zone on a sustainable basis. The document gives a broad picture of the critical issues that require to be addressed for management of the zone and identifies three main actions:

(a) **Development of a management system for the coastal zone:** Details are provided for the setting up of a coastal management system. The document advocates the avoidance of creating new institutions; and the effective use of existing administrative and technical departments, NGOs and local people within the existing or modified legal provisions. These two points underscore what is, perhaps, the most important role that the Environmental Protection Council would be required to play, i.e. coordination.

The Indicative Coastal Zone Management Plan proposes a three tier coastal management scheme (National, Regional and District). The present document considers this approach rather top heavy and impractical for the management of the selected coastal wetlands and proposes alternative mechanisms for implementation of the coastal wetlands management strategy.

(b) **The protection of selected coastal areas:** The document identifies the sites along the coast which need protection and gives the criteria for their selection. It also identifies the protected area category for each site. The present study has re-assessed the sites and prioritized them for conservation action.

(c) **Setting up of a coastal zone data base:** The proper acquisition and handling of data is a basic pre-requisite of any planning process and the centralized data-base advocated would be of immense value in guiding development policies in the coastal zone. It is, however, considered more appropriate to have this within a national framework, in view of the fact that many inland processes have significant effects on the coast.

## THE COASTAL WETLANDS MANAGEMENT PLANS

The present report identifies the internationally and nationally important lagoons and wetland habitats along the Ghana coast which require priority conservation action. It recommends the establishment and protection of the five most important coastal wetlands as Ramsar sites: Keta lagoon, Songor, Sakumo, Densu delta and Muni. It outlines a management strategy for the selected sites and defines institutional framework and mechanisms for the implementation of the conservation actions proposed (Section 1).

Sections 2-5 provides detailed management plans for four of the sites, Muni, Songor, Sakumo, and Densu delta. The fourth site, Keta, is a special case. Although the site is the most important seashore bird site on the Ghana coast, it is also the most problematic. The international importance of the Keta lagoon and the socio-ecological problems in the area are high-lighted; and recommendations on studies required for the preparation of detailed management plans for the site are given in Section 6. Section 7 identifies training needs and technical assistance requirements; and also provides a phased plan for implementation of the proposed programs. Cost estimates are given in section 8.

It should be emphasised at this point that the preparation of a management plan is a dynamic process. The plans outlined here were based on the information currently available on the sites. As more data become available through the scientific studies recommended, it would be necessary to review and update the plans as and when necessary.

**SECTION 1**

**COASTAL WETLANDS CONSERVATION:**

**GHANA**

## 1. COASTAL WETLANDS CONSERVATION GHANA

### 1.1. JUSTIFICATION

The importance of the Ghana coast for sea- and shorebirds is well documented (Grimes, 1974; 1987; Macdonald, 1978; Ntiamoa-Baidu and Grieve, 1987; Ntiamoa-Baidu and Hepburn, 1988; Ntiamoa-Baidu, 1988; 1991). Eighty sites along the Ghana coast, comprising lagoons, estuaries, salt pan complexes and stretches of sandy beaches have been regularly monitored by the survey team of the Save the Seashore Birds Project (SSBP-G) since 1986. This work undertaken with sponsorship from the Royal Society for the Protection of Birds (RSPB), U.K., has identified thirteen key coastal wetlands which provide important feeding, roosting and nesting sites for thousands of migratory and resident seashore birds (Fig. 1).

Waterfowl species of significance in coastal Ghana include waders, terns, herons and egrets. Eleven of the 42 species of waders recorded on the Ghana coast occur in internationally important populations. These are: curlew sandpiper, little stint, sanderling, spotted redshank, greenshank, grey plover, ringed plover, black-winged stilt, avocet, black-tailed godwit and turnstone (scientific names of all bird species are given in Appendix 1)

Eight of the thirteen key sites : Keta Lagoon, Songor Lagoon, Sakumo lagoon, Korle lagoon, Densu delta, Muni Lagoon, Elmina Salt Pans and Esiama Beach, qualify as internationally important wetlands by virtue of the species and /or populations of waterfowls they support (Tables 1 & 2). Over 90% of the bird species supported by these sites are migratory, including the threatened Roseate tern, Sterna dougallii.

**Table 1. Species counts and populations of seashore birds recorded at the key coastal sites (as at 30th June 1991).**

Site	No. of species recorded.	Estimated bird population*
Keta Lagoon	72	109,300
Songor Lagoon	57	111,000
Sakumo Lagoon	66	32,500
Korle Lagoon	31	21,700
Densu delta	57	35,000
Muni Lagoon	42	23,000
Elmina Salt Pans	43	8,600
Esiama Beach	43	9,700

\* Based on peak counts of species recorded on each site.

Table 2. International importance of selected sites for waders.

Species	1% of estimated East Atlantic Flyway population*	Peak counts*** recorded at							
		Keta	Songor	Sakumo	Korle	Densu delta	Muni	Elmina	Esiam
Spotted redshank	300	8,330	10,060	3,280	-	550	-	430	-
Greenshank	500	6,900	4,770	1,180	-	-	-	610	-
Ringed plover	2,000	2,860	3,010	-	3,500	-	-	-	-
Curlew sandpiper	4,500	14,810	6,920	3,270	7,050	4,700	-	-	-
Sanderling	1,000	-	-	-	-	-	-	-	4,520
Little stint	2,000	5,790	2,530	2,570	5,780	2,610	-	-	-
Black tailed godwit	1,500	1,270	-	1,500	-	-	-	-	-
Avocet	700	1,560	3,740	-	-	-	-	-	-
Black-winged stilt**	60	12,080	4,400	900	450	310	150	230	-

\* 1% criteria based on Altenburgh et al (1982); Smit & Piersma (1989).

\*\* Partial migrant, numbers recorded comprises c.55% palaeartic; 45% residents.

\*\*\* Peak counts as at 30th June 1991.

In addition to the migratory birds, the Ghana coast provides nesting grounds for marine turtles. Three species of marine turtles have been reported to nest on the coast: the Loggerhead Caretta caretta, the Green Turtle Chelonia mydas and the Leatherback Dermochelys coriacea (Toth and Toth, 1974). All three are listed in IUCN Red Data List of Threatened Animals. Marine turtles are also fully protected by the country's wildlife laws (L.I.685). However enforcement of this law is ineffective and marine turtles are heavily exploited for their eggs and meat in most of the villages along the Ghana coast. The actual status and breeding ecology of marine turtles in Ghana is unknown, but several sites along the coast, including the stretch of sandy beach between Srogboe and Ada, are known to be important turtle nesting grounds.

Fish provides an important protein source in the Ghanaian diet. The per capita consumption is estimated at 20 kg yr.<sup>-1</sup> constituting some 30% of the estimated protein requirement (Ministry of Agriculture, 1989). Current figures for Ghana's fish production levels indicate that the country's marine fish resources are declining rapidly.

Coastal wetland habitats are vital for the survival of the marine fisheries industry. Many wetlands provide nutrient rich habitats which are used by fish for spawning, as nursery grounds and as habitat for adult fish. It is estimated that two-thirds of the fish we eat depend upon wetlands at some stage in their life cycle (Dugan, 1990). In Ghana, Kwei (1978) reports spawning of the horse mackerel Caranx hippos in October - January, and the presence of juveniles in or near estuaries and lagoons that open directly into the sea. It is imperative, therefore, that the lagoons and estuaries which are so essential for the maintenance of marine fish populations should be protected and managed to ensure sustainability of our marine fisheries.

More importantly, wetland resources play a very significant role in the socio-economic life of Ghana's coastal communities. A large number of the coastal people depend on lagoon fisheries for their livelihood, while for others, lagoon fisheries provide, a significant income supplement. (Mensah, 1979; Gordon, 1991; Ntiamoa-Baidu, 1991). Resources like shells (used in animal feed and the building industry), salt (for domestic and industrial use), grass (for thatch and mats) and mangrove (for fuel wood) provide a valuable contribution to the livelihood of coastal people.

Most of Ghana's important coastal wetlands are situated in areas which have dense human population; and a number of them are already, seriously threatened by pollution from both solid and liquid waste from domestic and industrial sources (Biney, 1986; 1990; Gordon, 1990). Various proposed developments (e.g. the Tema Sewage Treatment at Sakumo and the industrial salt complex at Songor) also pose threats to the coastal lagoon habitats. As human population in the country increases, the demands for coastal wetland resources and the threats to these

In the past, rules and regulations including closed seasons, sacred days and taboos, associated with religious beliefs and lagoon fetishes protected the lagoon habitat and regulated over-exploitation of wetland resources. Unfortunately these traditions are no longer respected and the effectiveness of the rules and taboos as conservation tools have been eroded (Ntiamo-Baidu, 1991).

It is obvious from the the above that there is an urgent need to plan and develop an integrated management strategy, that would effectively ensure the maintenance of the ecological integrity of Ghana's coastal wetlands and the sustainable utilization of the resources they provide.

Ghana is party to two international conventions which seek to protect wetland habitats and migratory animals : the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention); and the Convention on the Conservation of Migratory Species of Wild Animal (Bonn Convention. Under the Ramsar convention, Ghana is obliged to designate, "suitable wetlands" (ref. appendix 2 for criteria) within her territory for inclusion in the list of wetlands of international importance (Ramsar sites), to protect such listed wetlands and to promote wise use of all wetlands. The Bonn Convention obliges Ghana to protect migratory species and specifically, to provide strict protection for species in danger of extinction. Ghana therefore has a duty to the international community to protect some of her important wetlands and the wildlife they support.

Ghana's ratification of the Ramsar and Bonn Conventions (in 1988) indicate her concern for wetland habitats and migratory birds. Ghana further demonstrated her concern for migratory species by placing all terns on the country's list of protected species (Legislative Instrument 1357). These initiatives clearly indicate that the Ghana government is willing to institute appropriate measures for the conservation of wetlands and the wildlife they support. However, the numerous more pressing socio-economic problems facing the country and the limited resources make it difficult for the country to accord any priority to wetland conservation. Support from the international community would therefore be required to enable the country to take further concrete actions towards the protection and management of her valuable wetland ecosystems.

## 1.2. MANAGEMENT STRATEGY

### 1.2.1. MANAGEMENT OPTIONS

#### 1.2.1.1. Traditional conservation strategies

In the past, various rules and regulations including closed seasons, sacred days and taboos based on religious beliefs governed most of Ghana's coastal lagoons. The regulations were usually associated with lagoon fetishes and they protected the lagoon habitat and prevented over-exploitation of the lagoon resources. The rules and taboos had no legal backing, but the beliefs were strong enough to make people respect the traditions.

Such traditional beliefs and associated taboos have been shown to be effective as tools for conservation in areas where they are still respected. For example, tabooed species are found to be most abundant in areas where their collection is forbidden: Sakumo often holds the entire population of black herons recorded along the Ghana coast; and the mollusc Tympanotonus fuscatus occurred at densities of 800-4000 times higher in areas where the species is tabooed and collection was forbidden than in areas where it was heavily exploited for food (Ntiamoa-Baidu, 1991).

Unfortunately, as a result of christianity, western influence and education, and the immigration of people from other ethnic groups who may neither believe nor respect local fetishes and taboos, these traditions and taboos are no longer respected. This has resulted in the undermining of the effectiveness of the traditional strategies as conservation tools to such an extent that the system can no longer be relied upon for the conservation of Ghana's coastal wetlands.

#### 1.2.1.2. Protection under the Ramsar Concept

The wildlife protected area system in Ghana has, hitherto followed the traditional "non-use" approach for the conservation of these areas. All the coastal wetland sites have human settlements and are heavily used by the local communities. The traditional protected area concept of "non-use" approach will therefore be inappropriate and unacceptable.

The Ramsar Convention advocates the designation of internationally important wetlands as Ramsar sites and wise-use of such wetlands. The Ramsar concept has the advantage over traditional protected areas (e.g. National Parks, Game reserves etc.) in that it adopts a multiple-use approach to management of listed wetlands. This means that compatible forms of development and human activities are not precluded on the site.

The Ramsar category of protected area is therefore considered to be the most appropriate for the coastal wetlands and it is recommended that all the sites along the Ghana coast which qualify as internationally important wetlands should be established as Ramsar sites. This will facilitate the effective



protection and management of the sites and the coordination of all activities affecting the sites, to ensure the maintenance of the value of the wetlands for both the wildlife and the local communities.

The sites which should be designated and protected as Ramsar sites are listed below in order of priority.

- (i) Songor (Songaw/Songhor) Lagoon
- (ii) Keta Lagoon
- (iii) Sakumo Lagoon (Sakumo II)
- (iv) Densu delta (Panbros Salt Pans/Sakumo I)
- (v) Korle Lagoon
- (vi) Muni Lagoon
- (vii) Amanzuri wetlands (comprising Esiama Beach i.e. the beach between the Rivers Ankobra and Amanzuri, and including the flood plains of the two rivers)
- (viii) Elmina Salt Pans.

It should be emphasised that the eight sites listed above cannot be treated as separate entities. There is ample evidence of movement of shorebirds between the sites: birds ringed at Esiama have been sighted at Korle and increases in bird numbers are observed at Songor when Keta Lagoon is flooded. Protection of just one or two sites would therefore not ensure continuous survival of shorebirds in the country, and it is essential that all the key sites are given adequate protection.

In actual fact, the Songor site, together with the Keta Lagoon complex, form one ecological unit: the Volta delta, and it should be treated as such. Protection of the two sites would also afford protection for one of the most important marine turtle nesting sites (the Ada-Srogboe beach) and the main stand of mangrove vegetation in the country.

This project proposes the establishment of the top six sites as Ramsar sites in the first instance, ie. Songor, Keta, Sakumo, Densu delta, Korle and Muni. Thereafter, the remaining two sites should be designated as and when resources become available. The six sites together support 84% of the estimated total seashore bird populations on the Ghana coast. 60% of the total is accounted for by the populations at the Songor-Ada-Keta complex alone.

Draft management plans were prepared by the SSBP-G during an international training course in site management for Sakumo, Densu delta and Muni (SSBP-G, 1987). These plans however focused on bird conservation. The present proposals incorporates some of the recommendations in the SSBP-G draft management plans, but focuses more on the integration of local people's needs with wildlife conservation. There are indications that Korle is being considered under the World Bank Urban II Project and management of that site would be incorporated in the Accra Coastal Zone Management Plan.

The procedure for designation would involve surveying, pillaring and detailed boundary descriptions. The survey work may be undertaken by the Survey Department. Private Surveyors have the advantage of rapid completion of the work, but the Survey Department has the merit of familiarity with demarcation and description of reserved areas and other government lands.

Once the boundary description is provided, the necessary legislation designating the site must be passed. The Department of Game and Wildlife has the responsibility of preparing the legal documents covering protected areas (with the help of the Attorney General's Department). These would then be submitted to the PNDC, through the Ministry of Lands and Natural Resources, for final approval and gazetting of the site. For the purpose of informing the Ramsar secretariat, based in Switzerland, a letter from the Ministry of Lands and Natural Resources together with site descriptions, maps and a statement indicating criteria for selection would be required.

#### 1.2.3.2. Conservation Education and Public Awareness Programmes

A large part of the current environmental degradation and the conservation problems facing the country result from people's ignorance of the adverse effects of their actions on the environment. It is therefore most important that the communities in the coastal wetlands project areas are made fully aware of the project's aims and objectives. It is recommended that the project's plan of activities incorporates a specific component for conservation education and public awareness programmes.

Provision should be made for the training of a conservation education officer who will operate from a central office and cover all the project sites. His job would include sensitization of the local communities to the conservation needs in each district and mobilization of the people for participation and involvement in conservation projects. He would also encourage and promote the formation of community and school wildlife clubs within the project districts; promote village environmental committees and organise appropriate training seminars for the members. A well defined conservation education and public awareness programme should be drawn up for the coastal areas and appropriate supporting education materials should be produced and widely distributed.

The SSBP-G already runs a very well organised conservation education program in schools and communities along the coast. The Wildlife Clubs of Ghana (WCG), which was introduced by the SSBP-G in 1987 to promote conservation interest and knowledge among the Ghanaian youth, is now well established with 102 clubs as at now in first and second cycle schools. The WCG has a magazine (Nko, the parrots) which is produced mainly for their members, but circulated to all second cycle schools and libraries in the country. Funds should be made available under the project to the WCG to enable them expand their activities to other parts of the country, and increase circulation of the magazine.

### 1.2.3.3 Sanitation along the coast

A major problem associated with the entire Ghana coast is pollution from human and domestic waste. Most of the coastal communities use the shore as toilets, and heaps of rubbish are a common site everywhere. The situation poses really serious health hazard, and requires urgent attention. It is recommended that in addition to the specific actions advocated for individual sites, a major nation-wide campaign on keeping the Ghana coast clean should be mounted.

### 1.2.4. RESEARCH AND MONITORING

A strong scientific data base would be required for the effective management of the coastal wetlands. Details of research and monitoring needs are given for each site. Some basic studies are however relevant to all the selected sites and the entire coastal zone, and these are listed below.

(i) Hydrological and limnological data. There is an urgent need to institute appropriate mechanisms for the routine monitoring of water quality as well as coastal wetland characteristics and functions.

(ii) Detailed inventory of the flora and fauna of the coastal wetlands. The importance of these wetlands has, hitherto, been assessed on their ornithological values, simply because data are not available on other phyla. It may well be that these wetlands are even more important, in terms of biodiversity, for their plant and invertebrate communities.

(iii) Determination of the status and distribution of marine turtles on the Ghana coast. This should provide the requisite data for the formulation of a marine turtle conservation action plan.

(iv) Monitoring of the spatial, temporal distribution and abundance of key wetland indicator species (eg. waterfowl, fish, invertebrates).

(v) Assessment of the fisheries potential of the coastal lagoons with the aim of encouraging aquaculture development in the lagoons.

(vi) Evaluation of the contribution of coastal wetland resources in the socio-economic life of the coastal communities.

(vii) Evaluation of the effectiveness of existing traditional beliefs and taboos associated with coastal lagoons as conservation tools, with the aim of encouraging, promoting and enforcing those beliefs which are found to be effective.

A system should be evolved to ensure that data collected on key indicator species are readily available to the relevant agencies for the formulation and implementation of policies affecting the coastal wetlands. The establishment of a national data base (currently under discussion) should greatly facilitate data accessibly.

There will also be a need to develop a National Wetlands Conservation Strategy. The Strategy should review existing data on wetlands, identify gaps in knowledge, define priority actions required and ensure that activities within the wetlands are coordinated. The terms of reference for the preparation of the strategy will have to be clearly defined.

### 1.3. INSTITUTIONAL ARRANGEMENTS

#### 1.3.1. EXPERT TECHNICAL COMMITTEE

The activities and problems associated with the coastal wetlands ecosystem cuts across several agencies and institutions. Effective management of the wetlands would therefore require a multi-sectoral administrative mechanism. It is recommended that a National Coastal Wetlands Expert Committee be established to advise on policy matters and developments likely to affect the proposed Ramsar sites. The committee will comprise directors of all the institutions whose operations affect the coastal wetlands, relevant traditional heads and independent experts including experts from relevant NGOs.

The list below gives the proposed composition of the committee.

- (i). The PNDC Secretary (or his representative),  
Ministry of Lands and Natural Resources
- (ii). The PNDC Secretary (or his representative),  
Ministry of local government
- (iii). The Chief Game and Wildlife Officer
- (iv). The Chief Conservator of Forests
- (v). The Executive Director, EPC
- (vi). The Director, Town and Country Planning
- (vii). The Executive Director, Minerals Commission
- (viii). The Director, Fisheries Research Institute.
- (ix). The Director, Institute of Aquatic Biology
- (x). The Project Officer, Save the Seashore Birds  
Project.

- (xi). A representative of the National House of Chiefs (he should be a traditional head from a coastal district)
- (xii). The Senior Technical Advisor, Coastal wetlands Conservation programme.
- (xiii). Independent experts may be co-opted unto the committee as and when necessary.

The Committee should be chaired by the PNDC member responsible for environment and appropriate mechanisms should be established for the direct communication of deliberations of the committee to the government for policy decisions. Such decisions would then be transmitted through the secretariat (see 1.3.2 below) to the relevant agencies for implementation.

#### 1.3.2. SECRETARIAT

The EPC would establish a Secretariat to provide administrative support for the committee and co-ordinate the activities within the different Ramsar sites.

#### 1.3.3. LEAD AGENCY

The Department of Game and Wildlife (GW) should be the lead agency for the Coastal Wetlands Conservation Programme. The Department is the official Ghana government agency responsible for all wildlife conservation issues and for management of wildlife conservation areas. Moreover, the Department is the official implementing agency for the Ramsar convention, under which coastal protected areas are to be constituted.

#### 1.3.4. STAFF

The GW is currently very under-staffed, and would not be in a position to release staff for the project. The implementation of the project would therefore be greatly hampered if additional staff are not recruited. It is recommended that the government approves the requisite increases in staff establishment, and ensures the appointment, training and retention of such personnel. As possible, efforts should be made to employ local people to manage the sites in their own areas. The use of local groups to assist in the management of the sites should also be encouraged. For effective implementation of the programme, it is recommended that one Principal Game Warden is appointed as a Coastal Wetlands Conservation Programme Coordinator, who would be based at the head office and would coordinate the coastal wetland management projects. He/she would be supported by a conservation education officer and site management staff, comprising, a game warden, appropriate technical officers and community wildlife officers; and would work under the supervision of a Senior Technical Advisor.

The Senior Technical Advisor should have proven knowledge of Ghana's coastal wetland ecosystems and the conservation needs of these areas. He/she would be contracted to provide technical advice and supervise the administration of the project to ensure that resources provided are efficiently used for the successful implementation of the programme.

#### 1.3.5. ASSOCIATED AGENCIES

It should be emphasised that the successful management of the coastal wetlands would require a multi-disciplinary approach. The Department of Game and Wildlife should therefore seek the expertise and involvement of relevant organisations for the execution of programmes. The departments/institutions whose activities and policies affect the sites, and whose involvement should be sought are listed under the mechanism for implementation for each site.

#### 1.3.6. LOCAL PARTICIPATION

Another crucial factor for the success of the coastal wetland conservation programme is the support and involvement of the communities who live in the coastal zone. These are the people whose life styles are interlinked with the coastal wetlands and whose activities directly affect the wetland ecosystem. Protection of the wetlands should therefore be "for" the people and not "against" them. Every effort should be made to secure the people's participation and involvement; and to integrate their needs with the management processes. Apart from the general community, groups whose involvement should be specifically sought include the traditional administrators (Chiefs, elders etc.), the town development committees and local political groups such as the District Assemblies, the Committees for the Defence of the Revolution (CDRs) and the 31st December Women's Movement.

#### 1.3.7. MANAGEMENT COMMITTEE

A site management committee is proposed for each site. The committee will comprise the Senior Technical Advisor (as Chairman), a Representative of the EPC (as Secretary), the Coastal Wetlands Conservation Programme Coordinator, the Game Warden in charge of the site and Representatives of the appropriate institutions. Details of the composition of the management committee are provided for each site.

#### 1.3.8. ORGANISATIONAL STRUCTURE

The diagram below shows the proposed organisational structure for the implementation of the coastal wetlands conservation programme.

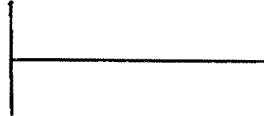
PROPOSED ORGANISATIONAL STRUCTURE

NATIONAL COASTAL WETLANDS EXPERT COMMITTEE



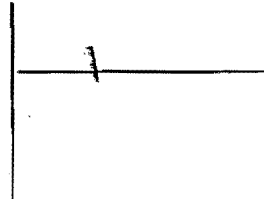
WETLANDS SECRETARIAT (EPC)

Chief Game and Wildlife Officer

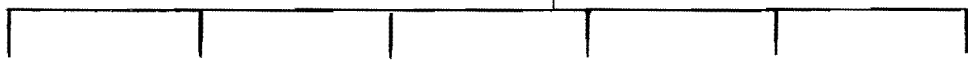


Senior Technical Advisor

Principal Game Warden  
(CWCP Coordinator)



Site Management  
Committees  
(Representatives of  
relevant institutions  
and local organs)



Game Warden  
Keta

Game Warden  
Songor

Game Warden  
Sakumo

Game Warden  
Densu delta

Game Warden  
Muni

Cons.Ed.  
Officer

Technical  
assistants/  
Community  
wildlife  
assistants

Technical  
assistants/  
Community  
wildlife  
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Technical  
assistants/  
Community  
wildlife  
assistants

Cons. Ed.  
assistants



**SECTION 2**

**SONGOR RAMSAR SITE**



## 2. SONGOR RAMSAR SITE

### 2.1. INTRODUCTION

#### 2.1.1. SITUATION

Songor is a brackish water lagoon situated to the west of the Volta estuary, Lat. 5° 49'N; Long 0° 28'E (Fig.1). The water body covers an area of c.115 km<sup>2</sup>. It extends c. 20 km along the coast and c.8 km inland behind a narrow sand dune. The lagoon can be approached from the east through Ada Foah, Pute and Potokpe, or from the north through Koluedor and Bonikope, or from the west through Sege, Anyaman and Lolonya. The Songor lagoon and surrounding floodplain provide extensive shallow water, mud-flats and islands suitable for feeding and roosting wading and shore birds. This site, together with Keta rank as the most important area for shorebirds in coastal Ghana.

#### 2.1.2. GEOMORPHOLOGY

Songor lies in a lagoonal depression comprising geologically recent materials of unconsolidated sands, clays and gravels. Typical of the closed lagoon systems of the West African coastline, the depression has been formed by a beach bar built by the longshore drifting processes. Current geomorphological processes include cut-and-fill erosion in the beach material. Erosion rates of up to 1.5 metres per annum have been suggested as occurring in the west and east of the lagoon along the coast at Prampram and Ada respectively (Agyepong, 1976).

#### 2.1.3. CLIMATE

The Songor lagoon lies in the eastern section of the Accra plains. The distinguishing characteristic of the plains is the dryness of the climate. The data in appendix 3 shows the climatic characteristics for Ada which is c.13 km east of the lagoon complex. The average mean daily minimum temperatures range between 23 °C and 26 °C. while the maximum ranges between 29 °C and 32 °C. The coldest months are July, August and September. Relative humidity is highest in the mornings (87-90%) and decreases in the afternoon (65-78%). The annual rainfall is less than 850 mm., occurring in two peaks, March to June, and September to October. December and January are the driest months, the prevailing winds during this period are the dust-laden northeasterlies.

#### 2.1.4. HYDROLOGY

The main streams drain directly into the Songor in the north. Of these, the Sege and the Zano are small streams that take their sources from a few kilometres across the Sege-Kase road. They have unrestricted flow into the lagoon even though small

dams have been constructed for water supply eg. on the Zano at Kpotweme village. The lagoon itself has no direct access to the sea. The Totokpe and Pute section of the lagoon is tidal with exchange of water between the lagoon and the sea occuuring through seepage through the sand dunes.

#### 2.1.5. HUMAN SETTLEMENTS AND LAND TENURE

Settlements are concentrated along the coast, particularly in the west and east; and around the landward outer margins of the lagoon. The principal villages are indicated in figure 7. Population data for the settlements within the proposed Ramsar site are given in appendix 4. The villages are connected by paths, tracks and roads. Access from the east, is through Ada. Communication and commercial orientation are towards Ada in the east and Ningo and Prampram in the west. The northern villages are oriented towards Kase and Sege.

The Songor lagoon area is traditionally the home of the Ningo people in the west and the Ada people in the east. These groups belong to the larger group of the Dangbes who migrated from the east in the past. Land is owned by kinship groups or families and is administered by the elders of the group. Traditionally, use rights of members of the group are permanent, where, for example, land once farmed by a member of the family cannot be taken away from him without his permission. As in other parts of the country however, strangers may be given land for renting or for purchase. Rights of way, fishing, hunting, grazing, water collection, fuelwood collection, sand and gravel collection are generally unqualified, ie., require no permission for stranger or indigene except in a few cases or in cases of commercial collection. Rights of salt collection are qualified.

#### 2.1.6. LAND USE

Land use in the Songor area includes farming, animal rearing, fishing, salt collection, recreation, settlement and associated constructions such as roads. Farming is widespread but varies in intensity. In some areas cropping of cassava, maize and vegetables (particularly okro, pepper and tomatoes) are possible on elevated land where the rooting zone is above the saline water table. Cultivation is particularly intense west of Ada and between Goi and Anyaman. The mud-flats and the saline marshes in the east are not extensively cultivated. Because of the scarcity of arable land the same plots are cultivated continuously with heavy use of fertilizer.

Small scale free range livestock production is widespread in all the villages. The common animals are chicken, goats, pigs, ducks and sheep. Cattle are grazed extensively on the grasslands particularly in the north.

Fishing is undertaken in both the lagoon and the sea, the latter being a major commercial activity. Marine fishermen interviewed

claimed they made a net profit of C 600 - C 1000 man<sup>-1</sup> day<sup>-1</sup>. Lagoon fishing is particularly important to older people who cannot go out to sea. Fishing in the lagoon is also resorted to when the sea is too rough for the canoes to go out to sea. The main species caught were tilapia and lagoon crabs. The local fishermen expressed concern over the drastic decline in lagoon fish stocks. Fish is available in the lagoon only during the wet season; in the dry season the lagoon becomes hyper-saline, causing the death of many fish.

Fuelwood for smoking fish in the coastal villages is obtained from the mangroves and also the scrubland in the north-west, particularly around Anyaman.

Salt winning is a major commercial activity in villages around the lagoon and majority of the people derive their livelihood from salt collection. Ownership of the lagoon and salt winning rights have in the past, been a source of serious conflict between the local people and external private salt mining companies. Currently there are seven salt mining cooperatives operating in the area. The biggest of these, the Ada-Songor Cooperative has 1000 registered members. Four private companies own concessions in the area, but only one, Vacuum Salt Industries was operational.

Traditional methods are used for the salt production. In the dry season, most parts of the lagoon dry up, depositing large quantities of salt, which is then scraped up by the people. The executive members of the Ada-Songor Cooperative interviewed claimed that each person could collect 10 bags (75 kg bag) per day, on average. These were sold for Cedis 2,400 per bag in the wet season and C 800 - C 1500 in the dry season. The buyers were taxed C 100 on each bag which was shared between the central government and the district council. Based on a 90 day season of peak salt production (ie. assuming the salt is collected only during the dry season) even the minimum price of C 800 per bag provides an income of C 720,000 per annum for each salt collector. This is equivalent to salaries within the "high income bracket" in government employment.

The town of Ada attracts moderate numbers of tourists and has a number of chalets and guest houses to cater for visitors. Beach recreation is, perhaps, the main tourist attraction.

#### 2.1.7. CULTURAL ASPECTS

Part of the lagoon (reported to be around the Lufenya section of the lagoon) is believed to be the abode of the lagoon god, Yomo. This area (c. 400 m<sup>2</sup>) is considered sacred, and no activity including fishing and salt collection is permitted in the area. The older generation believe that the salt in the lagoon is provided by the lagoon god. The fetish priest performs certain rites and offers sacrifices every year at the beginning of the dry season before the people are allowed to start salt collection.

### 2.1.8. THREATS AND CONFLICTS

The present traditional methods of salt production appears to be compatible with the conservation of the wetland ecosystem, although the level of productivity is low. Some improvement in technology could increase productivity and improve the quality of life for the local communities without necessarily destroying the ecological integrity of the wetland.

A feasibility study undertaken for the Minerals Commission advocates the development of a large scale industrial salt complex, with estimated production level of 1.2 million tons yr<sup>-1</sup>. The project proposes construction of pans at the west, east and northern edges of the lagoon and sea water inlets at Lolonya and Totokpe. Sea water would then be pumped into the lagoon and the entire lagoon would be used as concentration ponds.

Such scale of operations would certainly bring considerable income to the local communities and the country as a whole, but would also undoubtedly, cause major changes in the ecological integrity of the lagoon and the social/traditional structure of the area. In view of the international ecological importance of Songor, it is imperative this activity and any other development activities in the area must be preceded by detailed environmental impact assessment.

## 2.2. FLORA AND FAUNA

### 2.2.1. VEGETATION

The vegetation of the Songor wetland may be classified into five main types:

(i) saline marshes in the mud and salt flats, depicted by Sesuvium portulacastrum, Sporobolus virginicus, Paspalum vaginatum, Ipomoea pescaprae; Sesbania sesban and Opuntia species. Many Hyphaene thebaica (Dum Palm, a branching palm) occur along the shore, but probably due to salt spray or other disturbance the palms never developed into big trees.

(ii) waterlogged grassland dominated by Vetiveria fulvibarbis, Andropogon gayanus, Brachiaria yalcifera, Imperata cylindrica (Lalang grass), Sporobolus pyramidalis, Fimbristylis pilosa, with a few dicots like Cassia mimosoides and Polygala arenaria.

(iii) scattered thickets of shrubs, climbers and small trees on higher ground. The thicket population being composed principally of Allophylus africanus, Flacourtia indica, Griffonia simplicifolia, Grewia carpinifolia, G. mollis, Capparis erythrocarpos, Securinega virosa, Uvaria globosa, U. chamae, Waltheria indica and Zanthoxylum xanthoxyloides with emergent trees of Elaeophorbium drupifera and Diospyros mespiliformis and succulent-leaved herbs Sansevieria liberica (African Bowstring Hemp) and Aloe buettneri.

(iv) riverain woodland along the streams where Baphia nitida Camwood, Lonchocarpus cyanescens (West African or Yoruba Indigo), Dialium guineense (Velvet Tamarind) and Millettia thonningii are found; and

(v) low mangroves along the margins of the lagoon characterised by Avicinnia africana. The plants growing in or around the water are Cyperus articulatus (sometimes cultivated for matting and for the aromatic rhizomes), Borreria species, Lemna purpusilla, Nymphaea lotus, N. micrantha (both called Water Lily), Ludwigia species, Ipomoea aquatica and Abutilon mauritianum.

The common species recorded in a transect survey are given in Appendix 5). On the whole, there has been considerable damage to the vegetation, resulting in vast areas of depleted farmlands, abandoned farms, wastelands and eroded terrain. Generally one can see as far as the horizon in all directions. Only isolated trees like Borassus aethiopum (Fan Palm), Mangifera indica (Mango), Ceiba pentandra (Silk Cotton Tree) and Adansonia digitata (Baobab) were seen. The causes of this degradation may be attributed to the traditional slash and burn farming method, shifting cultivation and cutting for fuelwood and charcoal production. Any attempt to save the vegetation from further degradation has to be found in improved systems and methods of landuse.

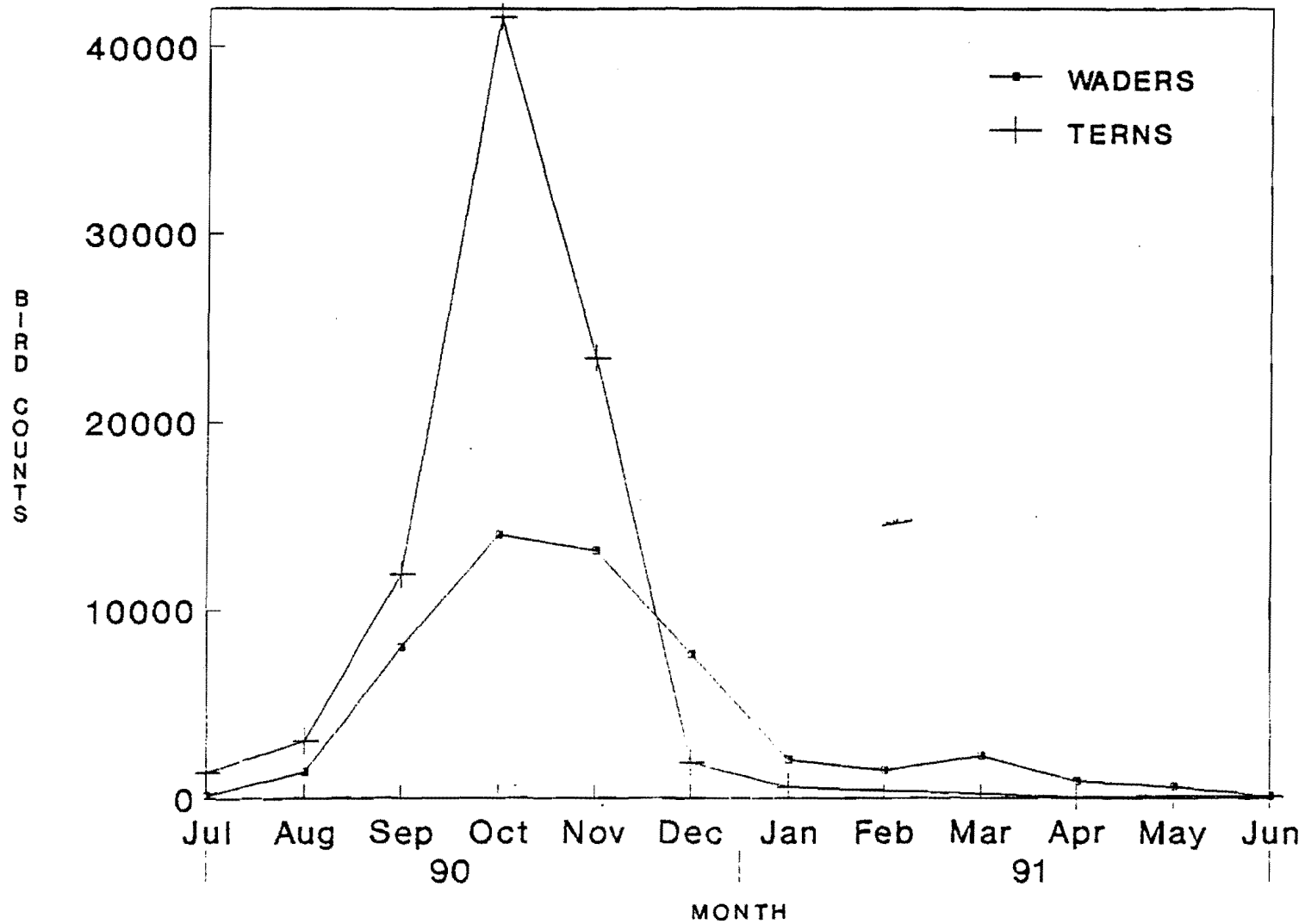
#### 2.2.2 FAUNA

Data on animal life in Songor is available only for birds. The Songor wetland supports spectacular concentrations of seashore birds, comprising terns, waders, herons and ducks. There is evidence that the area serves as a stop-over point and has a high rate of shorebird population turn over. Thus the estimated bird population of 110,000 (Table 1) is undoubtedly an underestimate of the importance of the site.

The wetland supports internationally important populations of seven species of waders: spotted redshank, greenshank, ringed plover, curlew sandpiper, little stint, avocet and black-tailed godwit (Table 2). The site has the highest total tern count on the Ghana coast and supports nationally important populations (over 10% of the total coastal count) of at least 32 species of water birds. Table 3 presents the peak counts and national importance of the most abundant seashore bird species recorded at Songor. A complete list of the species recorded on the site is provided in appendix 1.

Over 80% of the total number of species recorded in Songor are Palaearctic migrants. Migrant birds begin to arrive on the site in late August, and their numbers peak in September-November (Fig. 2). The birds start to leave the area at the onset of the dry season, when large sections of the lagoon dry up and by January, the bird population is less than 5% of the autumn peak.

FIG. 2. SEASONAL CHANGES IN NUMBERS OF SEASHORE BIRDS AT SONGOR LAGOON



### 2.3 PUBLIC CONSULTATION

The following people were consulted:

- (i). The District Secretary and CDR Organizer, Ada
- (ii). Executives of the Ada-Songor Co-operative Society, Bonikope and Head-teacher, Agbedrafor JSS.
- (iii). Chief Fisherman, CDR Chairman and people at Totokpoe village

#### 2.3.1 DISTRICT SECRETARY AND CDR ORGANIZER, ADA.

According to them since birds have little value for the people, their protection would not affect local commercial activities. They expressed the desire for the people to become part of the the wetland protection programme. Their involvement, however, must be compensated for by some form of development of the area, especially the fishing and farming industries. They suggested making available to the people; fishing nets, outboard motors, outboard motor repair shop, irrigation facilities etc.

The District Secretary suggested that one way of ensuring the protection of the lagoon and the coastal ecosystem was to transform the place into tourist centre. He confirmed that the traditional rulers, the various administrative units and Town Development Committee would be willing to organise the people to provide labour and assist in any conservation projects initiated in the area.

The CDR organizer pointed out that crabs were becoming scarce in the area and there was the need to protect them. He suggested that the mangrove vegetation which served as habitat for the crabs and other animals should be protected. The District Secretary expressed the willingness of the District Administration to help in protecting the mangrove vegetation. The District Secretary also suggested the need for preserving the lagoon area where the Ada people first settled, because of its historical significance. He suggested that the traditional Council could come out with by-laws to ensure the preservation of the area.

#### 2.3.2 ADA-SONGOR CO-OPERATIVE SALT MINERS SOCIETY EXECUTIVES AND HEADTEACHER FOR AGBEDRAFOR JSS

They felt strongly that seashore birds should be protected. They assigned the following reasons:

- (a) They serve as indicator for fishermen to locate fish in the lagoon/sea.
- (b) If such birds are disturbed there is the likelihood that they would move to another area and the people would lose

the benefit derived from them. Also, the birds make the area interesting.

(c) They stated that they could contribute their quota for the protection of the birds by educating the people.

They expressed the need for the protection of the lagoon, they advocated for the transformation of part of the lagoon into modern fish ponds so that during the rainy season when it is not possible to win salt, fishing can be done profitably. Fish ponds can be controlled and any fishing in them can also be regulated.

The main needs expressed by the local people were as follows:

1. **Water:** Potable water is a scarce resource in the area. In view of this the use of water for washing, drinking and cooking is very restricted. A bucket of potable water costs sixty cedis (C 60.00). Sinking of wells/boreholes would not work because of high concentration of salt in the soil.
2. **Schools:** Bonikope village where the Salt Cooperative was based has no school. Their children walk to Agbedrafor village 1.4 kilometres away to attend school.
3. **Sanitation:** The village had no public place of convenience. There is an urgent need for KVIP toilets to improve environmental health in the area.
4. **Communication:** Roads in the area are not all-weather motorable. This affects the easy movement of people, salt, foodstuff etc. in the area.
5. **Farming inputs:** Farming, which is next to salt-mining in commercial importance, is on the decline. The soil has lost its fertility, and there is the need to apply fertilizer extensively. They advocated for the provision of tractors in the area to aid farming. They also suggested the formation of a Farmers Cooperative Society, independent of the Ada Songor Cooperative Salt Miners Society, to help address farming issues.

#### 2.3.3. THE CHIEF FISHERMAN, CDR CHAIRMAN AND FISHING COMMUNITY, TOTOKPOE

The people used to trap and kill birds for food until their attention was drawn to the value of seashore birds by the Save the Seashore Birds Project's education team. Through a town crier, the inhabitants of the village had been informed to refrain from any act which would disturb the birds. They claimed they had benefited from film shows which educated them on the need for bird protection. They have instituted local sanctions against people who would contravene the orders to keep off the birds.



According to them they would welcome any by-laws which would restrict human activities in the lagoon to ensure its protection. They also suggested the need to regulate the use of fishing nets in the lagoon and in the sea. They expressed concern about the small mesh sizes of nets currently used. The people complained about persistent sea erosion which threatens their settlement. They also complained of difficulties in obtaining the necessary inputs for fishing and lack of fish storage facilities. They made a request for training in fishing methodology so as to increase their catch.

## 2.4 MANAGEMENT STRATEGY

### 2.4.1 OBJECTIVES

The primary aim for the establishment of the Songor Ramsar site is bird protection. It should, however, be emphasised that in the Songor situation where the density of human settlements is so high, any conservation programme advocated will not receive the support of the people and will not succeed unless it addresses the needs of the local communities. The management strategy for Songor will therefore aim at promoting sustainable development in the area and optimising exploitation of wetland resources, while maintaining the ecological value of the wetland. Specific objectives for management of the site are as follows:

(i) To maintain and enhance the value of the Songor lagoon and its environs as bird habitat.

(ii) To integrate the needs of local communities with wildlife management and ensure satisfactory coexistence. To this end, efforts will be concentrated on exploring and developing viable options for the maximization of salt production from the lagoon while at the same time maintaining the ecological integrity of the wetland.

(iii) To maintain and promote local traditions and cultures associated with the lagoon.

(iv) To develop and increase the fisheries potential of the lagoon.

(v) To promote general conservation awareness and encourage local participation in the conservation of natural resources in the Ada district.

(vi) To provide appropriate facilities for the development of a wetland research programme in Ghana and encourage participation of scientists and students in Ghanaian research institutions and universities.

### 2.4.2 MANAGEMENT ACTIONS

In order to achieve the above objectives, the following specific actions should be undertaken:

(i). Establishment and protection of the Songor wetland as a Ramsar site and provision of appropriate infrastructure and resources for the management of the site.

(ii). Establishment of a zonation scheme which will ensure adequate protection for the wildlife and also cater for the needs of the local people.

(iii). Institution of appropriate habitat enhancement and faunal management programmes.

(iv). Assessment of the salt production capability of the lagoon and the role of salt mining in the socio-economic life of the local people, with the aim of improving productivity without destroying the ecological value of the Songor wetland.

(v). Assessment of the fishery potential of the Songor lagoon and provision of requisite inputs to improve the lagoon fisheries.

(vi). Development of appropriate conservation education programme for the Ada district.

(vii). Development of facilities and promotion of controlled wildlife based tourism.

(viii). Establishment of a field research station and development of a coordinated wetland research programme.

#### 2.4.2.1 Site designation

The legal designation of the Songor Ramsar site should be pre-requisite to any further development of the site. The proposed site is, fortunately, clearly delineated by the existing road network (Fig.7). The western boundary is formed by the road from Sege to Anyaman. The eastern boundary is delineated by the Kase to Big Ada road, then along the edge of the river Volta to its mouth. The Sege to Kase road forms the northern boundary; while the southern boundary is the shoreline from the village of Akplabanya to the Volta mouth. The proposed site covers c.310 km<sup>2</sup>, all of which falls within the jurisdiction of the Dangme East (Ada) District.

Boundary descriptions should be prepared for the legal establishment of the site as a Ramsar site. The site should be clearly sign posted all along the roads forming the boundaries.

#### 2.4.2.2 Zonation

Considering the high human interest in the Songor wetland, effective management of the area would require the adoption of a zonation scheme which allows human usage and sustainable development of parts of the wetland, while providing protection to the sections which are important for wildlife. Four zones are envisaged (Fig.8):

##### (i) Core area (Zone A)

This comprises the southern sections of the open lagoon and islands between the villages of Lolonya, Kpotisekope, Anyonukope and Pute, covering c.37 km<sup>2</sup>. This area is currently the most important feeding and roosting sites for sea - and shorebirds. Settlements within this area are few and human disturbance, mainly fishing and use of the sand flats for drying fish, is currently minimal and restricted

to only a small proportion of the area. There is therefore no real need to restrict access during the peak season for migrant birds (August to December). There would however, be a need for restrictions on access during the breeding season of resident species, May to mid July. Species like little terns, pratincoles and black-winged stilts nest among the Sesuvium beds: and their nests and eggs could easily be destroyed by people walking around. Future developments including new settlements should be prohibited in the core area. Development of housing in the area should be restricted to the immediate vicinity of existing villages. The area should be demarcated by wooden posts and "keep-off" notices should be put up during the breeding season.

**(ii) Traditional Management area (ref. Fig. 8)**

This comprises the section of the lagoon near Lufenya believed to be the abode of the local god. The area is reported to be completely protected. Entry into the area is permitted to only the fetish priest and people associated with the lagoon fetish; and all activities including fishing and salt collection are prohibited. This area should be maintained as a traditionally protected area. The younger generation, particularly the educated ones, however, had neither the confidence nor the respect for the basic belief underlying the protection of the area, ie the belief that it is the lagoon god who provides the salt in the area. There would therefore be a need for a sociological study of the beliefs and taboos associated with the area and an assessment of the effectiveness of these traditions. If necessary, such taboos should be promoted by the provision of modern legal backing. This should be done through the enactment of local by-laws.

**(iii) Controlled area (Zone B)**

The controlled area includes the northern and north eastern sections of the open water and the immediate surrounding floodplain. The marshlands in this area are particularly important for herons and gallinules. The area is also considered to be more sensitive than the outer catchment in terms of possible adverse effects of industrial developments on the wetland ecosystem. The immediate surroundings constitute the areas earmarked for salt pans construction under the Minerals Commission Salt Industry proposal. Obviously such industrial developments are bound to affect the ecological integrity of the Songor wetland and detailed environmental impact assessment should be demanded before any developments takes place.

The development of aquaculture and/or culture based fisheries in this part of the lagoon should be explored and promoted if found feasible.

The traditional use of the area, including fishing and farming should be allowed to continue. Use of agrochemicals should however be monitored.

**(iv) Land use management area (Zone C)**

This comprises the outer catchment and includes numerous settlements. It would be impossible to control growth in the size and numbers of settlements in the area, and management efforts should concentrate on advocating wise-use of resources. The land use patterns in the area should be mapped out and efforts should be made to encourage proper land use practices to minimize possible adverse effects of such practices on the wetland ecosystem. Farmers in this area rely heavily on chemical fertilizers, but the level of usage and impacts are not known. There would be a need to monitor agro-chemical use in the area and institute appropriate controls if necessary. Environmental impact assessment should be demanded for industrial developments in the area.

Every effort should be made to improve sanitation in the villages within the whole area.

**2.4.2.3 Habitat management**

**Core area:**

A detailed hydrological study of the Songor wetland would be required to assess the possibility of manipulating the water levels in the lagoon. This is particularly critical during the dry season when most of the lagoon dries up leaving small pools of hyper-saline water. An increase in the fresh water inflow into the southern sections of the lagoon will greatly benefit animal life. It is reported that Songor was an open lagoon in the past and that the lagoon has been cut off as a result of sand accretion. This requires to be investigated since it might provide some clues for the hydrological manipulations being advocated. The services of an expert hydrologist should be sought.

Additional roosting sites should be provided through the creation of islands within the open lagoon, or provision of floating wooden platforms.

The few coconut trees along the sand ridge which separates the lagoon from the sea and also around the villages are all old trees. Provisions should be made for the planting of more coconut trees. Mangroves should also be planted to improve the mangrove vegetation.

**Controlled and land use management area:**

Habitat manipulation in the rest of the open lagoon will be related to the aquaculture and salt industry requirements. Advice should be sought from an aquaculture specialist with respect to requirements for developing the fisheries potential of the lagoon.

The immense salt production potential of the Songor lagoon makes the proposals for development of a large scale salt industry in the area very attractive. There is no doubt at all that this will provide substantial revenue to the local people and the central government, but it is also very obvious that the operation could cause drastic changes in the ecological integrity of the area. There is therefore an urgent need to commission an expert study to find ways of increasing salt production in the area without destroying the ecological value of the wetland.

Exploitation of the mangroves and other trees in the wetland for fuelwood is a major contributory factor to the degradation of the wetland habitat. Farmers in the area should be encouraged to take up agro-forestry to provide for their fuelwood needs and reduce pressure on the mangroves. Management of the Songor Ramsar site should also actively encourage tree planting to enhance the wetland habitat. Tree seedlings should be provided and the communities should be encouraged to participate in the tree planting exercise. Schools in the area could be effectively used for this exercise particularly if competitive basis, with prizes and commendations for the winners. The advice of the Forestry Department and an agroforestry specialist should be sought on this.

Farming practices in the area currently rely on heavy use of chemical fertilizers. In addition to monitoring and regulating chemical fertilizer usage, farmers should be encouraged to adopt crop rotation; planting of nitrogen fixing plants like leucaena Leucaena leucocephala and Pigeon pea, Cajanus cajan and the use of plant waste and animal manure to reduce reliance on chemical fertilizers.

#### **Settlements:**

Two major problems are apparent in all the communities within the Songor Ramsar site: lack of fresh water and poor sanitation. People interviewed from villages in the northern parts of the site reported severe scarcity of fresh water: a bucket of water cost C 60.00. The possibility of increasing fresh water availability in the area should be examined. It should be possible to provide structures for collection and storage of rain water, but the advice of a water resources specialist should be sought.

There are no decent facilities for domestic waste disposal in most of the villages within the project area. The shore line and lagoon banks are used as toilets and faecal material are deposited everywhere. The situation in Pute and Totokpoe requires urgent attention. The rich bird life of Songor can never be proudly exposed to visitors until the mess in these two villages which are adjacent to the most important bird sites is cleared up. Waste disposal facilities must be provided. Provision should be made in the project budget for a garbage truck and for the construction of KVIP toilets.

Provision of such facilities (water and sanitation) will improve the quality of life for the local people and greatly enhance the

image of the project and elicit local support for the project. The people will thus see concrete benefits from the establishment of the conservation project.

#### 2.4.2.4 Faunal management

No special faunal management is envisaged presently. Further studies on the use of the wetland by breeding birds will determine whether or not there is a need for provision of additional nesting sites.

Some tern trapping is undertaken by children in the coastal villages. The SSBP-G education team has already undertaken some public education campaigns in the area. This should be continued to ensure that trapping is stopped completely.

#### 2.4.2.5. Visitor/education and field research centre

Ada already attracts some tourists and holiday makers and has some facilities for tourism. The rich bird life of Songor should be publicised and bird watching should be promoted as part of the tourist package for the district. It is recommended that a visitor centre should be established on the site. The centre should be provided with basic equipment (audio-visual facilities, binoculars, telescopes, nature books and field guides) to facilitate bird watching. Publicity materials should be produced and distributed widely. Overnight camping facilities should be provided.

It is recommended that a field research station should be developed at Songor to promote wetland research in Ghana. The centre should have a fully equipped field laboratory, office space and accommodation (with toilet and kitchen facilities) for 10-12 people. Researchers and students from Ghanaian universities/research institutions should be encouraged to take advantage of the facilities provided.

## 2.5 RESEARCH AND MONITORING

Songor is a complex site and detailed research would be required for a much fuller understanding of the wetland ecosystem, and also to provide a data base for the formulation of management policies and actions. It is recommended that the under-listed baseline studies should be undertaken. The results of these studies should enable the definition of those aspects which require to be monitored on routine basis; and those which could be undertaken as long term study projects by researchers and students in the country's research institutions, using the field research facilities to be provided on the site.

**Baseline studies:** to be undertaken by local consultants during the early stages of project implementation.

(i) Hydrological studies - water level measurements; sediment flows; drainage characteristics of the basin; investigation into possibilities of manipulating inflows and lagoon water levels.

(ii) Limnological studies - basic measurements of water characteristics; aquatic productivity; invertebrate abundance and distribution; salt tolerance and effects of salinity changes on species which are important prey items for shorebirds.

(iii) Fish stocks and fish production potential of the lagoon; evaluation of potential for aquaculture development.

(iv) Evaluation of salt production in the Songor Lagoon and associated socio-economic problems, with the aim of improving technology to increase production while maintaining the ecological integrity of the wetland.

(v) Evaluation of traditional beliefs and conservation strategies associated with the Songor lagoon.

(vi) Ornithological studies:

- complete survey (possibly an aerial survey) of the Songor wetland to provide a more complete picture of the ornithological importance of the site.

- Detailed mapping of the use of the wetland by the different bird species for roosting, feeding and nesting.

(vii) Detailed mapping of the vegetation in the wetland to provide information on the plant species which could be used in the habitat enhancement programme.

**Routine monitoring** (to be undertaken by staff on the ground):

(i). Water levels and water quality (water level and salinity measurements should be undertaken by staff on site, water samples can be collected for analysis by the Institute of Aquatic Biology.

(ii) Basic meteorological data.

(iii) Human usage of the wetland with particular reference to lagoon fisheries (including mollusc collection); salt winning and fuelwood exploitation.

(iv) Regular census of wetland birds and census of breeding birds populations during the breeding season.



### Topics for long term institutional and student research:

Mmultidisciplinary research on the Songor lagoon and Volta delta ecosystem, should be initiated, with the aim of identifying options for development and optimization of productivity of the wetland. This would include aspects such as wetland functions, coastal erosion problems, fisheries development (including potential for prawn and shrimp culture), aquatic productivity, socio-economic problems including public health. Some of these could be undertaken as graduate student projects if the requisite support is provided.

#### 2.6. MECHANISM FOR IMPLEMENTATION

2.6.1. LEAD AGENCY: Department of Game and Wildlife

2.6.2. ASSOCIATED AGENCIES:

The Minerals Commission  
 The Save the Seashore Birds Project  
 Forestry Department  
 Institute of Aquatic Biology  
 Fisheries Research Institute  
 Ghana Water and Sewerage Corporation  
 Ministry of Health

2.6.3. LOCAL PARTICIPATION:

It is obvious from the management actions being advocated that the success of the project will depend on the involvement of the local people. The involvement of the District Assembly, the Chiefs, the fishing communities, and the local political groups should be sought. Local people should be employed as wildlife assistants as far as possible. The involvement and cooperation of the salt mining cooperatives will also be essential.

2.6.4. STAFF

The following staff would be required for the effective management of the Songor Ramsar site:

<u>Position</u>	<u>Number</u>
Game Warden	1
Rangers	2
Conservation education assistant	1
Drivers	2
Labourers (Community wildlife assistants)	10

#### 2.6.5. SITE MANAGEMENT COMMITTEE

A management committee with the under-listed composition is recommended for the Songor Ramsar site. The committee will serve primarily as a forum for the various groups with interest in the wetland to come together to debate and advise on site management policies and actions.

Senior Technical Advisor  
 Coordinator, Coastal Wetlands Conservation Programme  
 Game Warden in charge of site  
 Representative, SSBP-G.  
 Ada District Forestry Officer  
 Ada District Fisheries Officer  
 Ada District Secretary  
 Presiding member, Ada District Assembly  
 Representative, Ministry of Health  
 Representative, Ghana Water and Sewerage Corporation  
 Representative, Minerals Commission  
 Representative salt mining cooperatives,  
 Representative Fishermen Cooperative.

#### 2.7. SITE MANAGEMENT REQUIREMENTS

**Roads and access:** Two roads need to be constructed/repared: the road from Ada to Totokpe, so as to improve access from the south, and the road from Sege to Lolonya. This road is currently motorable only during the dry season and the improvement will not only facilitate access from the west, but also improve communication between the villages along that road and the other parts of the country.

**Buildings:** The site will require the construction of an office block, a visitor centre, a field research centre and staff accommodation. Ideally all these should be in the same locality. A suitable site within the village Pute would be appropriate. Three observation posts will be built to facilitate bird watching and to act as outposts for field work. In an effort to improve sanitation and reduce nutrient loading of the wetland, thirty KVIP latrines will be constructed in the settlements within the drainage basin.

**Equipment:** Basic equipment and furnishing should be provided for the office, the visitor centre and the field research centre. The staff on site would require field gear and some simple items of monitoring equipment to properly carry out their duties.

**Transport:** A four wheel drive pick-up, two motorcycles and a boat with a trailer should be provided for use in the protection and management work. In addition there would be a need for a 3 tonne tipper truck to be used as a garbage truck and also to move materials in and around the project area.

**SECTION 3**

**MUNI RAMSAR SITE**

### 3. MUNI RAMSAR SITE

#### 3.1. INTRODUCTION

##### 3.1.1. SITUATION

Muni is a shallow saline coastal lagoon situated on the outskirts of Winneba township, c.67 km from Accra, Lat.5° 19'N, Long. 0° 40' W (Fig.1). It covers an area of c. 3 km<sup>2</sup> and is fed by the two rivers Muni and Pratu. The lagoon adjoins the Yenku Forest Reserve, which together with the adjacent degraded forest lands forms the traditional hunting grounds of the Efutu people. The site is mainly important for terns, but a number of waders and herons also occur in significant numbers.

##### 3.1.2. GEOMORPHOLOGY

The Muni area is generally a low lying undulating plain. Two isolated hills are prominent: the Osi Hills to the north east of the lagoon rising up to 53 m and the Ejisimanku Hills near Mankwadzi. The parent rock is composed mainly of greenstone containing feldspar, lead, magnetite and tin. The soils are mainly clays, which are impervious to water and liable to sheet erosion during periods of seasonal flooding.

##### 3.1.3. CLIMATE

Temperature, rainfall and relative humidity data were not available for Winneba. Data for the nearest station, Apam (c. 15 km west of Winneba) are given in appendix 3. Mean monthly temperatures range from minimum of 24 °C in July/August to maximum of 28.9 °C in March. Total annual rainfall over a 10 year (1981-1990) period averaged 858.1 mm.

##### 3.1.4. HYDROLOGY

The drainage basin of Muni is c. 96.5 km<sup>2</sup>. The two rivers which feed the lagoon, Muni and Pratu, are seasonal. Reports from the local fishermen indicated that the lagoon spills over and the surroundings get flooded about every 10 years, the period of flooding coinciding with periods of very heavy rainfall. At such times, the villagers dig a canal to release the excess water into the sea to prevent inundation of the houses. Salinity varied from 37 g l<sup>-1</sup> at the seaward sections of the lagoon to 64 g l<sup>-1</sup> in the northern sections where the lagoon acts as an evaporation pan during the dry season. Salinity of the inflows was 2.5 g l<sup>-1</sup> in July/August (SSBP-G 1987).

### 3.1.5. HISTORICAL/CULTURAL ASPECTS

According to the Paramount Chief of the Efutu traditional area, Nana Ayirebi Acquah (IV), the Efutu people originated from Techiman. As they journeyed in search of water and fertile lands, they arrived at the Muni lagoon. The name "Muni" was originally "Boni" meaning "it is hard", used to describe the nature of the lagoon water.

The Efutu people have an annual tradition, the Aboakyir Festival, celebrated in remembrance of their ancestors and the journey through the wilderness to settle in the present place; and in reverence for the ancestral god "Apasekum", who protected them in wars with other tribes during the journey. The ceremonies associated with the festival involves the live capture of a bushbuck Tragelaphus scriptus for sacrifice to the god. In the old days, a human being had to be sacrificed to the god before every war to ensure victory. This was later negotiated, and currently a bushbuck is sacrificed annually.

On the day of the Aboakyir Festival, the two Asafo companies (Twafo/Tuafo, No 1 and Dentsifo, No 2) go to the hunting grounds at dawn to hunt for a bushbuck, which must be captured with bare hands. The Paramount Chief and his people wait at the palace grounds. The first company to bring the bushbuck becomes the winner. The animal is sacrificed and the meat is used in preparing the ceremonial dishes. This is followed by celebrations which brings together all the people of the Efutu traditional area.

### 3.1.6. HUMAN SETTLEMENTS AND LAND OWNERSHIP

The proposed Muni Ramsar site falls within the administration of two District Councils: Efutu/Ewutu and Gomoa. The lagoon area belongs to the Efutu Traditional Council, headed by the Paramount Chief, Nana Ayirebi Acquah (IV) who is based in Winneba. Communities along the coastal sand ridge separating the lagoon from the sea are migrant fishermen from the Volta Region (mainly Keta, Woe, Anloga and Anyanui). There are three main fishing villages who owe allegiance to the Efutu stool.

The lands in the upper drainage basin belong to the Gomoa Traditional Council. There is currently some dispute between the Gomoa and the Efutu people over ownership of the land, and this is being handled by a government appointed committee.

Population census data for the villages within the the proposed Ramsar site are given in Appendix 4.

### 3.1.7. LAND USE

Intensive commercial fishing is undertaken mainly by the migrant fishermen along the shores from Winneba to Mankwadze. The fishermen operate in eight main groups of 30 - 60 men in a group.

Each group is headed by the net owner. According to the chief fisherman, a net owner could earn 100,000 - 150,000 Cedis per day during the peak fishing season, which is reduced to only 1,000 - 5,000 Cedis in the lean season. Subsistence fishing is carried out on the lagoon. Species caught include tilapia Sarotherodon melanotheron, crabs Callinectes latimanus and molluscs mainly Tympanotonus fasciatus.

Marine fishing is forbidden on Tuesdays in the Winneba area while Wednesday is prohibited for fishing in the lagoon. These taboos, based on the belief that the "water gods" fish on those days, are examples of the traditional conservation strategies which regulated fisheries exploitation in the past.

Some amount of tern trapping and wader catching still go on in the Muni villages. In August 1987, one fisherman who had been trapping terns for years had 33 metal rings and 9 colour rings, which he used as a bracelet and also for hair decoration. This person promised to stop tern trapping after the SSBP-G team talked to him about bird migration and the value of ringing.

According to the Paramount Chief, there were some proposals for salt mining in the south eastern section of the lagoon, but this had been abandoned.

Communities within settlements in the upper catchment area are mainly subsistence farmers. The major crops grown are cassava, maize and vegetables. Livestock in the area include chicken, pigs, sheep and goats, and some cattle grazing was observed on the hill slopes.

Trees in the catchment are exploited by the villagers for fuelwood, charcoal and building materials. According to the villagers, this was the main contributory factor to the degradation of the forests in the area.

The adjoining forest reserve is administered by the Forestry Department. Part of this has been replanted with exotic species including Eucalyptus sp. and Chromolaena odorata. The Efutu traditional council retains hunting rights in the reserve.

Hunting rights in the traditional hunting grounds is controlled by the Asafo companies. Although this area is protected under traditional laws, the Paramount Chief reported uncontrolled tree cutting (mainly for fuelwood and charcoal burning) which has resulted in habitat degradation. He expressed concern about the scarcity of bushbucks in the area and the threat this poses to their traditional festival. There had been some years when the Asafo groups failed to locate and catch a bushbuck and therefore they were unable to perform the necessary sacrifices and celebrations. He and his elders expressed their support for the establishment of the area as a protected area. They believed that this would ensure improvement in the forest habitat, with subsequent increases in wild animal populations, thereby ensuring the perpetuation of their Aboakyir festival.

### 3.2. FLORA AND FAUNA

#### 3.2.1. VEGETATION

The Muni area lies within the coastal savanna vegetation zone. Four main habitat types are recognizable: the open water, the floodplain grassland, the degraded forest and scrubland including the farmed areas, and the sand dune. The extent of the open water varies according to the season, from 100 ha. in the dry season to 1000 ha. in the wet season; with maximum depth of 1.5 m, grading out to shallow margins and mud banks. Plant communities in the open water remain to be studied.

The size of the floodplain grassland is also variable and depends on the season. The vegetation in the seasonally flooded areas consists mainly of Sesuvium sp. and Paspalum sp. The drier area is predominantly grassland, the main species being Imperata sp, Cyperus sp, Dactyloctenium sp and Panicum sp.

The degraded forests and semi-natural scrubland is dominated by a mixture of coarse grasses and sedges (typically Vetiveria sp, Fimbristylis sp, Brachiaria sp, Sporobolus pyramidalis and Setaria); herbs (Cassia and Crium) and shrubs (Borrelia, Abutilon and Gymnema).

The vegetation on the narrow strip of sand dune which separates the lagoon from the sea consists mainly of the grasses Sporobolus and Remirea , Euphorbia and is fringed by coconut palms.

A list of common plant species recorded at Muni is given in Appendix 6.

#### 3.2.2. FAUNA

The Muni lagoon supports an estimated population of 23,000 water birds, comprising: 27 species of waders, 8 terns and 7 herons/egrets. The site is particularly important for terns: supporting 17-65% of the total coastal count of five species of terns. It also supports internationally significant numbers of black-winged stilt (Table 4). A full list of seashore bird species recorded for Muni is given in Appendix 1.

Seashore bird populations are highest at Muni during August to April, when palaeartic migrants are present on the Ghana coast. (Fig. 3). Black-winged stilts nest on the site during May-July.

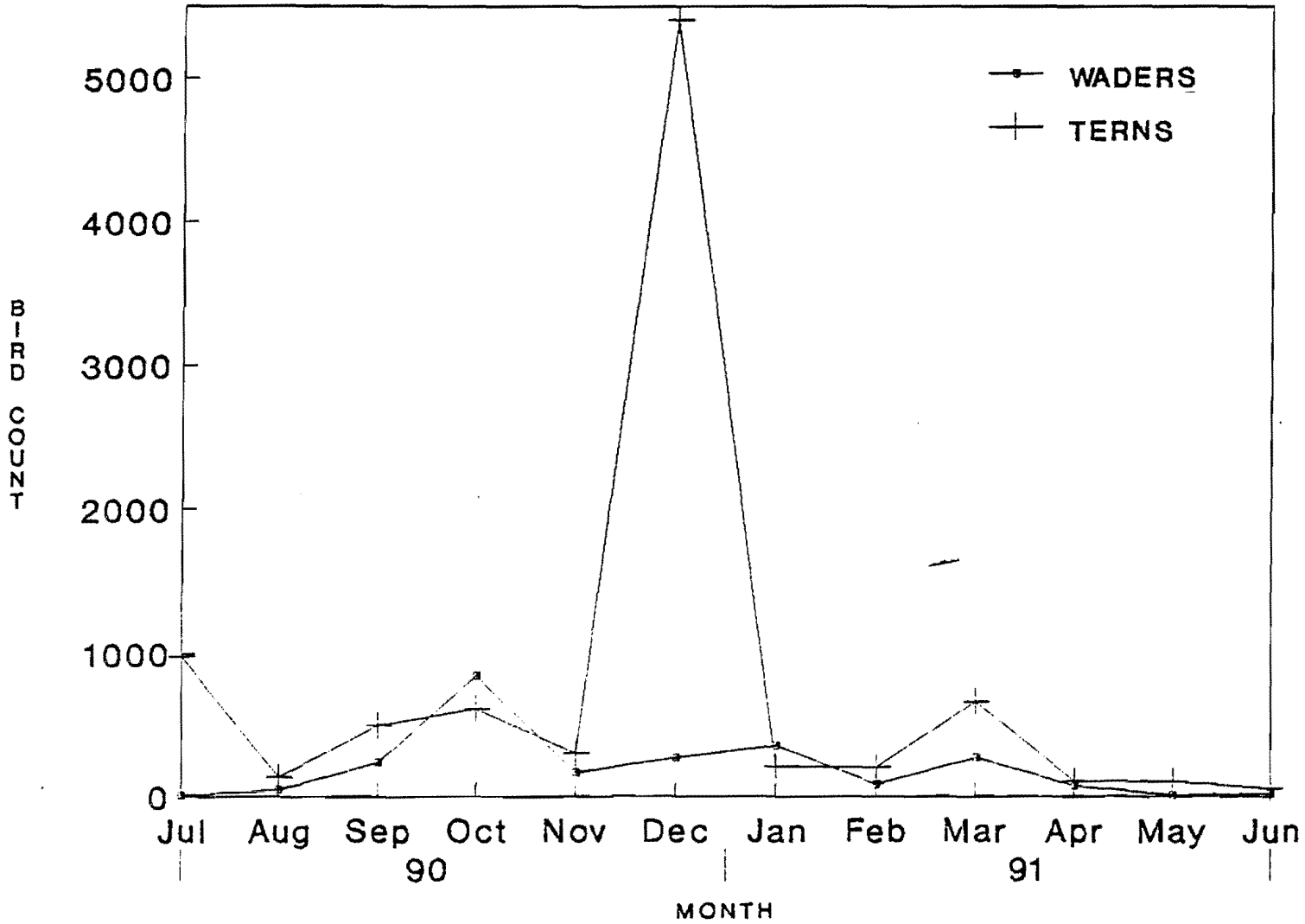
Land birds in the catchment as well as other forms of animal life are yet to be studied.

**Table 4. Peak counts and national importance of the most abundant bird species recorded at Muni (as at 30th June 1991).**

Species	Max. count entire coast*	Peak recorded at Muni	% entire coast
<b><u>SHOREBIRDS</u></b>			
Black-winged stilt	12,460	150	1.2
Avocet	3,750	50	1.3
Pratincole	1,700	40	2.4
Ringed plover	6,160	320	5.2
White fronted sand plover	110	25	22.7
Grey plover	2,780	130	4.7
Knot	2,360	30	1.3
Sanderling	6,480	150	2.3
Little stint	12,350	160	1.3
Curlew sandpiper	27,980	840	3.0
Black-tailed godwit	1,590	50	3.1
Bar-tailed godwit	500	30	6.0
Whimbrel	460	30	6.5
Marsh sandpiper	290	40	13.8
Greenshank	8,350	320	3.8
<b><u>TERNs</u></b>			
Royal tern	7,550	3,200	42.4
Sandwich tern	6,080	2,100	34.5
Roseate tern	400	80	20.0
Common tern	12,660	8,210	64.8
Little tern	3,240	210	6.5
Black tern	20,680	3,520	17.0
<b><u>HERONS &amp; OTHER WATER BIRDS</u></b>			
Western reef heron	1,520	80	5.3
Little egret	6,400	270	4.2
Great white egret	1,860	20	1.1



FIG. 3: SEASONAL CHANGES IN NUMBERS OF SEASHORE BIRDS AT MUNI



### 3.3. PUBLIC CONSULTATION

Two groups of people were consulted, namely: the representatives of the Winneba Traditional Council and the Chief Fisherman and his colleagues.

#### 3.3.1. REPRESENTATIVES OF THE WINNEBA TRADITIONAL COUNCIL

The elders representing the Traditional Council stressed the importance of the traditional hunting ground to the people and the need for protecting it to ensure continuous availability of the festival animal. They suggested the incorporation of the hunting ground into the nearby forest reserve as a way of protecting the fauna and the flora from wanton destruction.

They were convinced that preservation would ensure undisturbed atmosphere for the animals and their habitat to enable them to multiply. They believed that the 'Aboakyir' festival connected with the hunting ground ensures the survival of the people and their culture. According to them, the protection of the flora, would also enhance traditional medical practices which thrives on the availability of various medicinal plants.

The group was of the opinion that protection of the hunting ground and the lagoon would lead to increase in the number of birds in the area. The group pointed out that birds feed on harmful insects and their presence on the lagoon is an indication of the presence of fish.

The elders stated that the community would involve itself in the protection of the hunting grounds through their Asafo Companies. They talked about rules and regulations to govern the preservation and use of the site to be monitored by the Asafo Companies who would require a little incentive to boost their morale. Whilst the elders expected the community to provide the needed incentives, they requested some benevolent associations or the Government to provide the initial support until they could raise the necessary capital. They appealed to the Government to raise the grant allocated to the traditional Council so that part of it could be channelled into the project.

With regard to the protection of the lagoon and the fish life in it, the elders advocated for a ban on fishing activities in the lagoon during the period August to January. To them, this would allow increase in the lagoon fish stocks. They suggested that the Government should enforce the rules and regulations governing mesh sizes of nets used in both lagoon and marine fisheries. They suggested that the people should be involved in the enforcement of the rules and regulations.

### 3.3.2 MUNI LAGOON SITE

At the Lagoon site the chief fisherman and his colleagues were consulted. The fishermen pointed out that fishing in the Lagoon is largely undertaken by the Efutu people for the purpose of subsistence. The settler fishermen are commercial fishermen, who depend mainly on marine fisheries and they only fish in the lagoon occasionally. It could be inferred that the lagoon fisheries had little commercial value to the fishing community. The constraints cited by the fishing community included unavailability of fishing nets on the local market, difficulty in obtaining pulling ropes and lack of outboard motors. They also expressed the wish for financial assistance in the form of credit facilities during the lean season, to cushion them and to help them purchase fishing gear and other inputs.

### 3.3.3. NEW BEWADZE VILLAGE

The Chief and elders of Bewadze, a village within the proposed site were also consulted. The people are subjects of the Paramount Chief of Gomoa.

They were predominantly farmers and the main crops cultivated were tomatoes, maize, pepper and cassava. They complained that the soil had lost its fertility resulting in low crop yield. They felt that the provision of fertilizers and tractors would help them tremendously in their farming activities. The problem of soil infertility was a big worry to them since they were no longer allowed to farm in the forest reserve.

The people did not engage in hunting at all, bushmeat was therefore rare. They depended mainly on fish for their animal protein.

Fuelwood is the main source of energy for cooking. Some of the people produced charcoal, which was sold to urban dwellers and was scarcely used in the village. The people were not keen on tree planting to increase their source of fuelwood because of scarcity of land. They complained that already they do not have adequate land for farming. They, however, agreed to planting of avenue trees in the village.

### 3.4. MANAGEMENT STRATEGY

#### 3.4.1. OBJECTIVE

The specific objectives for the establishment and management of the Muni Ramsar site are as follows:

- (i) to maintain and enhance the value of the Muni wetland as habitat for birds;
- (ii) to enhance the value of the adjoining forest and scrub lands as wildlife habitat, with particular reference to species such as the Bushbuck Tragelaphus scriptus, which has significance in local traditions, and other antelopes which are important sources of bushmeat
- (iii) to maximise agricultural output in the catchment while minimizing the adverse effects of agricultural practices on the wetland ecosystem;
- (iv) to promote better understanding and greater awareness of local people of environmental issues, and to encourage local participation and support for conservation programmes within the district.

#### 3.4.2. MANAGEMENT ACTIONS

Specific actions to be undertaken for the achievement of these objectives may be summarised as follows:

- (i) Establishment of the Muni wetland as a Ramsar site and provision of necessary infrastructure and resources for effective protection of the site.
- (ii) Establishment of a zonation scheme which will integrate wildlife management with traditional use of the site, and cater for the needs of the local people while maintaining the wildlife value of the wetland.
- (iii) Institution of appropriate programmes for land, habitat and faunal management.
- (iv) Establishment of a conservation education and public awareness programme within the district.
- (v) Research and monitoring

#### 3.4.2.1. Site designation

The primary action required for the establishment of the Muni Ramsar site is to get the site boundaries demarcated and described, so that the site can be legally designated.

The proposed site covers the entire drainage basin of the rivers Muni and Pratu c. 96.5 km<sup>2</sup>, comprising sand dunes, open lagoon degraded forest and scrubland. The proposed boundaries are indicated on Fig.9. On the south is the sea and sandy beach between the Winneba and Mankwadze towns. The west boundary is formed by the existing Yenku Forest Reserves, Block B and part of Block A. The eastern boundary runs along the edges of the existing settlements: Winneba, Pomadze and Oquaakrom.

#### 3.4.2.2. Zonation

For effective management of the site, and also to ensure that both the wildlife and local people's needs are catered for, a zonation scheme is advocated. Five main zones are envisaged (fig. 10).

##### (i). Core area (Zone A)

This comprises the northern sections of the open lagoon and the immediate surroundings covering an area of c. 2 km<sup>2</sup>. This area is currently the most important area for feeding, roosting and nesting shorebirds but the least important in terms of fishing activities. Human activities in the area and access will be restricted during the peak season for palaeartic migrants, August to December, and breeding season of resident species, May to June, to ensure minimal disturbance to the birds. The boundaries of this area should be clearly marked with wooden pegs and sign boards.

##### (ii). Traditional hunting Grounds (Zone B)

This zone, comprising the degraded forest adjoining the forest reserve, would be a restricted hunting zone, managed for sustenance of the traditional Aboakyir festival of the Efutu people and for bushmeat production. The perpetuation of this tradition depends on the continuous availability of bushbucks. Management of the zone would seek to improve the habitat and ensure sustainable yield of desired wild animal species. Any activities that lead to habitat degradation, eg. farming, fuelwood collection, grazing of domestic animals and bushfires will be strictly controlled. Hunting would be regulated, based on a permit system. The participation and involvement of local communities, particularly the Asafo companies, would be essential for the protection of the area and the enforcement of hunting regulations. Management of this zone and bushmeat production in the district would be enhanced greatly if wildlife management components were incorporated into the current management programme of the adjoining Yenku Forest Reserve. The possibility for this should be explored with the Forestry Department.

**(iii). Controlled Zone (Zone C)**

This comprises the southern half of the open lagoon, the sand dunes and the surrounding flood plain adjoining the core area. This portion of the drainage basin is considered more sensitive in terms of likely effects of human activities (eg. agricultural practices) on the wetland ecosystem. The current traditional use of the zone (fishing, including shellfish collection and subsistence farming) would be allowed to continue, but monitored. Specific aspects required to be studied include fish exploitation and lagoon productivity, with the aim of initiating programmes to improve the lagoon fisheries. The use of agrochemicals and fire in farming operations should also be monitored and controlled.

Management should also seek to encourage agro-forestry to improve fuelwood supply in the area, thereby compensating for the restrictions on access into the traditional hunting grounds. Development of housing in this area would be restricted to only the immediate vicinity of existing villages.

**(iv). Land use management area (Zone D)**

This area includes the outer sections of the drainage basin and comprises scrublands, farms and small settlements. The land use patterns in this area should be mapped out, and appropriate management measures and controls should be put in place to minimize any possible adverse effects of land use practices on the wetland ecosystem (e.g. deforestation, soil erosion, agrochemical run off). Particular efforts should be made to control bushfires and encourage tree planting.

**(v). Settlements (Zone E)**

This area comprises part of the Winneba township and villages within the drainage basin. Management efforts in these areas would be directed at rationalising waste disposal to minimise pollution.

**3.4.2.3. Habitat management****Core area:**

No major habitat management is envisaged for this area, but additional roosting sites could be provided, through the creation of islands and or the provision of floating wooden platforms in the open water. Such structures are known to be favourite roosting posts in other sites.

**Traditional Hunting Grounds:**

(a) Establishment of a fire break (five metres wide) around the perimeter with the exception of the side adjoining the forest reserve. The fire break will serve the dual purpose of keeping fires out of the zone and clearly demarcating the boundaries of the zone.

(b) Habitat enhancement - Desired plant species (based on diet preference of key antelope species) would be encouraged through the planting of such species and or removal of undesirable species within the zone. Detailed mapping of the vegetation in this area and studies on range composition and feeding ecology of key antelope species would be required to provide basic information on the plant species which should be promoted. The tree planting should be undertaken by the Asafo Companies with the support and supervision of the wildlife staff. The Department of Forestry should be consulted for expert advice on forestry practices and also supply of seedlings.

**Controlled Zone and land use management Area.:**

The use of fires for farming in these area should be controlled, to ensure that burning is restricted to farm plots. Use of agro-chemicals should also be monitored.

Farmers in these areas should be encouraged to take up agroforestry and community woodlot projects, with the aim of increasing fuel wood supply, reducing pressure on trees in the basin and generally improving the vegetation cover in the area. The services of an Agro-forester would be required to assist the wildlife officers in the design and implementation of the agroforestry and woodlot programmes.

Some efforts should be put into planting coconut trees on the sand dunes. With the exception of a few seedlings planted in Mankwadze village, all the coconut trees fringing the stretch of beach within the project area are old trees and there is a need to make provision for replacement when these die off.

**Settlement areas:**

Appropriate waste disposal systems (eg. KVIP toilets, garbage truck) should be provided to improve sanitation in the area. Currently, people living along the coast use the beach as toilets and domestic waste is littered all around. Apart from the high health risk, the mess created is unsightly and completely mars the beauty of the beaches.

The road from Winneba to Muni should be improved.

**3.4.2.4. Faunal management**

**Avian communities:** There may be a need to provide, and improve nesting sites to encourage breeding of some bird species but detailed studies on the importance of the site for breeding birds and use of the site by such species would be required to justify such actions. The law prohibiting tern trapping (L.I. 1357) should be enforced through conservation education and legal action against offenders.

**Mammalian communities**

Without information on species and populations of the mammalian species occurring in the area, it is impossible to define appropriate management prescriptions. Ecological studies

(particularly population dynamics, feeding ecology and habitat requirements) would be required for culturally important species like Bushbuck, and favourite bushmeat species like Black duiker Cephalophus niger, Maxwell duiker C monticola, Royal antelope Neotragus pygmaeus, Grasscutter Thryonomys swinderianus and Brush-tailed porcupine Atheurus africanus.

In view of the special significance of Bushbuck to the Efutu people, there may be a need for restocking of the traditional hunting grounds, but this will depend on the current status of the species in the area. Restocking should only be done when effective protection of the zone has been achieved, and there is the assurance that animals introduced will not be immediately hunted down.

### 3.5. RESEARCH AND MONITORING

A strong scientific data base is required for effective management of the wetland habitat and associated fauna. Baseline data would be required on some aspects of the wetland ecosystem and these should be collected during the first months of the project. This would be undertaken by local consultants contracted on short term basis.

Thereafter, appropriate mechanisms should be developed for continuous monitoring of key elements by the wildlife staff on the ground, with assistance of specialists where necessary.

In addition to the baseline studies and the routine monitoring, certain studies would be best carried out by student researchers from Ghanaian universities. Provision should be made under the research and monitoring component to cover such student projects.

The list below gives the relevant areas where data are required.

#### Baseline studies:

- (i). Hydrological studies - water level measurements, sediment flows, and drainage characteristics of the basin.
- (ii). Limnological studies - basic water quality, aquatic productivity, point sources of pollution, species and abundance of invertebrates.
- (iii). Botanical studies - detailed vegetation mapping of traditional hunting grounds.
- (iv). Ornithological studies - species and distribution of land birds within the traditional hunting grounds and controlled zone; detailed mapping of use of the wetland by feeding, roosting and nesting birds.
- (v). Other vertebrate studies - inventory of key mammalian species in the traditional hunting grounds and adjoining forest reserves.



Depending on the findings from the above studies, there may be a need for long term monitoring of some aspects and it would be necessary for the relevant specialists to come in for 2 - 4 days a month over at least a one year period during the second year of the project.

**Routine monitoring (to be undertaken by staff on the ground).**

(i). Water levels and water quality (the water level and salinity measurements can be done on site by staff, but there will be a need for water samples to be collected for analysis by the Institute of Aquatic Biology).

(ii). Basic meteorological data

(iii). Human usage of the lagoon with particular reference to lagoon fisheries (including mollusc collection).

(iv). Census of breeding birds (to be carried out during the breeding season).

(v). Regular recording of sightings of larger mammals and census of key species in the traditional hunting ground (population census should be carried out twice a year in the dry and wet seasons).

**Topics for graduate student research**

(i). Ecological studies on key mammalian species with particular emphasis on feeding ecology, population turnover and habitat requirements.

(ii). Primary productivity and carrying capacity

(iii). Aquatic productivity.

**3.6. MECHANISM FOR IMPLEMENTATION**

**3.6.1. LEAD AGENCY:** Department of Game and Wildlife.

**3.6.2. ASSOCIATED AGENCIES:**

The Save the Seashore Birds Project  
Forestry Department  
Institute of Aquatic Biology  
Extension Services Division, Ministry  
of Agriculture.

**3.6.3. LOCAL PARTICIPATION:**

The support and involvement of the communities living in the vicinity of Muni is crucial for the successful management of the site and every effort should be made to encourage local

participation. Particular groups whose involvement would be most productive are the Asafo Companies, and the local political groups, ie. the Committees for the Defense of the Revolution (CDRs) and the 31st December Women's Movement (31st DWM).

The Asafo Companies can be used effectively to protect the traditional hunting grounds (and they have expressed their willingness to do this); while the CDRs/31st DWM would be more effective in public awareness campaigns and in mobilizing the people for specific projects of tree planting.

#### 3.6.4. STAFF

The following staff would be required for the effective management of the Muni Ramsar site:

<u>Position</u>	<u>Number</u>
Game Warden	1
Rangers	1
Driver	2
Labourers (Community wildlife assistants)	4

The Game Warden and Rangers will be drawn from the staff of the Department of Game and Wildlife. Efforts should be made to employ local people in the case of Rangers and certainly, as community wildlife assistants. The team would work in close collaboration with the Asafo Companies and the local CDRs to manage the site. The site will also be served by support staff and equipment based at the head office, ie. the Conservation Education Officer and the secretarial staff.

#### 3.6.5 SITE MANAGEMENT COMMITTEE

In addition, a management committee with the under-listed composition is recommended for the site. The committee will serve primarily as a forum for the various groups with interest in the wetland to come together and air their views on the management of the site.

Technical Advisor.

Coordinator, Coastal Wetlands Conservation Programme.

Game Warden in charge of site

Representative, SSBP-G.

Winneba District Agric. Extension Officer

Winneba District Forestry Officer.

Representative, Central Regional Administration

Paramount Chief of Efutu Traditional Council

Paramount Chief of Gomoa Traditional Council

Presiding member, Winneba District Assembly

Presiding member, Gomoa District Assembly

Chief Fisherman, Muni fishing villages.

Representative, Asafo Companies.

### 3.7. SITE MANAGEMENT REQUIREMENTS

**Roads and access:** The road from Winneba to Muni Lagoon should be constructed/improved.

**Buildings:** The site will require the construction of an office block, a moderate education/visitor centre and housing for staff. These should be sited in an appropriate location within the controlled zone. Two observation posts will be built to facilitate bird watching and to act as outposts for field work. In an effort to improve sanitation and reduce nutrient loading of the wetland, ten KVIP latrines should be constructed for the villages within the drainage basin.

**Equipment:** Basic office equipment and furnishing for the office and the education centre should be provided. The staff on site would require field gear and some simple items of monitoring equipment to properly carry out their duties.

**Transport:** A four wheel drive pick-up, one motorcycle and a small boat would be required by the staff in their site protection work. In addition, there will be a need for a 3 tonne tipper truck to be used as a garbage truck and also to move materials in and around the project area.

**SECTION 4**

**SAKUMO RAMSAR SITE**

## 4. SAKUMO RAMSAR SITE

### 4.1. INTRODUCTION

#### 4.1.1. SITUATION

The Sakumo wetland is situated north of the coastal road between the cities of Accra and Tema, approximately 3 km from the Tema township, Lat. 5° 37'N, Long. 0° 03'W (Fig.1) The wetland comprises an open lagoon, a floodplain and a freshwater marsh. The brackish water lagoon covers an area of 1 - 3.5 km<sup>2</sup> depending on the season and has a surrounding flood plain of c.7 km<sup>2</sup>. The lagoon is separated from the sea by a narrow sand dune on which the Accra - Tema road is built. The Sakumo wetland is the third most important site for shorebirds on the Ghana coast.

#### 4.1.2 CLIMATE

Temperature, rainfall and relative humidity data for Tema (which is the nearest meteorological station) are given in appendix 3. Mean monthly temperatures range from minimum of 24 °C in August to maximum of 29 °C in March. Total annual rainfall over a 10 year period (1981-1990) averaged 578.5 mm.

#### 4.1.3 HYDROLOGY

The lagoon is fed by two main rivers from the north, Gbagbla - Ankonu and Mamahuma, with a catchment of c.222 km<sup>2</sup>. The lagoon is connected to the sea by a sluice, constructed in 1953 to prevent flooding of the coastal road. This sluice is presently non-operational and there is free exchange of water between the lagoon and the sea, with the direction of flow depending on the tide. There is very little freshwater inflow into the lagoon. This may be attributed to the re-channelling of the water from the inflowing rivers to irrigated rice and vegetable farms in the northern sections of the wetland. The entire flood plain may, however be inundated during the rainy season.

Salinity measurements taken during the SSBP-G training course in August 1987 varied from 2.8 g l<sup>-1</sup> in the north to 18 g l<sup>-1</sup> in the southern parts of the lagoon near the sluice. The freshwater input north of the motorway had a salinity of 1.4 g l<sup>-1</sup> as compared to the 38.5 g l<sup>-1</sup> reading for the sea. With very little freshwater and seawater inflow, the lagoon acts as an evaporative pan during the dry season, resulting in high salinity. The effect of this on lagoon organisms remain to be studied.

#### 4.1.4 HUMAN SETTLEMENTS AND LAND OWNERSHIP

The Sakumo site lies between two major cities, Accra and Tema, with housing developments in the immediate vicinity of the lagoon. The Sakumono village housing developments are in the immediate west of the lagoon while the eastern boundary adjoins the Tema Communities 3, 5 and 12 housing project. Appendix 4 gives the 1984 census data for the settlements which fall within the proposed Sakumo site, and whose activities would have a direct influence on the wetland. The Sakumo area is expected to have the highest rate of urban growth within the Accra coastal zone during the coming years, with an estimated population of 1.5 million by the year 2010. The lagoon is already severely polluted from sewage and other domestic waste, and the increase in population could pose a serious threat to the health of the lagoon unless appropriate waste disposal systems are developed.

The lagoon and surrounding flood plain is traditionally owned by the Tema and Teshie people, but is presently under the jurisdiction of the Tema Development Corporation.

#### 4.1.5 LAND USE

Intensive fishing (including crab collection) is undertaken in the Sakumo lagoon all year round. The fishermen, who came from surrounding communities (Tema, Sakumo, Nungua, Teshie, Accra) were either full-time fishermen or had jobs elsewhere and fished part-time, particularly at week-ends, to supplement their income. Fishing is carried out throughout the day and sometimes at night, fishing intensity peaks between 0900 hr. and 1200 hr.

Fishing intensity was lowest during October - March which was the closed season (see section 4.1.6 below), and most intensive during the first few weeks after the opening of the fishing season. The number of fishermen recorded at any one time in 1988 ranged from 30 - 310 (Ntiamoa-Baidu, 1991). The fishermen fished for 1-5 hrs each day and worked singly using cast nets, or in groups of 4-12 using draw nets. Their catch ranged from 1.0-6.1 kg man<sup>-1</sup> h<sup>-1</sup> (Table 5).

The tilapia Sarotherodon melanotheron accounted for 98% (by weight) of the fishermen's catch. Other species caught included the horse mackerel Caranx hippos the grey mullet (Mugilidae) and the blue-legged lagoon swimming crab Callinectes latimanus (Mensah, 1979; Ntiamoa-Baidu, 1987; 1991)

The lagoon fisheries provided a very significant contribution to the livelihood of the fishing communities. With a fishing effort of 3.5 man hours day<sup>-1</sup> (Table 5), the average income from the lagoon fisheries during the peak season in 1988 was 3-4 times higher than the minimum government wage of C 480 for an 8-hr working day. The average daily income from crab collection was also twice as much as the government minimum wage.

Table 5. Sakumo Lagoon Fisheries (source: Ntiamoa-Baidu, 1991)

Fishery	Method	No. of groups/ fishermen	Mean time hr.(range)	Catch (kg/man/hr.)	Value (C/kg)	Daily earning /person (C)**
Tilapia	Cast net	7	3.5 (3-4)	2.90	165.00	1675
	Draw net	5	3.2 (1-5)	2.24	165.00	1183
Crab	Traps*	5	2.3 (0.5-3)	0.51	421.00	494

\* Mean number of net traps per fisherman = 23.2

\*\* C 350.00 = U.S.\$ 1.00

Large quantities of shell were exploited from the shores of Sakumo lagoon for the building industry and as a source of calcium in animal feed. A study in 1987 reported a collection capacity of 5 tons of shells by two people every two days. The quantity was sold for C 4,500, thus providing an income of C 1,125.0 person<sup>-1</sup> day<sup>-1</sup>, equivalent to ten times the government minimum daily wage at that time (Ntiamoa-Baidu, 1987).

The Typha which grow along the edges of the freshwater end of the lagoon were also exploited for mats and as material for thatching

Rice, cassava and vegetable farming is undertaken in the northern sections of the wetland, along the banks of the rivers which are the main source of freshwater input into the lagoon. Farmers rely on the rivers and also illegal tapping of pipe-borne water to irrigate their farms. According to the Management of the Tema Development Corporation (TDC), these farming activities were illegal.

Some cattle grazing was observed in the northern sections of site. Previous attempts at salt mining in the eastern part of the lagoon had been abandoned.

Records from the TDC indicated that the northern portions of the wetland, constituting about one third of the area proposed for the Ramsar site had been earmarked for clay extraction for brick and tile manufacture. This was to be undertaken by the TDC, the Bank of Ghana, Clay Products Limited, VALCO and State Insurance Corporation. The Boateng Committee, set up by the PNDC Member and Chairman of Committee of Secretaries to investigate the Sakumo Ramsar Site reservation issues has recently recommended the termination of the clay extraction and brick and tile manufacturing project. According to the committee's report (Office of the Director of Town and Country Planning Report No P/GHA.6/SF IA/TJ of 31st May 1991), the brick and tile project was not only detrimental to the objectives of the Ramsar site, but also offensive and non-conforming to the zoning of the Accra-Tema Metropolitan Area Greenbelt and protected water catchment area, as detailed in the Coastal Management Plan for Accra.

A fair amount of recreation occurs at the Sakumo lagoon area. The major development in this regard is the Celebrity Golf Club and Holiday resort. The Boateng Committee noted that the

existing developments of the Celebrity Golf Club can be accommodated within the Ramsar concept. The proposed acquisition of additional 172.03 ha of the Ramsar site for the Celebrity Club was disapproved and it was recommended that future land needs and recreational developments were to be assessed in the light of their compatibility with the Ramsar site objectives.

#### 4.1.6 CULTURAL ASPECTS

A number of traditional belief's and taboos are associated with the Sakumo lagoon. The lagoon is regarded as a fetish by the local community and it has a Fetish Priest, the Sakumo Wulomo and a Priestess, Naa Yoo Wulomo. The black heron Egretta ardesiaca was considered a sacred bird associated with the lagoon fetish and its capture or killing was forbidden. Rules and taboos associated with the lagoon included:

- prohibition of the use of seine nets and other nets of mesh size (stretched) below 2.5 cm;
- prohibition of fishing from daybreak to 12 noon on Fridays (which was considered a sacred day for the lagoon fetish);
- a closed season for fishing from October/November to end of March/early April.

Crab collection was not affected by these rules. The beginning of the closed season was determined by the status of the lagoon fish stocks. The closure was instituted when the fishermen felt that the stocks were becoming depleted. The closing ceremony involved the pouring of libation and insertion of a coconut branch at the entrance of the shrine as a symbol for the closure.

The opening of the fishing season is, however, linked with the annual Kpledjoo festival of the Tema people, which takes place in early April. The opening normally took place 1-2 weeks before this festival. The ceremony involved the pouring of libation, followed by the casting of a net by the Fetish Priest. The fish caught by this net were smoked and used with palm oil and maize flour to prepare a dish which was sprinkled on the banks of the lagoon to declare it open. The opening ceremony was a big event which attracted fishermen from neighbouring villages and others from as far as Ada and Keta to join the fishing activity which followed.

The rules were enforced by the local community. A fine of 5,000 Cedis, plus one sheep could be imposed on offenders, and in the case of the use of prohibited nets, the nets were confiscated.

Such regulations are typical examples of traditional strategies which inadvertently protected the lagoon habitat and regulated exploitation of the lagoon resources. They functioned effectively as conservation tools in the past, but without legal backing, these rules and taboos are presently disregarded by a large number of fishermen. Fishing (including crab collection)



was undertaken every day in Sakumo, even during the closed season and on prohibited days.

#### 4.1.7 THREATS

The major threat to the Sakumo wetland is pollution from sewage and domestic refuse. Raw sewage is regularly dumped in the northern parts of the catchment within the vicinity of the bridge over the Ashiaman road along the motorway. Faecal material and other domestic waste from the communities in Ashiaman are also dumped into the catchment. This is washed into the lagoon during the rains, resulting in eutrophication, massive blooms of phytoplankton and highly anoxic conditions in the bottom sediments. The bottom of the lagoon is presently literally dead; the substrate is thick black mud with a strong smell of hydrogen sulphide and practically no invertebrate life.

Another disturbing factor is the proposals for the siting of the Tema Sewage Treatment Plant. This project, being undertaken under the World Bank Urban II Programme, proposes the siting of the treatment plant within the Sakumo Ramsar Site and discharge of treated effluent into the lagoon. The assumption here is that whatever is discharged into the lagoon will be flushed out with the tide. This assumption is, obviously, based on a gross overestimate of the tidal influence on the lagoon and lack of recognition of the fact that the sediment retention capacity of Sakumo lagoon is already overstretched. The lagoon is presently over-loaded and management of the wetland habitat would have to consider some cleaning up exercise. A more realistic, albeit expensive, approach to the effluent disposal problem would, perhaps, be to discharge the treated effluent direct into the sea. It is strongly recommended that the proposals for the Tema Sewage disposal be re-examined. The terms of reference for the EIA on this particular project requires critical assessment to ensure that it addresses the biological processes in the lagoon which will be seriously affected by any additional waste input.

Another development which could seriously affect the integrity of the Sakumo wetland is the proposed diversion of the Accra-Tema coastal road. The plan for the new road indicates that it will pass through the wetland, which would mean the construction of a bridge over the lagoon. This proposal should be critically examined and a detailed environmental impact assessment should be carried out before any construction work is undertaken.

## 4.2. FLORA AND FAUNA

### 4.2.1 VEGETATION

Four main habitat types are recognisable in the Sakumo wetland: the open lagoon, the surrounding floodplain, the freshwater marsh and the coastal savanna grasslands in the northern sections of the catchment. The floodplain is periodically inundated and the areas which are flooded frequently are bare of vegetation. Other areas are dominated by Sesuvium portulacastrum near the water, Bothriochloa bladhii at mid-point and Imperata cylindrica near the high ground. In the extreme north east, the flood plain grades into a fresh water marsh where the dominant plant is Typha domingensis. The open water is often covered with floating water lettuce Pistia stratiotes.

A zonation of the vegetation in the wetland is discernible. The main vegetation zones are formed either by pure stands of Sesuvium portulacastrum, Paspalum vaginatum, Sporobolus virginicus and Imperata cylindrica or associations of these, eg. Sesuvium - Sporobolus association. Within the main zones, there may be clumps or patches of other species of Cyperus articulatus, Bothriochloa bladhii, Typha domingensis.

Scattered plants of other species also occur e.g. Cleome viscosa, Scoparia dulcis and Portulaca foliosa. Appendix 7 lists the common plants occurring at Sakumo.

### 4.2.2. FAUNA

Pauly (1975) lists the invertebrate and fish species recorded in Sakumo lagoon in the 1970's (Table 6) It is clear from the comments on the status of the organisms listed, that the lagoon supported a lot more animal life in the 1970's than it currently does. Presently there is very little else apart from the tilapia and the blue-legged lagoon swimming crab. Species like Tympanotonus fuscatus which were abundant at Sakumo in the 1970's (and which are still abundant in areas where they are not subjected to heavy human exploitation ) are, presently, practically non-existent presently.

The Sakumo Lagoon supports large numbers of seashore birds. The recorded total of 66 species and the estimated population of 32,500 makes the site the third most important seashore bird site on the Ghana coast. The site supports internationally important populations of six wader species: spotted redshank, greenshank, curlew sandpiper, little stint, black-tailed godwit and black-winged stilt (Table 2); and nationally important populations (> 10% of total coastal record) of at least 30 species of waterfowl (Table 7). At some times of the year, Sakumo supports 90 - 100% of the total populations of black heron, teal, black-tailed godwit and ruff recorded on the Ghana coast.

Over 80% of the seashore bird species recorded at Sakumo is accounted for by palaeartic migrants. Migrant birds are most

abundant on the site during September to March/April (Fig.4). Resident birds recorded breeding on the site include Kittlitz's sand plover, pratincole, little tern, pied kingfisher, yellow throated longclaw, plain-backed pipit, fantail warbler and red bishop.

**Table 6. Species and status of animal life recorded in Sakumo Lagoon in the 1970s (Source, Pauly 1975).**

Species	Comments on Status
<b>POLYCHAETES</b>	
<u>Syllis hyaline</u>	uncommon
<u>Notonectus lineafus</u>	common
<u>Nephtys pyrifanis</u>	common
<b>GASTROPODS</b>	
<u>Tympanotonus fuscatus</u>	abundant largest fraction of molluscs biomass in the lagoon
<b>BIVALVES</b>	
<u>Ostrea tulipa</u>	enormous quantities
<b>CRUSTACEAN</b>	
Copepods	
	common
<b>Mysids</b>	
<u>Siriella</u> sp.	large numbers
<b>Amphipod</b>	
<u>Brandidirella mequa</u>	small numbers
<b>Decapods</b>	
<u>Penaeus notialis</u>	large quantities
<u>Penaeus ketathurus</u>	fairly common
<u>Clibanarius africanus</u>	common, living in shells of <u>T. fuscatus</u>
<u>Callinectes latimanus</u>	abundant
<u>Uca tangeri</u>	common
<u>Cardiosoma armatum</u>	very common
<u>Goniopsis cruentata</u>	not common
<b>PISCES</b>	
Tilapia = <u>Saratherodon melanotheron</u>	abundant 93% of fish biomass
<u>Ethmalosa fimbriata</u>	fairly common
<u>Elops senegalensis</u>	fairly common
<u>Oxyurichtys occidentalis</u>	fairly common
<u>Mugil</u> sp.	uncommon
<u>Pomadasys jubelini</u>	uncommon
<u>Lutjanus</u> sp.	small numbers
<u>Synaptura punctissima</u>	small numbers
<u>Caranx hippos</u>	small numbers

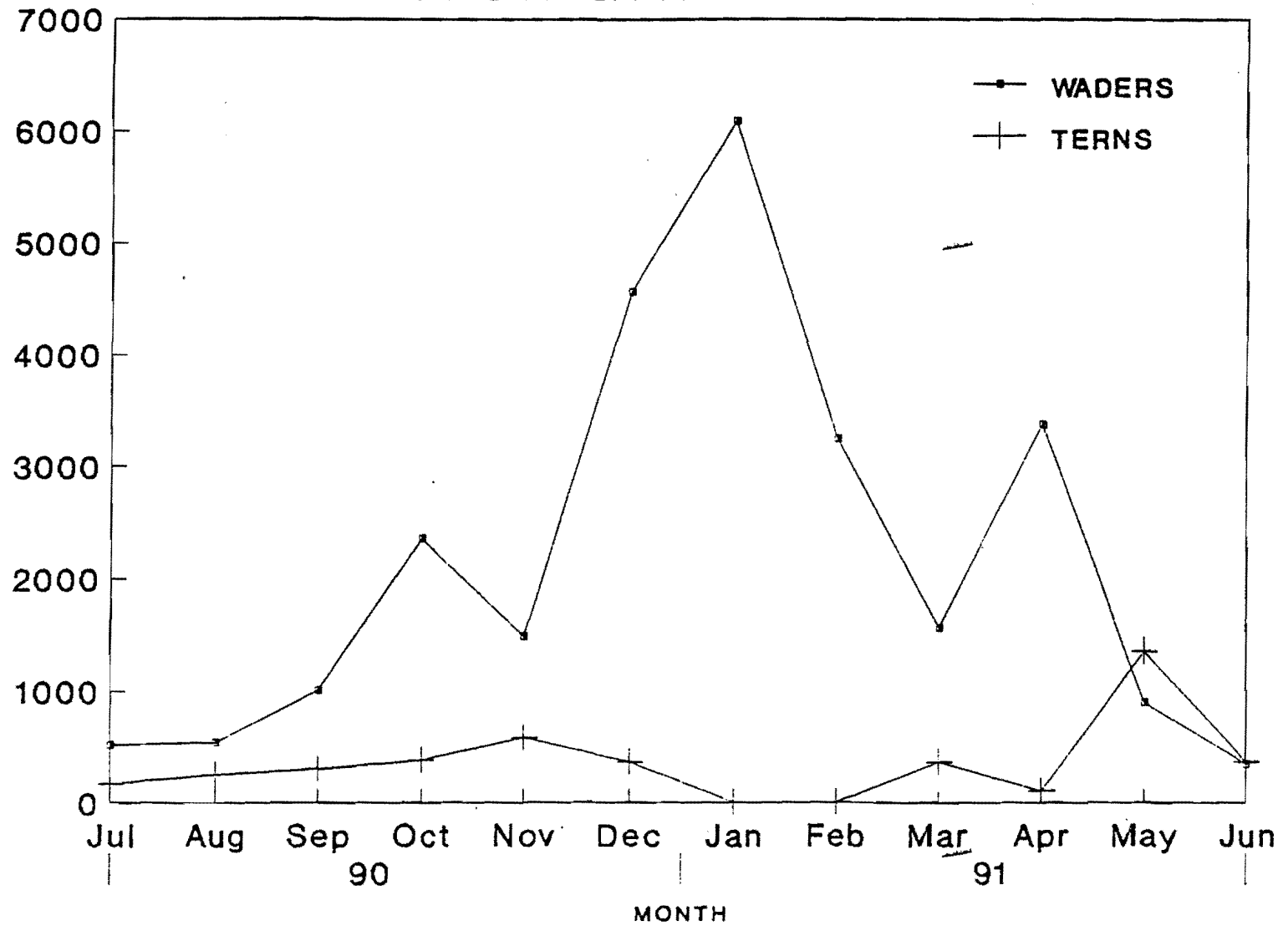
**Table 7. Peak counts and national importance of the most abundant seashore birds recorded at Sakumo (as at 30th June 1991).**

Species	Max. count entire coast	Peak recorded at Sakumo	% entire coast
<b>SHOREBIRDS</b>			
Black-winged stilt	12,460	900	7.2
Avocet	3,750	450	12.0
Pratincole	1,700	1,420	83.5
Ringed plover	6,160	1,040	16.9
White-fronted sand plover	110	20	18.2
Kittlitz's sand plover	480	100	20.8
Grey plover	2,780	300	10.8
Knot	2,360	210	8.9
Sanderling	6,480	180	2.8
Little stint	12,350	2,570	20.8
Curlew sandpiper	27,980	3,270	11.7
Ruff	300	300	100
Black-tailed godwit	1,590	1,460	91.8
Bar-tailed godwit	500	200	40.0
Whimbrel	460	40	8.7
Curlew	360	10	2.8
Spotted redshank	10,440	3,280	31.4
Redshank	450	30	6.7
Marsh sandpiper	290	110	37.9
Greenshank	8,350	1,180	14.1
Wood sandpiper	600	190	31.7
Common sandpiper	600	150	25.0
Turnstone	440	140	31.8
Jacana	400	170	38.6
<b>TERNs</b>			
Royal tern	7,550	340	4.5
Sandwich tern	6,080	610	10.0
Roseate tern	400	40	10.0
Common tern	12,660	2,150	16.9
Little tern	3,240	200	6.2
Black tern	20,680	2,630	12.7
<b>OTHER WATERFOWLS</b>			
Long-tailed cormorant	790	60	7.6
Squacco heron	600	110	18.3
Black heron	140	130	92.8
Western reef heron	1,520	1,020	67.1
Little egret	6,400	1,360	21.2
Great white egret	1,860	380	20.4
Grey heron	1,720	740	43.0
Glossy ibis	120	10	8.3

White-faced tree duck	17,060	640	3.7
Garganey	7,450	830	11.3
Teal	140	140	100
Black headed gull	280	30	10.7
Lesser black-backed gull	760	10	1.3

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FIG. 4. SEASONAL CHANGES IN NUMBERS OF SEASHORE BIRDS AT SAKUMO



### 4.3 MANAGEMENT STRATEGY

#### 4.3.1 OBJECTIVE

Three main objectives have been identified for the management of the Sakumo Ramsar site:

- (i) To maintain and enhance the biological value of the site with particular reference to its ornithological value.
- (ii) To maintain and enhance the productivity of the site, with particular reference to lagoon fisheries.
- (iii) To develop and enhance the educational, recreational and tourist potential of the site.

#### 4.3.2 MANAGEMENT ACTIONS

The specific actions required to be undertaken to achieve the outlined objectives may be summarised as follows:

- (i) Establishment of the Sakumo wetland as a Ramsar site.
- (ii) Institution of appropriate habitat and faunal management programmes.
- (iii) Development of visitor/educational facilities.
- (iv) Institution of appropriate research and collection of data required for the management of the site.

##### 4.3.2.1 Designation of the Sakumo Ramsar Site

Two conservation area categories are proposed for designation within the Sakumo wetland: the core area, to be designated as a Ramsar site; and the outer catchment, to be designated as a Ramsar Support Zone/Land use Management Zone.

The proposed Sakumo Ramsar Site (core area, fig. 11 & 12) covers 13.4 km<sup>2</sup> and comprises the open lagoon, surrounding flood plain, the freshwater marsh and the scrubland to the north of the lagoon. The area has already been demarcated, pillared and boundary descriptions provided by the Survey Department (at the request of the SSBP-G and the Department of Game and Wildlife). Steps should be taken for the legal designation of the site as a Ramsar Site. The Ramsar site should be under the direct administration of the Department of Game and Wildlife.

The ecological integrity of the core area, however, depends on the activities which go on within the outer catchment of the lagoon. It is already evident that the faecal and domestic waste dumped in the catchment is the major source of pollution to the lagoon. It is therefore recommended that the entire drainage basin of Sakumo should be declared as a land use management zone,

to serve as buffer (support) zone for the site. The proposed Ramsar Support zone includes all the lands drained by the rivers Onukpawahe, Mamahuma, Dzorwulu and Gbagbla-Ankonu, and including the township of Ashiaman (Fig. 11)

The zone should be properly demarcated and sign posted. A public education campaign should be mounted to ensure that the public is well informed of the purpose and objectives for designating the area as a controlled zone. The greater part of the area is currently under the jurisdiction of the TDC and developments within it are controlled by the TDC and the Tema District Assembly. It is recommended that the Sakumo Ramsar Support Zone remain under the management of TDC. Applications for developments in the Zone, however, should be presented with TDC's recommendation, to the site management committee for the committee's approval, to ensure that development projects would not have detrimental effects on the health of the Sakumo wetland.

Current land use in the zone should be mapped out. Existing land use practices which are likely to adversely affect the wetland ecosystem should be re-located wherever possible. Detailed environmental impact assessment should be demanded for all future developments in the zone.

#### 4.3.2.2 Habitat Management

The boundary of the core area should be planted with coconut trees or any other appropriate plant (the advice of the Forestry Department should be sought on this).

The southern half of both the eastern and western boundaries should be cleared, creating a 2 m wide path, which will form a nature trail. The southern half of the wetland has the highest concentration of birds.

The scrubland in the northern half of the wetland is often destroyed by bushfires during the dry season. Appropriate fire management should be initiated to protect the habitat from unwanted fires. It may also be necessary to initiate tree planting in this area to enhance the habitat and encourage colonization and nesting of woodland/savanna birds. Further studies are required to determine appropriate tree species that could be planted.

Farming in the river valley and associated diversion of the water from the inflowing rivers for irrigation should be minimised. The sluice which currently connects the lagoon to the sea requires repair/re-construction to make it operational. The advice of AESC should be sought on this.

The lagoon is currently highly polluted and there would be a need for some cleaning up exercise, possibly dredging some parts. Expert advice on this should be sought from a hydrologist and an aquatic biologist. Steps should be taken immediately to stop the dumping of sewage and other domestic refuse in the catchment.



There would also be a need to tidy up the immediate surroundings of the lagoon, which is currently heavily littered with plastics, empty cans, bottles etc, resulting from the activities of fishermen and food sellers. This could be done using members of the Ghana Wildlife Society, the Wildlife Clubs of Ghana, and users of the lagoon. The latter should then be educated to ensure that the littering would not continue. Facilities for refuse disposal should be provided. Fishermen using the lagoon should be registered to enable monitoring of fish productivity and human usage of the lagoon.

Although the Sakumo site supports large numbers of birds despite the intensive fishing which goes on in the lagoon, there is some evidence that the fishing activity disturbs roosting birds. It is therefore recommended that additional open water and roosting sites should be created in the south western corner of the floodplain, beside the main road. The low lying bare sand/mud flats and sparsely vegetated parts in this area would be suitable for this purpose. This area should then be maintained as a disturbance free zone (ie. fishing should not be allowed in the area) to encourage birds to roost and feed in this area while fishing continues in the parts of the lagoon currently used for that purpose.

Creation of the new water area could be done by scraping/digging of surface soil. Results from the monitoring of changes in water levels due to seasonal climatic changes should enable determination of appropriate depth of the new water body. The material excavated should be used to create islands within the new water body to serve as roosting sites for birds. Surplus material could be used for landscaping the surroundings of the education centre (see section 4.3.2.4).

#### 4.3.2.3 Faunal Management

The only faunal management required immediately is the prohibition of hunting in the area. A number of bird species are hunted at Sakumo, including even the black heron which is considered sacred. Public education, coupled with enforcement of hunting laws should effectively stop bird hunting in the site. Detailed research on habitat requirements and extent of use of the site by breeding birds would enable definition of additional faunal management requirements.

#### 4.3.2.4 Educational and Recreational Facilities

The situation of the Sakumo wetland between the two cities of Tema and Accra, and its rich bird life give the site great potential for education and recreation, which should be exploited. It is therefore recommended that a visitor/education centre should be constructed at the site. The centre should have a modern auditorium for talks and films, an exhibition hall, seminar rooms, offices and catering facilities. The centre should be provided with field equipment such as binoculars and

telescopes to facilitate bird watching; and a small library of nature books and field guides. Guide pamphlets and leaflets should be produced and made available to visitors.

The offices and facilities could be used as the head office for the Coastal Wetlands Conservation programme, where the Programme Coordinator and conservation education officer would be based. A conservation education assistant, trained in site interpretation, should be based permanently at the site.

The facilities and opportunities available at the site should be widely publicised, and arrangements should be made with the Ministry of Education to ensure that the site is optimally used for nature studies by schools within the Accra/Tema metropolitan area. The seminar rooms could also be hired out for meetings and conferences with arrangements for participants to be taken on nature walks. The catering facilities should be rented out to a private caterer, with necessary arrangements to ensure that required standards are maintained.

The advice of a hydrologist and an architect should be sought on the siting and plans for the centre. It would appear that the high ground next to the Celebrity property would be a good location. The SSBP-G commissioned the preparation of a design for an education centre for Sakumo. The plans should be examined and adopted if considered appropriate.

Two observation posts should be constructed on the site, one in the western section close to the centre and another in the north eastern side, just before the freshwater marsh, where large numbers of birds often congregate.

#### 4.4 RESEARCH AND MONITORING

##### Baseline studies

The baseline research required at Sakumo are:

(i) Hydrological studies to determine requirements for sluice construction, freshwater inputs, ground water levels and appropriate depths for the new water body to be created.

(ii) Limnological studies to determine current level of pollution and define appropriate measures for cleaning up, bearing in mind the requirements of the aquatic life forms which form prey items for shorebirds.

(iii) Fishery productivity of the lagoon, with the aim of investigating possibilities of improving the lagoon fishery.

(iv) Detailed mapping of the vegetation.

##### Routine monitoring

Other studies which require to be undertaken on routine long term basis include:

- (i) Regular monitoring of water levels and fresh water inflow.
- (ii) Regular monitoring of water quality.
- (iii) Regular monitoring of bird populations.
- (iv) Mapping of the distribution of breeding birds and their habitat requirements with particular reference to ground/nesting birds and losses due to floods.

#### 4.5. MECHANISM FOR IMPLEMENTATION

4.5.1. LEAD AGENCY: Department of Game and Wildlife.

4.5.2. ASSOCIATED AGENCIES:

Tema Development Corporation  
The Save the Seashore Birds Project  
Institute of Aquatic Biology  
Fisheries Research Unit

4.5.3. LOCAL PARTICIPATION:

The cooperation and involvement of the Tema District Assembly, the Chief and Fetish Priest of Tema New Town, the local political groups and the Chief and people of Sakumono should be sought. The people of Tema New Town and Sakumono would be particularly useful in site protection activities and law enforcement.

4.5.4. STAFF

The following staff should be adequate for the effective management of the Sakumo Ramsar site:

<u>Position</u>	<u>Number</u>
Game Warden	1 (to be shared between Sakumo and Densu delta Ramsar sites)
Ranger	1
Conservation education assistant	1
Drivers	1
Labourers (Community wildlife assistants)	2

#### 4.5.5. MANAGEMENT COMMITTEE

A management committee with the under-listed composition is recommended for the Sakumo Ramsar site. The committee will serve primarily as a forum for the various groups with interest in the wetland to come together to debate and advise on site management policies and actions.

Senior Technical Advisor.  
 Coordinator, Coastal Wetlands Conservation Programme.  
 Game Warden in charge of site  
 Representative SSBP-G.  
 Managing Director, TDC.  
 Director, Fisheries Research Unit.  
 Presiding member, Tema District Assembly  
 Fetish Priest, Tema New Town.  
 Representative Sakumono Town Development Committee.  
 Representative Ashiaman Town Development Committee

#### 4.6. SITE MANAGEMENT REQUIREMENTS

**Roads and access:** An access road should be constructed from the main road to the education centre.

**Buildings:** An education centre, offices and accommodation for the site warden should be constructed. The site warden's accommodation should be sited at Sakumono village. Two observation posts will be built to facilitate bird watching. Two public toilets should be constructed for Sakumono.

**Equipment:** Basic office equipment and furnishing for the offices and the education centre should be provided. The staff on site will require field gear and some simple items of monitoring equipment to carry out their duties.

**Transport:** A four wheel drive pick-up, one motorcycle and a small boat with a trailer should be provided for the site.

**SECTION 5**

**DENSU DELTA RAMSAR SITE**

## 5. DENSU DELTA RAMSAR SITE

### 5.1. INTRODUCTION

#### 5.1.1. SITUATION

The Densu delta lagoon and salt pans complex (also known as Sakumo I and Panbros Salt Pans) lie in the river valley formed by the Aplaku-Takuse and Weiija McCarthy Hills, 11 km west of Accra, Lat. 5° 31'N, Long. 0° 20'W. The wetland comprises sand dunes, open lagoon, salt pans, marsh and scrub, which provide extensive suitable feeding, roosting and nesting grounds for seashore birds.

#### 5.1.2 CLIMATE

Meteorological data for the nearest station Weiija, were either not available or unreliable, and data for Accra are used. Mean temperature, rainfall and humidity for a 10 year period (1981-1990) are presented in Appendix 3. Mean monthly temperatures vary by no more than 5°C in July/August to 30° C in March. Mean annual rainfall for the period was 656.82 mm., with maximum precipitation occurring in March - June and September -October. December and January are the driest months. Relative humidity is over 90% in the mornings throughout the year. Lowest humidity are recorded in the afternoons, ranging from 35 - 50% in the dry months to around 70% in the rainy season.

#### 5.2.3 HYDROLOGY

The Densu wetland is fed mainly by the River Densu, which is dammed upstream (the Weiija Dam). The Weiija dam is one of the two dams which supply water to the city of Accra. The dam has a daily production capacity of 180,000 m<sup>3</sup>. The dam has had profound effect on the lagoon and the general hydrology of the wetland. Freshwater inflow is controlled by the Weiija Water works management. Water is only released from July to November, and the maximum discharge permissible is 200 m<sup>3</sup> per sec. This limit is imposed to safeguard the bridge over the Densu river on the Accra-Winneba road. The following data on the dam was provided by Mr. Malcom Adjetey, Ghana Water and Sewerage Corporation, Weiija:

Normal working level of the Reservoir: 14.33 m above datum.

Maximum level of the reservoir: 15.25 m.

Usual Operating level: 12.8-13.7 m.

Maximum permissible discharge: 200 m<sup>3</sup> sec<sup>-1</sup> (Discharge over spillway normally only from July to November).

Normal daily production of drinking water: 90,919,200 l day<sup>-1</sup>.

Maximum daily production of water: 104,557,080 l day<sup>-1</sup>.

Chloride: 50 ppm.

Value of reservoir fishery, up to 10 tons day<sup>-1</sup>. On a good day as many as 150 fishing canoes may be seen on the lake.

The Dam commissioned in 1978, the old dam was destroyed on 12th July 1968 by exceptional heavy rain and clogging of the spillway by vegetation.

The depth of water in the wetland varies according to site and season. Water depth can be over 2 m in some parts during the rainy season whereas in the dry season, large parts dry up completely. There is currently no direct outlet channel into the sea, but in some years the lagoon opens into the sea at the south west corner after heavy rains. In other years, the management of the Panbros Salt Company attempts to bull-doze an opening in the sand dunes to let out water from the pans. Salinity readings taken in August 1987 ranged from  $1.5 \text{ g l}^{-1}$  at point of freshwater inflow to  $11.5 \text{ g l}^{-1}$  at the seaward end (SSBP-G, 1987).

#### 5.1.4 HUMAN SETTLEMENTS AND LAND OWNERSHIP

The eastern and north eastern sections of the wetland are heavily settled (Dansoman, Malam, Mendskrom and McCarthy Hill). Settlements within the wetland itself consist of small villages with populations of less than 5,000 (Appendix 4). According to the Operations Manager of Panbros Salt Company, Mr. Karikari Apenteng, the area comprising the wetland is held in trust by the Ghana Government for the people of James Town. Panbros has a concession of 2,792 acres (Fig.13)

#### 5.1.5 LAND USE

The major human activities in the area are large scale commercial salt extraction and lagoon fisheries. It is estimated that over 1,500 people live and work in the area. Salt production by the Panbros Salt Company is carried out by the concentration of sea water in a series of salt pans. Approximately 75% of the company's concession is currently developed and worked as salt pans and a further 10-15% is being developed.

Fishing in the lagoon is undertaken mainly by people from the fishing villages located on the sand dunes, but fishermen may also come from the adjoining settlements in Accra. A few of the fishermen were part time, but most of them were full time fishermen who derived their livelihood from lagoon fisheries. The fishermen use cast nets, draw nets, bottle traps and fence traps. In recent years a few fishermen have introduced Acadja fisheries in some parts of the lagoon. The catch (which was mainly tilapia) varied greatly depending on the season and the water level, being greatest when the water level was moderate, low when the lagoon dried up and none at all when it is flooded. The income from the fishery therefore fluctuated greatly, but could be up to C 5,000  $\text{man}^{-1} \text{ day}^{-1}$ . Blue-legged lagoon swimming crabs were also collected, using crabs traps. The few fishermen interviewed reported lower catches in recent times and smaller fish sizes, and attributed this to the increased number of fishermen.

A limited amount of mangrove cutting for household firewood was observed. Sedges and reeds (mainly Imperata, Cyperus and Typha) were collected during the rainy season to be used for thatch and mats. A few cattle were regularly seen grazing in the scrub and also in the marshlands during the season.

Some hunting goes on in the wetland. Herons were the main species shot. Tern trapping have also been observed on the site. Hunting on the site has gone down drastically in recent times as a result of restrictions by the Panbros Company. A small number of people use the site for recreation, mainly swimming and sun bathing at week-ends. Permission was required from the Company for entry into the area.

#### 5.1.6 CONFLICTS

The water regime determined by the Weija Water Works, is a major source of conflict between the water supply company, the owners of the salt industry and the fishing communities. The flow of water into the wetland is regulated by the Water Works who (during the rainy season) must periodically release water into the wetland to maintain the reservoir level at the right height and to avoid flooding the bridge over the Densu river on the Accra-Winneba major road. Peak salt production takes place when conditions are dry and the salt company is unhappy when the wetland is flooded, as it happens during heavy rains or when water is released by the water works.

The fishermen's catch declines when water levels are too high. The flooding also destroys property in nearby settlements. Flooding of the wetland impairs bird roosting and nesting sites and often washes away nests and eggs of ground nesting birds - particularly pratincole, black-winged stilt and little terns. Plans for management of the site should therefore seek to address the problem and develop a water management strategy which will be satisfactory to all interested parties.



## 5.2 FLORA AND FAUNA

### 5.2.1 VEGETATION

Five main habitat types are recognizable in the Densu wetland: sand dunes, salt pans, brackish lagoon, freshwater marsh, coastal savanna grassland and thickets. There is very little vegetation on the sand dunes and in the salt pans. Coconut trees fringe the dunes, while the banks of some of the pans are colonised by Sesuvium portulacastrum. The open lagoon and freshwater marsh is fragmented as a result of the salt pan construction. Scattered stands of mangrove may be found in some areas around the lagoon, while in the less saline areas, the vegetation is mainly Imperata and Typha stands, with extensive areas of open water interspersed with islands of Cyperus. The marshlands adjoin scrub, where the main trees are Brysocarpus and Securinega, with extensive open areas dominated by Vetiveria. A list of the more common plant species occurring in the wetland is given in Appendix 8. A detailed study of the vegetation would be required, particularly in the coastal savanna thicket and grassland areas on the western sections of the site.

### 5.2.2 FAUNA

Detailed information on fauna is available only on birdlife. Distribution and abundance of other animals, particularly invertebrates, require to be studied.

The Densu delta site has a record of 57 species of seashore birds with an estimated population of 35,000. 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 site is further enhanced by its population of Roseate terns, a threatened species. The peak count of 200 Roseate terns at this site accounts for approximately 20% of the European breeding population of this rare species. Other water birds which occur in significant numbers on the site include waders and herons. The site supports internationally important populations of four species of waders: curlew sandpiper, little stint, spotted redshank and black-winged stilt (Table 2). Fifteen other species of water birds occur in nationally important numbers (> 10% of peak count for the entire coast, Table 8). Seashore birds are most abundant on the site August - March (Fig. 5).

At least 70 species of land birds have been recorded on the site, but this is by no means, the complete list, and further studies are required on this aspect. From May to August, the site becomes important for a number of resident breeding birds (Table 9).

Table 8. Peak counts and national importance of the most abundant seashore birds recorded at Densu delta (as at 30th June 1991).

Species	Max. count entire coast*	Peak recorded at Densu delta	% entire coast
<u>SHOREBIRDS</u>			
Black-winged stilt	12,460	310	2.5
Avocet	3,750	100	2.7
Pratincole	1,700	330	19.4
Ringed plover	6,160	1,560	25.3
White-fronted sand plover	110	10	9.1
Kittlitz's sand plover	480	30	6.2
Grey plover	2,780	340	12.2
Knot	2,360	30	1.3
Sanderling	6,480	230	3.5
Little stint	12,350	2,610	21.1
Curlew sandpiper	27,980	4,730	16.9
Ruff	300	20	6.7
Bar-tailed godwit	500	10	2.0
Whimbrel	460	30	6.5
Curlew	360	5	1.4
Spotted redshank	10,440	550	5.3
Marsh sandpiper	290	30	10.3
Greenshank	8,350	390	4.7
Wood sandpiper	600	50	8.3
Common sandpiper	600	50	8.3
Turnstone	440	50	11.4
<u>TERNs</u>			
Royal tern	7,550	2,590	34.3
Sandwich tern	6,080	1,970	32.4
Roseate tern	400	200	50.0
Common tern	12,660	3,130	24.7
Little tern	3,240	930	28.7
Whiskered tern	100	30	30.0
Black tern	20,680	2,250	10.9
<u>OTHER WATERFOWL</u>			
Long-tailed cormorant	790	130	14.4
Squacco heron	600	20	3.3
Black heron	140	2	1.4
Western reef heron	1,520	310	20.4
Little egret	6,400	1,630	25.5
Great white egret	1,860	290	15.6
Black headed gull	280	60	21.4
Lesser black- backed gull	760	30	3.9

FIG. 5: SEASONAL CHANGES IN NUMBERS OF SEASHORE BIRDS AT DENSU DELTA

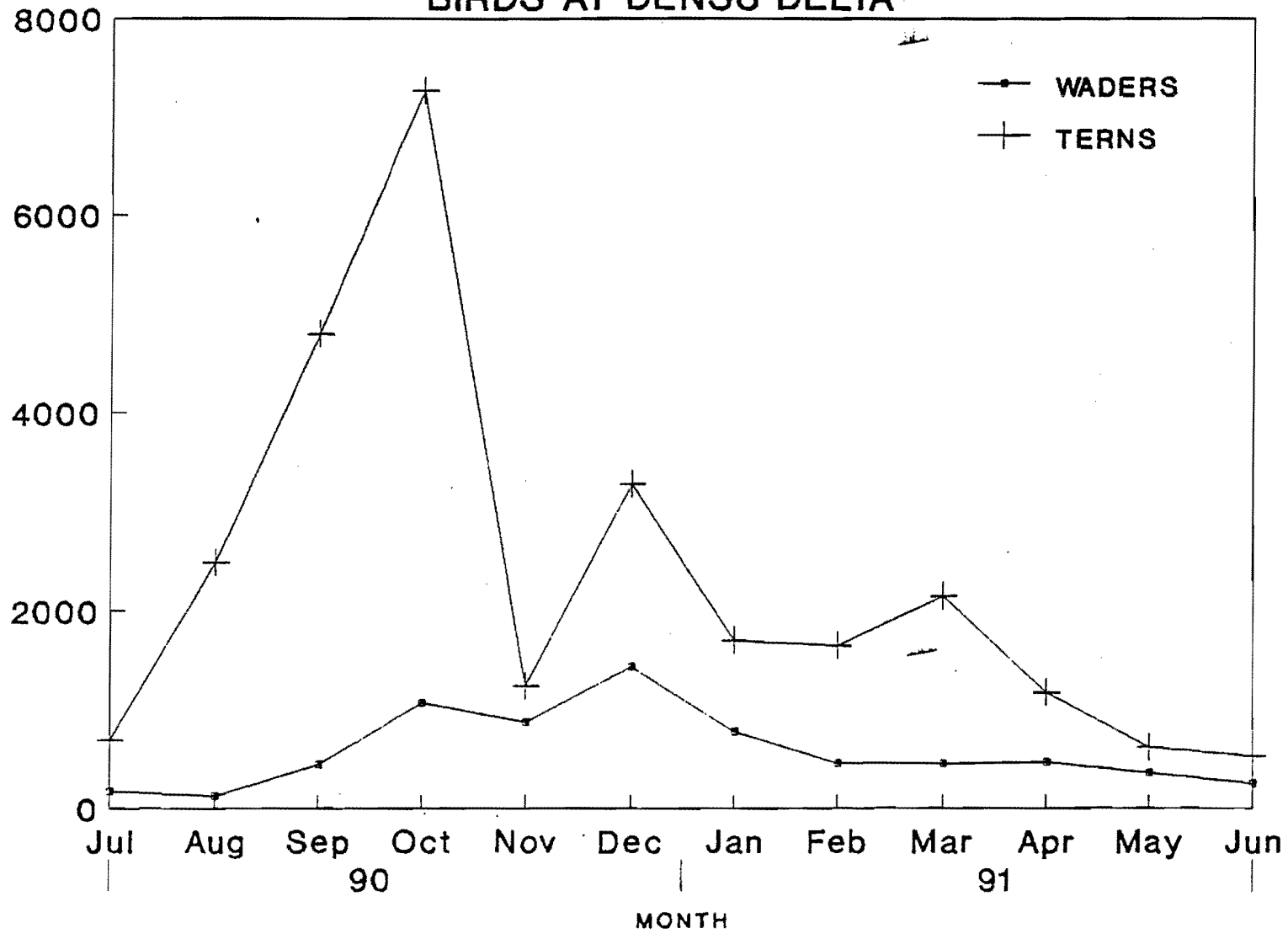


Table 9. Species of birds recorded breeding at the Densu delta site

Species	Comments
Black-winged stilt	Nests, eggs, nestlings
Pratincole	Nests, eggs, fledglings
Kittlitz's sand plover	Newly hatched young, fully fledged young following parent
Little tern	Nests, eggs, fledglings
Little bittern	Nest, parent nest visiting
Pied kingfisher	Nest holes in bank of salt pan
Purple gallinule	Nest and eggs
Yellow crowned bishop	Several nests, containing eggs, singing and displaying males
Red bishop	Several nests containing eggs, singing and displaying males
Yellow-throated long claw	Singing birds
African pied wagtail	Singing and displaying birds
Copper sunbird	Singing bird
Brown sunbird	Singing bird
Pin-tailed whydah	Displaying birds.

### 5.3 MANAGEMENT STRATEGY

#### 5.3.1 OBJECTIVE

The management strategy advocated for the Densu delta Ramsar site has three main objectives:

(i) To integrate wildlife management with the existing human use of the site and enhance the benefits derived from the wetland by the current users.

(ii) To develop the education and recreational potential of the site.

(iii) To maintain and enhance the ecological value of the wetland particularly for water resources, fisheries and birds.

#### 5.3.2 MANAGEMENT ACTIONS

Specific actions to be undertaken for achievement of the above objectives include the following:

(i) Establishment of the Densu delta Ramsar site and designation of the outer drainage basin as a Land-Use Management area.

(ii) Establishment of a zonation scheme to ensure minimum disturbance to breeding birds.

(iii) Institution of appropriate habitat and faunal management programmes.

(iv) Development of appropriate water management scheme.

(v) Development of educational and visitor facilities.

##### 5.3.2.1 Site designation

It is recommended that the Densu delta wetland should be legally established as a Ramsar site. The proposed Ramsar site covers c.46 km<sup>2</sup> and comprises the salt pans, sand dunes, the flood plains and catchment of the Densu river south of the Accra - Winneba road (Fig. 13). The western boundary runs along a transect between Bortianor and the point marked on the map as the Microwave station, then eastward along a foot path to the main road which forms the northern boundary. The eastern boundary runs along the edge of the Dansoman settlements. The area should be surveyed and demarcated to enable accurate description of the boundaries.

Protection activities in the area should be undertaken by the Department of Game and Wildlife, but management will have to be

in close consultation with Panbros Salt Company who owns part of the proposed Ramsar Site. Existing land use in the area should be allowed to continue, but future developments should be strictly assessed in terms of their compatibility with the Ramsar concept.

It is further recommended that the drainage basin of the River Densu immediately north of the Accra - Winneba road, and including the Weiya dam and reservoir areas should be declared a Land Use Management Zone (Fig.13). This area should be demarcated and sign posted as appropriate. Part of the area is currently under the management of Water and Sewerage Corporation. It is recommended that a management board should be set up to draw up modalities for management of the site. The board should have on it, representatives of departments/institutions such as the Water and Sewerage Corporation, Game and Wildlife, Forestry, Town and Country Planning, Institute of Aquatic Biology and Fisheries Research Unit.

#### 5.3.2.2 Zonation

The site is currently heavily utilized for various human activities. This, coupled with the fact that most of the important bird areas are under private ownership, makes it difficult to impose any stringent restrictions. The areas which are important for roosting and feeding birds are the salt pans and the marshlands. The marshland to the west of the main road leading into the salt pans, and the patch between the housing developments and the eastern end of the salt works, provide nesting sites for breeding birds. It is recommended that some arrangement should be worked out with the salt company for the establishment of these areas as bird sanctuaries. The sanctuaries should then be kept free of human disturbance, particularly during the breeding season. The salt company is currently extending the pans and it may be necessary to pay some compensation to the company to stop development of the important bird nesting areas into pans.

The savanna lands to the west of the site, including the Weiya hills, should be developed as a nature park. Provision has been made in the budget for habitat enhancement activities in the area.

#### 5.3.2.3 Habitat management

Most of the areas where habitat management is required fall under the Panbros Company's concession. The actions advocated can therefore only be undertaken in consultation with and with the agreement of the management of the Company. Fortunately, the Company has shown interest in the designation of the Densu delta area as a Ramsar site and the developments proposed.

The bunds between the pans and the wooden pegs in some of the pans are favourite tern roosting sites. The possibility of

providing additional pegs in the two main tern roosting sites should be explored. Every year several eggs of black-winged stilts, pratincoles and little terns are washed away by floods. The only eggs which survive are those on the mounds within the flood plains. One mound on the edge of the main lagoon has been used every year by black-winged stilts for nesting over the past five years; and in some years, the same mound has been used sequentially for two or more broods. It is recommended that additional mounds should be created in the bird sanctuary to provide more nesting sites. Small islands and wooden platforms should also be provided in the lagoon to attract roosting and nesting birds.

Extensive areas of the water bodies are dominated by Imperata sp. and there will be a need for periodic control to keep it from spreading too widely.

#### 5.3.2.4 Faunal management

The Management of the Panbros Salt Company already exert some restriction on hunting, but some hunting, particularly tern trapping still continues. Hunting should be completely prohibited on the site through regulation and enforcement. Apart from the unnecessary disturbance, it is incompatible with the management objectives and it also poses a risk to the large number of people who move about in the wetland.

Detailed studies should be carried out on reproductive success of ground nesting birds, with particular reference to the effects of flooding on survival rates. If found necessary, rescue operations should be mounted during periods of heavy rains to reduce clutch losses and increase hatching success.

#### 5.3.2.5 Water management

The conflict between the Water Works, the Salt Company, the Fishermen over the present water regime has been referred to in section 5.1.7. There is a need to develop a water management strategy which would be satisfactory to all interested parties and which will also enhance the wetland habitat for birds. It would be necessary to construct a sluice(s) at appropriate points to regulate the water levels in the wetland. Such a system will ensure that excess water drains into the sea, and when necessary, water can be retained in the sections of the wetland where this is required. It is recommended that AESC or some other water engineering company should be commissioned to undertake feasibility studies and design an appropriate system for solving the problem.

#### 5.3.2.6 Educational and Visitor Facilities

The Densu delta site offers immense opportunities for nature studies and recreation. The existing road network developed by

the salt company provides easy access and close bird viewing, which makes the site ideal for bird watching. Visitors will also have the opportunity to see the salt production process. If appropriate facilities are developed, school groups from Accra and nearby villages could greatly benefit from use of the site as a field laboratory. It is recommended that a moderate education/visitor centre should be established at the site. The centre should have an office, a small exhibition room and a lecture/audio visual hall which is big enough to seat a class (c.40). The centre should be provided with field guides; nature books, slide and film projectors, binoculars and telescopes. A conservation education assistant should be stationed permanently at the site if the level of visitor use of the site warrants this. Two observation posts should be provided at the site to facilitate bird watching. The siting of both the centre and the observation posts should be negotiated with the salt company.

#### 5.4 RESEARCH AND MONITORING

**Baseline studies** required at the Densu delta site are:

- (i) Hydrological studies - this would be required as part of the feasibility studies to design appropriate water management strategy.
- (ii) Detailed mapping of habitat usage by birds to enable a clearer definition of important bird areas within the wetland.
- (iii) Vegetation mapping, particularly in the dry lands to the west of the site. This will define any needs for habitat enhancement by way of tree planting.

#### **Routine Monitoring**

- (i) Regular monitoring of water levels.
- (ii) Regular monitoring of water quality.
- (iii) Monthly census of birds - this is currently undertaken by SSBP-G staff and should be continued.
- (iv) Human usage of the water bodies for fishing and assessment of the fisheries productivity, with the aim of improving the fisheries. The Acadja system currently practised by some fishermen should be evaluated and encouraged if found profitable.

#### **Student Research Project**

The accessibility of the site and large numbers of birds provide attractive conditions for ecological studies, which students from the Zoology, Botany and Geography Departments of the University of Ghana should be encouraged to exploit. Examples of studies which could be undertaken as student projects include:



- (i) Feeding ecology of major bird species.
- (ii) Reproductive biology of resident birds.
- (iii) Effect of habitat changes (cutting of Typha and Cyperus) on birds.
- (iv) Fishery productivity and harvesting within the lagoon.
- (v) Distribution and abundance of invertebrates.
- (vi) Mangrove distribution and effects of coppicing on establishment of the mangrove vegetation.
- (vii) General ecology and socio-economics of wetland usage.

#### 4.6. MECHANISM FOR IMPLEMENTATION

4.6.1. LEAD AGENCY: Department of Game and Wildlife.

#### 4.6.2. ASSOCIATED AGENCIES:

Panbros Salt Company  
 Ghana Water and Sewerage Corporation  
 The Save the Seashore Birds Project  
 Institute of Aquatic Biology

#### 4.6.3. LOCAL PARTICIPATION:

The cooperation and involvement of the fishing communities and the Ga (Rural) District Assembly should be sought.

#### 4.6.4. STAFF

The following staff should be adequate for the effective management of the Sakumo Ramsar site:

<u>Position</u>	<u>Number</u>
Game Warden	1 (to be shared with Sakumo)
Ranger	1
Conservation education assistant	1
Labourers (Community wildlife assistants)	2

#### 4.6.5. MANAGEMENT COMMITTEE

A management committee with the under-listed composition is recommended for the Densu delta site. The committee will serve primarily as a forum for the various groups with interest in the site to come together to debate and advise on site management policies and actions.

Senior Technical Advisor.  
Coordinator, Coastal Wetlands Conservation Programme.  
Game Warden in charge of site  
Representative SSBP-G.  
Managing Director, Panbros Salt Company.  
The Site Manager, GWSC, Weija.  
Presiding member, Ga (Rural) District Assembly  
Representative, Bortianor Town Development Committee/CDR.

#### 4.7. SITE MANAGEMENT REQUIREMENTS

**Buildings:** An education centre should be constructed for the site. Two observation posts should also be built to facilitate bird watching. Four public toilets should be constructed for the villages along the shore.

**Equipment:** Basic equipment should be provided for the education centre. The staff on site will require field gear and some simple items of monitoring equipment to carry out their duties.

**Transport:** The site would share the four wheel drive pick-up and a small boat with a trailer provided for Sakumo. One motorcycle should be provided for the ranger.

**SECTION 6**

**ANLO-KETA RAMSAR SITE**

## 6. ANLO-KETA RAMSAR SITE

### 6.1. INTRODUCTION

The Keta wetland, comprising a large expanse of open lagoon, floodplain, marsh land and extensive mangrove stands, lies to the east of the Volta estuary (Lat. 5° 55'N, Long. 0° 59'E). The lagoon stretches for c.40 km along the coast and is separated from the sea by a narrow coastal ridge on which the Keta township and other settlements are situated.

The Anlo-Keta area is very densely populated. Farming, fishing and salt mining are the main occupations of the indigenous people in the area. The area is famous for shallot farms and market gardening, which produces large quantities of onion and okro. Other crops grown include pepper, tomatoes, cassava and maize. Lagoon fisheries is a major source of livelihood for many people in the area. Salted and smoked tilapia from the Keta lagoon is sold in markets throughout the Volta Region and as far as Accra.

Salt winning is another major industry, particularly during the drier periods of the year, November - March. A survey undertaken by the National Service Secretariat reported 3,500 families engaged in salt mining within the Ketu district in 1989.

Another important source of income in the area is firewood. The mangroves are intensively exploited for firewood. Lucrative firewood markets thrive all along the main road from the Anlo-Keta junction to Keta and in towns like Anyanui on the edges of the lagoon, where the firewood is transported in canoes over the water to the market centres.

### 6.2. ORNITHOLOGICAL IMPORTANCE OF THE KETA WETLAND

The Keta wetland is the most important seashore bird site along the Ghana coast. The site has all the 72 seashore bird species recorded for the Ghana coast. Current estimated seashore bird population is around 110,000, but the true population is believed to be several times higher than this estimate. This is because only a small proportion of the area is covered in the SSBP-G bird monitoring programme. Ground accessibility to the lagoon is difficult and only the accessible areas are covered. Secondly, counts are taken on foot, thus limiting the total area that can be covered. The site is therefore more important for water birds than the current figures portray.

The bird populations include several thousands of waders, terns, herons and ducks. At times, Keta alone holds 60% of the total population of waders on the Ghana coast (Ntiamoa-Baidu and Hepburn 1988). The site supports internationally important populations of eight species of waders: spotted redshank, greenshank, ringed plover, curlew sandpiper, little stint, black-tailed godwit, avocet and black-winged stilt (Table 2).

The site is important for one species of tern, caspian tern; the entire coastal population of caspian tern is often found on the Keta lagoon. Table 10 shows the peak species counts recorded at Keta and the national importance of the site for seashore birds. The site contributes 90 - 100% of the recorded total count for ten species: black-winged stilt, knot, curlew, wood sandpiper, caspian tern, western reef heron, squacco heron, purple heron, white-faced tree duck and garganey. Eighteen other species occur in numbers which account for over 50% of the recorded coastal total population for the species.

The site is most productive during September to April (Fig.6). Bird numbers at Keta are greatly influenced by the level of water in the lagoon. As much as 90% of the population disperse to other areas, particularly Songor lagoon, when the area gets flooded and all the shallow margins and mud banks which form the important feeding areas are inundated. Birds flock in thousands to the area as the water recedes. Presently the most important areas for birds in the Keta wetland are the shallow waters and mud banks around Anloga, between Woe and Fiahor, around Adina and Afiadenyigba. The Adina section alone often holds 10,000 - 15,000 curlew sandpipers, equivalent to 2-3% of the estimated East Atlantic Flyway population of the species.

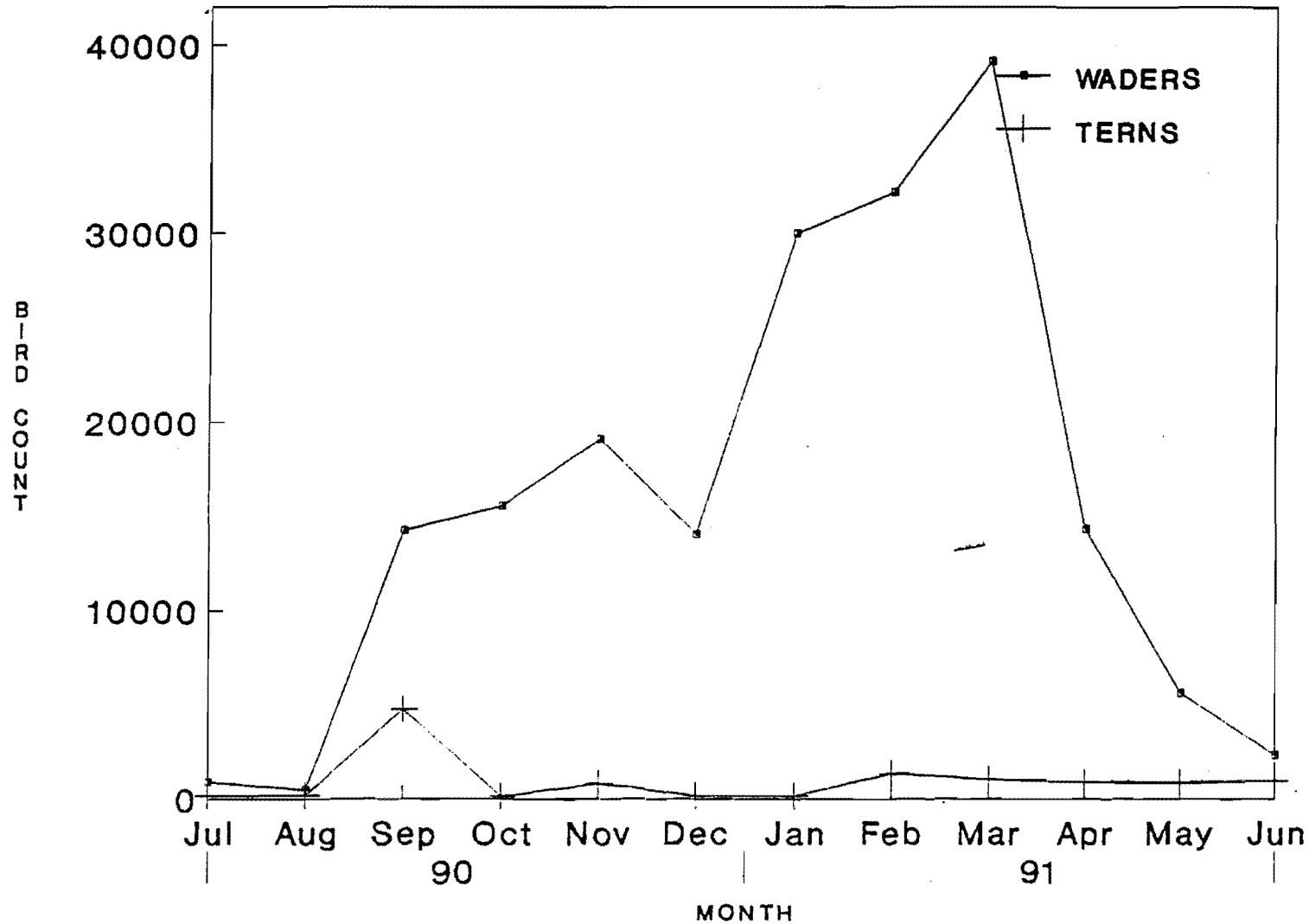
Table 10. Peak counts and national importance of the most abundant seashore birds recorded at Keta (as at 30th June 1991)

Species	Max. count entire coast*	Peak recorded at Keta	% entire coast
<u>SHOREBIRDS</u>			
Black-winged stilt	12,460	12,080	96.9
Avocet	3,750	1,560	41.7
Pratincole	1,700	1,010	59.4
Ringed plover	6,160	2,860	46.4
White-fronted sand plover	110	50	45.5
Kittlitz's sand plover	480	390	81.3
Grey plover	2,780	1,390	50.0
Knot	2,360	2,340	99.1
Sanderling	6,480	580	8.9
Little stint	12,350	5,790	46.9
Curlew sandpiper	27,980	14,810	52.9
Ruff	300	140	46.7
Black-tailed godwit	1,590	1,270	79.9
Bar-tailed godwit	500	230	46.0
Whimbrel	460	60	13.0
Curlew	360	330	91.7
Spotted redshank	10,440	8,330	79.8
Redshank	450	170	37.8
Marsh sandpiper	290	260	89.6
Greenshank	8,350	6,910	82.7
Wood sandpiper	600	540	90.0
Common sandpiper	600	280	46.7
Turnstone	440	110	25.0
Jacana	400	280	70.0
<u>TERNs</u>			
Caspian tern	440	440	100
Royal tern	7,550	290	3.8
Sandwich tern	6,080	520	8.5
Roseate tern	400	10	2.5
Common tern	12,660	2,770	21.9
Little tern	3,240	810	25.0
Whiskered tern	130	130	100
Black tern	20,680	1,870	9.0
<u>OTHER WATERFOWL</u>			
Long-tailed cormorant	790	650	82.3
Pink-backed pelican	900	690	76.7
Squacco heron	600	570	95.0
Black heron	140	40	28.6
Western reef heron	1,520	1,420	93.4
Little egret	6,400	3,980	62.2
Great white egret	1,860	1,650	88.7

Purple heron	100	100	100
Grey heron	1,720	1,170	68.0
Glossy ibis	120	80	66.7
White-faced tree duck	17,060	17,040	99.9
Garganey	7,450	6,910	92.7
Teal	140	110	78.6
Black headed gull	280	100	35.7
Lesser black- backed gull	760	500	65.8
Little gull	225	130	59.1

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FIG. 6: SEASONAL CHANGES IN NUMBERS OF SEASHORE BIRDS AT KETA LAGOON





## 6.3

## THREATS

Three main problems face the communities around the Keta lagoon. The first is the coastal erosion problem. Over the past 50 years, the coastline has receded by some 500 m (Dorbu, 1985). Many houses have been destroyed as a result of the erosion, causing many people to migrate from the district. The situation has led to disintegration of families and created serious social problems in the area. The second problem is the periodic inundation of the lagoon and its surroundings, leading to destruction of farms and major losses to human property. The third problem is the inadequacy of land high enough to enable construction of houses which will be safe from the lagoon floods. The narrow sand ridge on which the towns and villages are built is only c.2.5 km at its widest point and c.0.92 km at the narrowest portion (Dorbu, 1985).

The lagoon collects water from a large catchment. The sources of inflow into the lagoon are:

- (i) Run-off from the Todzie River which enters and fills the Avu lagoon in wet years and overflows into the Keta lagoon via several small tributaries.
- (ii) Run-off from Aka and Belikpa streams which enter Keta lagoon directly from the north.
- (iii) Interflow into the Keta lagoon from the Volta River.

Flow from the Volta River has become less important in the past 20 years owing to the regulation of flow of the Volta River by the Akosombo dam. It is estimated that 100% of the flood flow from the Aka/Belikpa river basin and 50% of the flood flow from the Todzie basin enter the Keta lagoon (Tahal Consulting Engineers, 1986).

The ecological changes which have affected the eastern coastline stretching from Tema through Togo and the western coast of Benin have been attributed to the construction of the Akosombo dam, among other factors. Changes which have occurred over the years following the construction of the dam include silting and blockage of the channels inter connecting the lagoons. This has affected the direct and natural drainage system that used to regulate the lagoon water levels. The only significant outlet of water from the lagoon is by evaporation, estimated at 1,500 mm annually (Tahal Consulting Engineers, 1986).

The result of the changes in the natural drainage system is that in the dry season, large areas of the lagoon and marshlands dry up, leaving small pools of hyper-saline water. In the wet season and during heavy rains, the water level in the lagoon become so high that houses and crops around the periphery of the lagoon become inundated.

Several committees have been set up and many consultants have been commissioned at various points in time to find a solution to the Keta lagoon problem. Proposals put forward for solving the problems include:

(i) establishment of structures and barriers on the sea-side for protection against the excessive erosion.

(ii) replacement of lost land on the sea-side by reclamation from the lagoon.

(iii) protection against the flooding caused by high lagoon water levels. Proposals for this include the provision of a permanent outlet from the Keta lagoon, to the sea for flood relief, which will also prevent drying up of the lagoon in periods of low rainfall by the admission of sea water into the lagoon. It is believed that a coupling of this with beach stabilization measures to counteract the strong sand erosion and deposition process would be able to contain the flood problem.

The developments being advocated in the above proposals will obviously affect the wetland ecosystem and the wildlife it supports. It is, however, very clear that any attempts at conserving the Keta wetland cannot succeed unless it first addresses the serious socio-ecological problems in the area. Huge sums of money are required to provide solutions to the problems. In 1986, Tahal Engineering Consultants estimated that an amount of US\$ 5.37 m. would be required to construct the flood control outlet and associated jetties. The international ornithological importance of the Keta lagoon no doubt warrants its designation as a Ramsar site. But this is definitely a case where conservation should be used for development and for improvement of the quality of life for a people whose very existence, cultural identity and total environment is severely threatened.

#### 6.4 MANAGEMENT STRATEGY

We do not, at the present moment, know enough about the ecological processes and sociological forces operating in the Keta wetland to even attempt to draw up management plans for the site.

We can, however make two recommendations and define what these entail:

(1) It is recommended that the Keta Lagoon Complex should be established as a Ramsar site. Thereafter, the Ramsar concept of wise use of wetlands should be exploited to develop and manage the site to enhance its ecological value for the benefit of the local communities.

The proposed Anlo-Keta Ramsar Site covers c. 530 km<sup>2</sup> and includes the Keta, Angaw and Avu lagoons and their surrounding flood plains and the mangrove swamps east of the Volta River (Fig.13). The Volta River forms the western boundary, while the northern and north-eastern boundaries are delineated by the road from Sogakope through Akatsi and Abor to Denu. The boundaries should be properly demarcated and described to enable legal designation of the site as a Ramsar site.

The area is heavily settled and it would be necessary to define a zonation scheme for effective management. This, however, can only be done after detailed studies on human usage of the wetland and detailed mapping of the use of the wetland habitat by birds.

(2) It is further recommended that detailed studies of relevant aspects of the Anlo-Keta wetland ecosystem should be commissioned to enable development of appropriate management strategy for the site.

The relevant studies would include:

(i) Assessment of the human usage of the wetland and the contribution of wetland resources in the socio-economic life of the communities in the proposed Ramsar site. Particular attention should be paid to fisheries resources, (including proposals for shrimp farming developments), salt mining, mangrove exploitation and flood plain farming.

(ii) Complete assessment of the ornithological importance of the Anlo-Keta wetland and detailed mapping of important bird areas within the wetland.

(iii) Collation of the various studies undertaken on the Keta coastal erosion and inundation problem; and the various solutions proposed, with the aim of recommending appropriate solution.

A team of consultants comprising a wetland ecologist, and ornithologist, a hydrologist, and a socio-economist would be required to undertake the study. The expertise of a fisheries specialist and a botanist would also be required. The information from the study should enable development of a more comprehensive management strategy for the Anlo-Keta Ramsar Site.

**SECTION 7****TRAINING NEEDS, TECHNICAL  
ASSISTANCE AND IMPLEMENTATION  
PROGRAMME**

## 7. TRAINING NEEDS, TECHNICAL ASSISTANCE AND IMPLEMENTATION PROGRAMME

### 7.1. TRAINING

The success of the coastal wetlands conservation programme being advocated, will depend on the availability of qualified local manpower to carry out the work. There is, however, very little expertise for wetlands management within the Department of Game and Wildlife (GW). The limited expertise in wetland management available in the Department has resulted mainly from training programmes and initiatives of the Save the Seashore Birds Project (SSBP-G). Training should therefore be an important component of the project and funds should be made available for the identified training needs.

In designing or selecting training programmes, the need for training in community relations should be borne in mind. The training hitherto given to staff of GW does not welcome or promote local participation in wildlife management. The staff see themselves as "policemen", protecting wildlife resources from the people and their approach is to keep the local communities out of protected areas. The management strategy advocated for the coastal wetlands seeks to adopt a multiple use approach, and encourages support and participation of local people. Staff assigned to the programme should therefore, in addition to the training in wetlands management, be trained in community relations. This would ensure a change in the current attitude of the staff and promote good working relationship with the communities living in and around the proposed Ramsar sites.

Facilities for post graduate training in wetland management is currently not available in Ghana. Training would therefore have to be provided outside the country in the initial stages. The possibility of developing wetland programmes in local universities should, however, be explored when the project takes off and there is demand for more trained personnel.

Three levels of training are recommended initially:

(i) 1 - 2 year MSc./M. Phil Course in Wetlands Management for the programme Coordinator. Such a course is presently not available locally, but a number of British and American institutions offer suitable courses.

(ii. a) 10 - 12 week intensive short courses in wetlands conservation for the four site wardens. Such courses are also not available locally, but suitable places can be found outside. The Department of Game and Wildlife already has some experience of the Coastal and Marine Parks and Protected areas course organised by the U.S. National Park Service and the Rosentiel School of Marine and Atmospheric Science, University of Miami.

(ii. b) 10 - 12 week short course in conservation education

for the conservation education officer. The International Centre for Conservation Education (ICCE) U.K., offers a suitable programme.

(iii) 2 - 3 week short courses in wetlands management and waterfowl census for the wardens, rangers and community wildlife assistants. These courses should be organised locally. The SSBP-G has organised similar courses in conjunction with the Zoology Department, University of Ghana, the Royal Society for the Protection of Birds (RSPB) and the International Wetland and Waterfowl Research Bureau (IWRB); and it should be possible to get the SSBP-G to organise similar training programmes for the staff. The community relations training component could either be incorporated in this training programme; or be taken up separately in short training seminars.

## 7.2 TECHNICAL ASSISTANCE

A strong scientific data base would be required for effective management of the coastal wetlands. The areas where data are required have been defined for each site. The implementing agency for the programme, the Department of Game and Wildlife, however, has neither adequate staff nor the expertise to undertake all the research required. It would therefore be necessary to bring in outside expertise. Most of the expertise required are available locally, but allowance has also been made for the occasional instances where expertise may not be available in the country.

It is recommended that a Senior Technical Advisor should be appointed to supervise the execution of the programme. He/she would provide technical direction, identify experts and ensure that the required research and the management actions outlined are efficiently executed. In addition to the Technical Advisor, the following experts would be required for varying terms at different periods of the project life:

### International:

Wetland Ecologist.

### Local:

Hydrologist  
 Aquatic biologist  
 Fisheries/Aquaculture Specialist  
 Ornithologist  
 Vertebrate Zoologist  
 Botanist  
 Socio-economist  
 Development/Land use Planner.

These experts should be contracted on consultancy basis to undertake the various baseline studies defined. There would be a need to retain some of the experts to define and establish

mechanisms for collection and analysis of routine data on key biological and physical indicators of wetland health. Selection of the parameters for long term monitoring would depend on the findings of the baseline studies, but it is certain that the expertise of the Hydrologist, Aquatic Biologist, Fisheries/Aquaculture Specialist and Ornithologist would be required.

It is estimated that a total of 12 man-months would be required in foreign technical assistance and 260 man-months in local consultancies. Details of these are provided below:

#### 1. INTERNATIONAL:

Wetland Ecologist: 12 man months over the five year period.

#### 2. LOCAL

- (i) Senior Technical Advisor : 30 man months.
- (ii) Baseline studies: 71 man months (details in table 11).
- (iii) Monitoring: 159 man months.

**Table 11. Technical Assistance required for Baseline Studies**

Expertise	Man months required for				
	Muni	Songor	Sakumo	Densu delta	Keta
Hydrologist	2	4	2	2	4
Aquatic Biologist	2	4	2	2	4
Fisheries/Aquaculture Specialist	-	3	-	1	4
Ornithologist	2	3	2	2	4
Vertebrate Zoologist	2	-	-	-	-
Botanist	2	2	1	1	3
Socio Economist	-	2	-	-	4
Development Planner	-	2	-	-	3

#### 7.3. PROGRAMME OF IMPLEMENTATION

The management actions recommended would need to be phased out over a period of time for efficient execution. Table 12 outlines the recommended implementation programme.







**SECTION 8**  
**COST ESTIMATES**

## 8. COST ESTIMATES

### 8.1 INTRODUCTION

The project has a 5-year horizon. The estimates involve both capital and recurrent expenditures for the five components, namely Programme Co-ordination, Muni, Songor, Sakumo/Densu delta and Keta. The total cost of the entire project comes to ₦2,014 million or \$5.8 million. The costs of the respective sites as a proportion of total cost are as follows: Keta, 38%; Co-ordination, 26%; Songor, 19%; Sakumo/Densu delta, 9%; and Muni, 8%.

### 8.2 CAPITAL EXPENDITURES

The capital cost of the project is the largest cost component accounting for 91% of the total cost. For individual sites, the capital cost ranges from a high of 94% for Keta to a low of 85% for Sakumo. Apart from Programme Co-ordination, the capital component of the four sites are made up of buildings, roads, equipment, vehicles and habitat enhancement. Roads and habitat enhancement take up the largest share. It is only Sakumo which does not have a road component. Thus, the largest share of the capital expenditures are a benefit to the people in the area.

The highest capital expenditures are for Keta with road construction and habitat enhancement accounting for 40% and 37% respectively, of the total capital cost.

Technical assistance (local and foreign) takes 51% of programme co-ordination while training is 8%. This technical assistance goes to support the four sites since studies have to be conducted.

### 8.3 RECURRENT COST

The components of the recurrent cost for all sites and for programme co-ordination are salaries and allowances, operating costs, repairs and maintenance. Operating costs, consisting of extension and labour cost is the largest cost component for all the 5 projects.

### 8.4 PROGRAMME SUSTAINABILITY

It is assumed that the recurrent cost which is about 9% of total cost is made up of local cost component which can be supported by government budgetary sources. Capital expenditures consist almost of foreign exchange component. What needs to be investigated in terms of sustainability is to consider those items that have to be repaired and those to be replaced. The items that need to be replaced are mainly vehicles and equipment. Using a straight line depreciation and considering a 5-year horizon, a provision of about \$64,000 a year for the whole project with a slight adjustment to take care of inflation should be considered.

It is worthwhile to take 1% of the remaining capital cost for repair

## 8.5 COST TABLES

Details of costings for the various components of the project are provided in the cost tables which follow. The costs of the major constructional works, namely, sluices at Sakumo and Densu delta, erosion and flood control works at Keta, and possible sluices/embankments at Songor, have not been included in the budget submitted. These require detailed feasibility studies before costings can be provided.

Component	BIODIVERSITY		Exchange rate		350								
Sub-component	Coastal management												
Costab	A: Programme co-ordination												
Category Item	Unit	Curr	Unit Cost ('000)	Project year					Total		Total		
				1	2	3	4	5	Cedi ('000)	US\$ ('000)	US\$ ('000)	%	
<b>CAPITAL</b>													
Equipment											56	4%	
Office and furniture	Set	Cedi	750	2						1,500	4.286		
Computer	Set	Cedi	3250	1						3,250	9.286		
Photocopier	Set	US\$	2	1						700	2.000		
Extn and trng	Set	Cedi	7150	1	.25	.25	.25	.25		14,300	40.857		
Vehicles											40	3%	
Pickup 4WD	Veh	US\$	20	2						14,000	40.000		
Training: Overseas											90	6%	
Coordinator	Course	US\$	20		1	1				14,000	40.000		
Education Officer	Course	US\$	10	1						3,500	10.000		
Wardens	Course	US\$	10	2	1	1				14,000	40.000		
Training: local	Course	Cedi	500	10		10				10,000	28.571	2%	
Technical assistance: International											150	10%	
Wetland ecology	Month	US\$	12.5	2	4	2	2	2		52,500	150.000		
Technical assistance: Local											615	41%	
Sen Technical Adviser	Month	US\$	2.1	6	6	6	6	6		22,050	63.000		
Baseline	Month	US\$	2.1	50	30					58,800	168.000		
Monitoring	Month	US\$	2.1	15	42	42	42	42		134,505	384.300		
BORS											350	23%	
Foreign	Month	US\$	12.5		24					105,000	300.000		
Local	Month	US\$	2.1		24					17,640	50.400		
<b>Total</b>										<b>465,745</b>	<b>1,330.700</b>	<b>1331</b>	<b>89%</b>
<b>RECURRENT</b>													
Salaries and allowances											20	1%	
Coordinator		Cedi	375	1	1	1	1	1		1,075	5.357		
Education Officer		Cedi	350	1	1	1	1	1		1,750	5.000		
Secretary		Cedi	180	1	1	1	1	1		900	2.571		
Data entry		Cedi	500	.25	.25	.25	.25	.25		625	1.786		
Driver		Cedi	180	2	2	2	2	2		1,800	5.143		
Repairs and maintenance											24	2%	
Equipment 5 % p.a.		Cedi		595	595	595	595	595		2,975	8.500		
Vehicles 7.5 % p.a.		US\$		3	3	3	3	3		5,250	15.000		
Operating costs											123	8%	
Monitoring studies		US\$		29.82	32.76	20.16	20.16	20.16		43,071	123.060		
<b>Total</b>										<b>58,246</b>	<b>166.417</b>	<b>166</b>	<b>11%</b>

Component	BIODIVERSITY		Exchange rate		350								
Sub-component	Coastal management												
Costab	B: Muni lagoon development plan												
Category Item	Unit	Curr	Unit Cost ('000)	Project year					Total		Total		
				1	2	3	4	5	Cedi ('000)	US\$ ('000)	US\$ ('000)	x	
<b>CAPITAL</b>													
<b>Buildings</b>												83	17x
Edugn centre/office	m <sup>2</sup>	Cedi	80	120					9,600	27.429			
Staff accomodation	m <sup>2</sup>	Cedi	80	100					8,000	22.857			
Observation posts	No	Cedi	800	2	1				2,400	6.857			
Sanitation units	Units	Cedi	900	2	4	4			9,000	25.714			
<b>Roads</b>												125	26x
Construction	km	Cedi	12500	2.5					31,250	89.286			
Upgrading	km	Cedi	2500	2.5	2.5				12,500	35.714			
<b>Equipment</b>												7	1x
Office and furniture	Set	Cedi	750	1					750	2.143			
Furniture	Set	Cedi	100	1					100	.286			
Education/training	Set	Cedi	585	1					585	1.671			
Field	Set	Cedi	225	3					675	1.929			
Monitoring	Set	Cedi	380	1					380	1.086			
<b>Vehicles</b>												51	11x
Pickup 4WD	Veh	US\$	20	1					7,000	20.000			
Motorcycles	Veh	Cedi	400	1					400	1.143			
Tipper truck	Veh	Cedi	10000	1					10,000	28.571			
Boat	Veh	Cedi	500	1					500	1.429			
<b>Habitat enhancement</b>												154	32x
Boundary demarcation	List	Cedi	20000	1					20,000	57.143			
Enhancement	List	Cedi	8280	1					8,280	23.657			
Erosion control pltg	Ha	Cedi	38	80	80	80	80	80	15,000	42.857			
Restocking	List	Cedi	150		10	20	20	20	10,500	30.000			
<b>Total</b>									146,920	419.771	420	86x	
<b>RECURRENT</b>													
<b>Salaries and allowances</b>												15	3x
Warden	Year	Cedi	375	1	1	1	1	1	1,875	5.357			
Rangers	Year	Cedi	300	1	1	1	1	1	1,500	4.286			
Drivers	Year	Cedi	180	2	2	2	2	2	1,800	5.143			
<b>Operating costs</b>												11	2x
Labour	LS	Cedi	700	1	1	1	1	1	3,500	10.000			
Extension costs	List	Cedi	50	1	1	1	1	1	250	.714			
<b>Repairs and maintenance</b>												41	8x
Buildings 1 % p.a.	Year	Cedi		210	254	290	290	290	1,334	3.811			
Roads	Year	Cedi	50	2.5	2.5	2.5	2.5	2.5	13	.036			
Equipment 5 % p.a.	Year	Cedi		120	120	120	120	120	598	1.707			
Vehicles 7.5 % p.a.	Year	Cedi		1343	1343	1343	1343	1343	6,713	19.179			
Boundary maint	Year	Cedi	1125	1	1	1	1	1	5,625	16.071			
<b>Total</b>									23,207	66.304	66	14x	

Component	BIODIVERSITY			Exchange rate					350			
Sub-component	Coastal management											
Costab	C:			Songor lagoon development plan								
Category Item	Unit	Curr	Unit Cost ('000)	Project year					Total		Total	
				1	2	3	4	5	Cedi ('000)	US\$ ('000)	US\$ ('000)	%
<b>CAPITAL</b>												
<b>Buildings</b>										162	15%	
Field centre	m <sup>2</sup>	Cedi	80	240					19,200	54.857		
Staff accomodation	m <sup>2</sup>	Cedi	80	100					8,000	22.857		
Observation posts	No	Cedi	800	2	1				2,400	6.857		
Sanitation units	Units	Cedi	900	16	14				27,000	77.143		
<b>Roads</b>										514	47%	
Construction	km	Cedi	12500	10					125,000	357.143		
Upgrading/repair	km	Cedi	2500	12	10				55,000	157.143		
<b>Equipment</b>										18	2%	
Office and furniture	Set	Cedi	750	1					750	2.143		
Laboratory	Set	US\$	10	1					3,500	10.000		
Education/training	Set	Cedi	585	1					585	1.671		
Field	Set	Cedi	225	3					675	1.929		
Monitoring	Set	Cedi	380	2					760	2.171		
<b>Vehicles</b>										53	5%	
Pickup 4WD	Veh	US\$	20	1					7,000	20.000		
Motorcycles	Veh	Cedi	400	2					800	2.286		
Tipper truck	Veh	Cedi	10000	1					10,000	28.571		
Boat, trailer	Veh	Cedi	750	1					750	2.143		
<b>Habitat enhancement</b>										256	24%	
Boundary demarcation		Cedi	20000	2					40,000	114.286		
Erosion control pty	ha	Cedi	8280	6					49,680	141.943		
<b>Total</b>									351,100	1,003.143	1003	92%
<b>RECURRENT</b>												
<b>Salaries and allowances</b>										19	2%	
Warden	Year	Cedi	375	1	1	1	1	1	1,875	5.357		
Rangers	Year	Cedi	300	2	2	2	2	2	3,000	8.571		
Drivers	Year	Cedi	180	2	2	2	2	2	1,800	5.143		
<b>Operating costs</b>										21	2%	
Labour	LS	Cedi	700	2	2	2	2	2	7,000	20.000		
Extension	List	Cedi	50	2	2	2	2	2	500	1.429		
<b>Repairs and maintenance</b>										46	4%	
Buildings 1 % p.a.		Cedi		432	566	566	566	566	2,696	7.703		
Roads		Cedi	50	10	10	20	10	20	70	.200		
Equipment 5 % p.a.		Cedi		139	139	139	139	139	693	1.979		
Vehicles 7.5 % p.a.		Cedi		1391	1391	1391	1391	1391	6,956	19.875		
Boundary maint		Cedi	1125	1	1	1	1	1	5,625	16.071		
<b>Total</b>									30,215	86.328	86	8%

Component	BIODIVERSITY			Exchange rate					350			
Sub-component	Coastal management											
Costab	D:			Sakumo/Densu delta development plan								
Category Item	Unit	Curr	Unit Cost ( '000)	Project year					Total		Total	
				1	2	3	4	5	Cedi ( '000)	US\$ ( '000)	US\$ ( '000)	%
<b>CAPITAL</b>												
<b>Civil works</b>										199	39%	
Visitor centre	m <sup>2</sup>	Cedi	80	675					54,000	154.286		
Staff accomodation	m <sup>2</sup>	Cedi	80	100					8,000	22.857		
Observation posts	No	Cedi	800	1	2	2			4,000	11.429		
Sanitation units	Units	Cedi	900	2	2				3,600	10.286		
<b>Equipment</b>										10	2%	
Office and furniture	Set	Cedi	750	1					750	2.143		
Education/training	Set	Cedi	585	2					1,170	3.343		
Field	Set	Cedi	225	3					675	1.929		
Monitoring	Set	Cedi	380	2					760	2.171		
<b>Vehicles</b>										24	5%	
Pickup 4WD	Veh	US\$	20	1					7,000	20.000		
Motorcycles	Veh	Cedi	400	2					800	2.286		
Boat, trailer	Veh	Cedi	750	1					750	2.143		
<b>Habitat enhancement</b>										186	36%	
Boundary demarcation	List	Cedi	20000	2					40,000	114.286		
Enhancement	List	Cedi	8280	2					16,560	47.314		
Aquaculture	pond	Cedi	8500	1					8,500	24.286		
<b>Feasibility Studies</b>										17	3%	
Engineering/hydrology	months	US\$	2.1	8					5,880	16.800		
<b>Total</b>									152,445	435.557	436	85%
<b>RECURRENT</b>												
<b>Salaries and allowances</b>										21	4%	
Warden	Year	Cedi	375	1	1	1	1	1	1,875	5.357		
Asst Educ officer	Year	Cedi	300	1	1	1	1	1	1,500	4.286		
Rangers	Year	Cedi	300	2	2	2	2	2	3,000	8.571		
Drivers	Year	Cedi	180	1	1	1	1	1	900	2.571		
<b>Operating costs</b>										27	5%	
Labour	LS	Cedi	700	2	2	2	2	2	7,000	20.000		
Extension	LS	Cedi	50	10	10	10	10	10	2,500	7.143		
<b>Repairs and maintenance</b>										30	6%	
Buildings 1 % p.a.	Year	Cedi		646	680	696	696	696	3,414	9.754		
Equipment 5 % p.a.	Year	Cedi		168	168	168	168	168	839	2.396		
Vehicles 7.5 % p.a.	Year	Cedi		118	118	118	118	118	589	1.682		
Boundary maint	Year	Cedi	1125	1	1	1	1	1	5,625	16.071		
<b>Total</b>									27,242	77.833	78	15%
<b>Grand total</b>									179,687	513.390	513	100%



Component	BIO DIVERSITY		Exchange rate					350				
Sub-component	Coastal management											
Costab	E: Keta lagoon development plan											
Category Item	Unit	Curr	Unit Cost ('000)	Project year					Total		Total	
				1	2	3	4	5	Cedi ('000)	US\$ ('000)	US\$ ('000)	%
<b>CAPITAL</b>												
<b>Buildings</b>										296	14%	
Field centre	m <sup>2</sup>	Cedi	80	320					25,600	73.143		
Staff accomodation	m <sup>2</sup>	Cedi	80	200					16,000	45.714		
Observation posts	No	Cedi	800	10					8,000	22.857		
Sanitation units	Units	Cedi	900	40	20				54,000	154.286		
<b>Roads</b>										857	40%	
Construction	km	Cedi	12500	10	10				250,000	714.286		
Upgrading/repair	km	Cedi	2500	20					50,000	142.857		
<b>Equipment</b>										18	1%	
Office and furniture	Set	Cedi	750	2					1,500	4.286		
Education/training	Set	Cedi	585	2					1,170	3.343		
Field	Set	Cedi	225	9					2,025	5.786		
Monitoring	Set	Cedi	380	4					1,520	4.343		
<b>Vehicles</b>										61	3%	
Pickup 4WD	Veh	US\$	20	1					7,000	20.000		
Motorcycles	Veh	Cedi	400	8					3,200	9.143		
Tipper truck	Veh	Cedi	10000	1					10,000	28.571		
Boat,outboard	Veh	Cedi	1250	1					1,250	3.571		
<b>Habitat enhancement</b>										808	37%	
Boundary demarcation		Cedi	20000	10					200,000	571.429		
Erosion control planting		Cedi	8280	10					82,800	236.571		
<b>Total</b>								714,065	2,040.186	2040	94%	
<b>RECURRENT</b>												
<b>Salaries and allowances</b>										28	1%	
Warden		Cedi	375	1	1	1	1	1	1,875	5.357		
Rangers		Cedi	300	4	4	4	4	4	6,000	17.143		
Drivers		Cedi	180	2	2	2	2	2	1,800	5.143		
<b>Operating costs</b>										43	2%	
Labour	LS	Cedi	700	4	4	4	4	4	14,000	40.000		
Extension	List	Cedi	50	4	4	4	4	4	1,000	2.857		
<b>Repairs and maintenance</b>										58	3%	
Buildings 1 % p.a.		Cedi		856	1036	1036	1036	1036	5,000	14.286		
Roads		Cedi	50	10	20	20	20	20	90	.257		
Equipment 5 % p.a.		Cedi		311	311	311	311	311	1,554	4.439		
Vehicles 7.5 % p.a.		Cedi		1609	1609	1609	1609	1609	8,044	22.982		
Boundary maint		Cedi	1125	1	1	1	1	1	5,625	16.071		
<b>Total</b>								44,988	128.536	129	6%	
<b>Grand total</b>								759,053	2,168.721	2169	100%	

## 8.3 SUPPORTING TABLES FOR COST ESTIMATES

Table 8.1 Office Furniture and Equipment (Set)

Item	Quantity	Unit Cost Cedis	Total Cost Cedis
Manual Typewriter	1	250,000	250,000
Filing Cabinets	2	100,000	200,000
<b>Office Furniture</b>			
1. Desk	2	55,000	110,000
2. Chairs	6	8,333	50,000
3. Book Shelf	2	20,000	40,000
Sundries	-	-	100,000
<b>Grand Total</b>			<b>750,000</b>

Table 8.2 Computer Equipment (Set)

Item	Quantity	Unit Cost Cedis	Total Cost Cedis
UPS	1	325,000	325,000
Computer	1	1,625,000	1,625,000
Printer	1	650,000	650,000
Software	-	325,000	325,000
Others	-	325,000	325,000
<b>Grand Total</b>			<b>3,250,000</b>

Table 8.3 Training Equipment (Set)

Item	Quantity	Unit Cost Cedis	Total Cost Cedis
Film Projector Unit and Public Address System	1	2,600,000	2,600,000
Slide Projector	1	650,000	650,000
Screen	1	130,000	130,000
Generator	1	650,000	650,000
Binoculars	20	32,500	650,000
Telescopes	5	130,000	650,000
Photocopier	1	650,000	650,000
Camera	1	325,000	325,000
Education Books	100	6,500	650,000
Sundries	-	-	195,000
<b>Grand Total</b>			<b>7,150,000</b>

Table 8.4 In-country Training

Item	Cost Cedis
Tuition	4,290,000
Accommodation	90,000
Night Allowance (Participants)	30,000
Transport (Participants)	10,000
Transport (Course)	120,000
<b>Grand Total</b>	<b>4,540,000</b>

Table 8.5 Training/Education Equipment (Set)

Item	Quantity	Unit Cost Cedis	Total Cost Cedis
Display Shelving	4	20,000	80,000
Display Cabinet	2	100,000	200,000
Desk	1	55,000	55,000
Chairs	30	8,333	250,000
<b>Grand Total</b>			<b>585,000</b>

Table 8.6 Field Equipment (Set)

Item	Quantity	Unit Cost Cedis	Total Cost Cedis
Cutlass	1	3,250	3,250
Boots	1	6,500	6,500
Water bottles/ Utensils	1	3,250	3,250
Haversack	1	13,000	13,000
Telescope	1	130,000	130,000
Binoculars	1	32,500	32,500
Sundries		39,000	39,000
<b>Grand Total</b>			<b>227,500</b>

Table 8.7 Monitoring Equipment (set)

Item	Quantity	Unit Cost Cedis	Total Cost Cedis
Salinity Meter	1	130,000	130,000
Water Level Gauge	1	6,500	6,500
Weather Station	1	195,000	195,000
Sample Bottles	1,500	325	487,500
Grand Total			819,000

Table 8.8 Boundary Demarcation

Item	Quantity km	Unit Cost Cedis	Total Cost Cedis
Boundary Description and Survey	48.5	162,500	7,881,250
Pillars	40.0	100,000	4,000,000
Boundary Clearance	48.5	6,700	324,950
Sign Boards	10.0	50,000	500,000
Fire Break	13.5	60,000	810,000
Grand Total			13,516,200

Table 8.9 Habitat Enhancement/Management

Item	Quantity	Unit Cost Cedis	Total Cost Cedis
Nature Trails	4.5 km	6,700	30,150
Border Planting	24 km	187,500	4,500,000
Habitat Enhancement	100 ha	37,500	3,750,000
Erosion control Planting	400 ha	37,500	15,000,000
Grand Total			23,280,150

Table 8.10 Boundary Maintenance (Per year)

Item	Quantity km	Unit Cost Cedis	Total Cost Cedis
Boundary Clearance	48.5	6,700	324,950
Fire Break	13.5	60,000	810,000
Grand Total			1,134,950

## REFERENCES

- Altenburgh, W. Engelmoer, M. Mes R. & Piersma, T. 1982. Wintering Waders on the Banc d' Arguin, Mauritania. Report of The Netherlands Ornithological Mauritanian Expedition 1980. Stichting Veth totsteum aan Waddenonderzoek, Leiden.
- Agyepong, G. T. 1976. Erosion and pollution on the eastern coast of Ghana. Report submitted to the Environmental Protection Council, Accra.
- Agyepong, G. T., Yankson, P.W.K. and Ntiamoa-Baidu, Y. 1990. Coastal Zone Indicative Management Plan. Report prepared for the Environmental Protection Council. Accra.
- Biney, C.A. 1982. Preliminary survey of the state of pollution of the coastal environment of Ghana. Oceanologica Acta (Special volume), pp. 39 - 43.
- Biney, C.A. 1986. Preliminary physico-chemical studies of lagoons along the Gulf of Guinea in Ghana, Tropical Ecology 27, 147 - 156.
- Dorbu, V.L. 1985. Engineering review and recommendation for Solving the Keta Sea erosion problem. Dorbu & Associates Clairton PA 15025 47 p. Illustrated.
- Dugan, P.J. 1990. Wetland Conservation, A Review of Current Issues and Required Action. 96p. IUCN.
- Gordon, C. 1987. Coastal lagoons of Ghana. In M.J. Burgis and J.J. Symoens Ed. African wetlands and shallow water bodies
- Gordon, C. 1989. Traditional fisheries management in the Amansuri Wetland. Ghana. In: Marchand, M. and Udo De Haes, H.A. (Eds) The People's Role in Wetland Management. Proceedings of the International Conference, Leiden, The Netherlands.
- Grimes, L. 1974. Radar tracks of Palaearctic waders departing from the coast of Ghana in spring. Ibis, 116, 165-171.
- Grimes, L. 1987. The Birds of Ghana, an annotated check-list. B.O.U. Check-list No. 9, 276p
- Kwei, E.A. 1978. Food and spawning activity of Caranx hippos (L) off the coast of Ghana. J. nat. Hist., 12: 195 - 215.
- Macdonald, M.A. 1978. Seasonal changes in numbers of waders at Cape Coast, Ghana. Bull. Nigerian Orn. Soc., 14 (45), 28-35
- Mensah, M.A., 1979. The hydrology and fisheries of the lagoons and estuaries of Ghana. Mar. Fish. Res. Rep. No.7.

- Ministry of Agriculture, 1989. Medium-Term Agricultural Development Plan (MTADP). Fisheries Sector Action Programme. Ministry of Agriculture. Accra.
- Nedeco, 1982. Outfall Keta Lagoon. Delft Hydraulics Laboratory report on Model investigations. Report M 1613. Ministry of Foreign affairs of the Netherlands, Directorate General for international Cooperation p.
- Ntiamoa-Baidu, Y. 1988. Three years of saving Seashore Birds in Ghana. SSBP-G Publ. No.2.
- Ntiamoa-Baidu, Y. 1991. Conservation of coastal lagoons in Ghana: The traditional approach. Landscape and Urban Planning, 20. 41-46
- Ntiamoa-Baidu, Y. 1991. Seasonal changes in the importance of Coastal wetlands in Ghana for wading Birds. Biological conservation 57.
- Ntiamoa-Baidu, Y. (In press). Multiple use approach to coastal wetland conservation: case studies from Ghana Proceedings of the International Seminar on Coastal Wetlands Conservation and Coastal Zone Planning, their Contribution to Sustainable Development in West Africa, Senegal, November 1987.
- Ntiamoa-Baidu, Y. & Hepburn, I.R. 1988. Wintering waders in coastal Ghana. RSPB Cons. Review. 2:85-8.
- Pauly, D. 1975. On the ecology of a small West African lagoon Ber. dt wiss. Komm. Meeresforsch 24: 46 - 62.
- Scura, E.E. 1988. Ghana Shrimp farming for Export. Mission report. Project No GHA/50/08.ITC/DTC/88/898.
- Smit, Cor. J. & Piersma, T. 1989. Numbers, midwinter distribution and migration of wader population using the East Atlantic Flyway. In Flyways and Reserve Networks for Water Birds. ed. by H. Boyd & J.Y. Pirot. IWRB Spec. Publ, No. 9, 24-63.
- SSBP-G, 1987. Draft management plans for three coastal sites in Ghana. Unpublished.
- Statistical Services, 1989. 1984 Population census of Ghana. Report on Localities by Local Authorities. Statistical Services, Accra, Ghana.
- Toth, E.F., and Toth, K.A. 1976. Coastal National Park site selection survey. Dept. of Game and Wildlife, Mimeo.
- Tahal Consulting Engineers 1986. An appraisal of a flood control outfall for Keta Lagoon. Report prepared for Diamond Shamrock Africa petroleum Accra.

**APPENDICES**

APPENDIX 1. List of seashore bird species recorded at the proposed Ramsar sites.

SPECIES	Muni	Songor	Sakumo	Densu Delta	Keta
<b>SHOREBIRDS (WADERS)</b>					
Painted snipe					
<u>Rostratula benghalensis</u>	-	-	-	-	+
African jacana					
<u>Actophilornis africana</u>	-	+	+	+	+
Oystercatcher					
<u>Haematopus ostralegus</u>	+	-	-	+	-
Black-winged stilt					
<u>Himantopus himantopus</u>	+	+	+	+	+
Avocet <u>Recurvirostra avosetta</u>	+	+	+	+	+
Senegal thicknee					
<u>Burhinus senegalensis</u>	+	+	-	-	-
Collared pratincole					
<u>Glareola pratincola</u>	+	+	+	+	+
Senegal wattled plover					
<u>Vanellus senegalensis</u>	+	+	+	-	+
Spur-winged plover					
<u>Vanellus spinosus</u>	-	-	+	-	+
Golden plover					
<u>Pluvialis apricaria</u>	-	-	+	-	-
Grey plover					
<u>Pluvialis squatarola</u>	+	+	+	+	+
Kentish plover					
<u>Charadrius alexandrinus</u>	-	-	-	-	-
Little ringed plover					
<u>Charadrius dubius</u>	-	+	-	-	-
Ringed plover					
<u>Charadrius hiaticula</u>	+	+	+	+	+
Kittlitz's sandplover					
<u>Charadrius pecuarius</u>	+	+	+	+	+
White-fronted sandplover					
<u>Charadrius marginatus</u>	+	+	+	+	+
Black-tailed godwit					
<u>Limosa limosa</u>	+	+	+	+	+
Bar-tailed godwit					
<u>Limosa lapponica</u>	+	+	+	+	+
Whimbrel <u>Numenius phaeopus</u>	+	+	+	+	+
Curlew <u>Numenius arquata</u>	+	+	+	+	+
Spotted redshank					
<u>Tringa erythropus</u>	+	+	+	+	+
Redshank <u>Tringa totanus</u>	+	+	+	+	+
Marsh sandpiper					
<u>Tringa stagnatilis</u>	+	+	+	+	+
Greenshank <u>Tringa nebularia</u>	+	+	+	+	+
Lesser Yellow Legs					
<u>Tringa flavipes</u>	-	-	-	-	-
Green sandpiper					
<u>Tringa ochropus</u>	-	-	-	+	-
Wood sandpiper					
<u>Tringa glareola</u>	+	+	+	+	+
Terek sandpiper <u>Xenus cinereus</u>	-	-	-	-	+
Common sandpiper					
<u>Actitis hypoleucos</u>	+	+	+	+	+
Pectora sandpiper					
<u>Calidris melanotos</u>	-	-	+	-	-
Broad billed sandpiper					
<u>Limicola falcinellus</u>	+	+	-	-	+
Turnstone <u>Arenaria interpres</u>	+	+	+	+	+
Common snipe					
<u>Gallinago gallinago</u>	-	-	+	-	+
Knot <u>Calidris canutus</u>	+	+	+	+	+
Sanderling <u>Calidris alba</u>	+	+	+	+	+
Little stint <u>Calidris minuta</u>	+	+	+	+	+



## APPENDIX 1 CONT.

<u>Temminck's stint</u>					
<u>Calidris temminckii</u>	-	-	+	-	-
<u>Dunlin Calidris alpina</u>	+	+	-	+	+
<u>Curlew sandpiper</u>					
<u>Calidris ferruginea</u>	+	+	+	+	+
<u>White-rumped sandpiper</u>					
<u>Calidris fuscicollis</u>	-	-	-	-	-
<u>Buff-breasted sandpiper</u>					
<u>Tryngites subruficollis</u>	-	+	-	-	-
<u>Ruff Philomachus pugnax</u>	-	+	+	+	+
<b>TERNS AND GULLS</b>					
<u>Gull-billed tern</u>					
<u>Gelochelidon niloticus</u>	-	+	-	+	+
<u>Caspian tern Sterna caspia</u>	+	+	-	+	+
<u>Royal tern Sterna maxima</u>	+	+	+	+	+
<u>Lesser crested tern</u>					
<u>Sterna bengalensis</u>	-	-	-	-	-
<u>Sandwich tern</u>					
<u>Sterna sandvicensis</u>	+	+	+	+	+
<u>Roseate tern Sterna dougallii</u>	+	+	+	+	+
<u>Common tern Sterna hirundo</u>	+	+	+	+	+
<u>Sooty tern Sterna fuscata</u>	+	+	+	+	-
<u>Damara tern Sterna balaenarum</u>	-	+	-	-	-
<u>Little tern Sterna albifrons</u>	+	+	+	+	+
<u>Whiskered tern</u>					
<u>Chlidonias hybridus</u>	-	+	-	+	+
<u>Black tern Chlidonias niger</u>	+	+	+	+	+
<u>White-winged black tern</u>					
<u>Chlidonias leucopterus</u>	-	-	+	+	+
<u>Brown noddy Anous stolidus</u>	-	+	-	-	+
<u>Little gull Larus minutus</u>	-	+	+	+	+
<u>Black headed gull Larus ridibundus</u>	+	+	+	+	+
<u>Grey headed gull</u>					
<u>Larus cirrocephalus</u>	-	-	-	-	-
<u>Lesser black backed gull</u>					
<u>Larus fuscus</u>	+	+	+	+	+
<u>Skimmer Rynchops flavirostris</u>	-	+	+	+	-
<u>Pomarine skua</u>					
<u>Stercorarius pomarinus</u>	-	-	-	+	+
<u>Arctic skua</u>					
<u>Stercorarius parasiticus</u>	-	-	-	-	-
<b>HERONS AND DUCKS</b>					
<u>Little grebe</u>					
<u>Tachybaptus ruficollis</u>	-	-	+	+	+
<u>Long-tailed cormorant</u>					
<u>Phalacrocorax africanus</u>	-	+	+	+	+
<u>Little bittern</u>					
<u>Ixobrychus minutus</u>	-	+	+	+	+
<u>Dwarf bittern</u>					
<u>Ixobrychus sturmii</u>	-	-	+	+	+
<u>Squacco heron</u>					
<u>Ardeola ralloides</u>	-	-	+	+	+
<u>Green-backed heron</u>					
<u>Butorides striatus</u>	+	+	+	+	+
<u>Black heron</u>					
<u>Egretta ardesiaca</u>	-	+	+	+	+
<u>Night heron</u>					
<u>Nycticorax nycticorax</u>	-	-	-	-	+
<u>Western reef heron</u>					
<u>Egretta gularis</u>	+	+	+	+	+
<u>Little egret</u>					
<u>Egretta garzetta</u>	+	+	+	+	+
<u>Yellow-billed egret</u>					
<u>Egretta intermedia</u>	-	-	+	+	+
<u>Great White egret</u>					
<u>Egretta alba</u>	+	+	+	+	+

## APPENDIX 1 CONT.

Purple heron <u>Ardea purpurea</u>	-	-	+	+	+
Grey heron <u>Ardea cinerea</u>	+	+	+	+	+
Cattle egret <u>Bubulcus ibis</u>	-	-	-	-	-
Glossy ibis					
<u>Plegadis falcinellus</u>	-	-	+	-	+
Sacred ibis					
<u>Threskiornis aethiopicus</u>	-	-	+	-	+
Spoon bill <u>Platalea alba</u>	-	+	+	-	+
White necked stork					
<u>Ciconia episcopus</u>	-	-	-	-	-
Wood ibis <u>Ibis ibis</u>	-	-	-	-	-
Fulvous tree duck					
<u>Dendrocygna bicolor</u>	-	-	+	-	+
White-faced tree duck					
<u>Dendrocygna viduata</u>	-	+	+	+	+
Northern pintail <u>Anas acuta</u>	-	-	+	-	+
Garganey <u>Anas querquedula</u>	-	-	+	-	+
Shoveler <u>Anas clypeata</u>	-	-	+	-	-
Teal <u>Anas capensis</u>	-	-	+	-	+
Common pochard					
<u>Aythya ferina</u>	-	-	-	-	-
Common shelduck					
<u>Tadorna tadorna</u>	-	-	-	-	-
Pygmy goose <u>Nettion curvirostris</u>	-	-	-	-	+
Egyptian goose					
<u>Alopochen aegyptiaca</u>	-	-	-	-	+
Spur-winged goose					
<u>Plectropterus gambensis</u>	-	-	-	-	+
Pink backed pelican					
<u>Pelecanus rufescens</u>	-	+	-	-	+
Finfoot <u>Podiceps senegalensis</u>	-	-	-	-	-

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APPENDIX 2. Criteria for identifying wetlands of international importance: The Convention on Wetlands of International Importance, especially as Waterfowl Habitat (RAMSAR CONVENTION).

### Introduction

Article 2.1 of the Convention states that "Each Contracting Party shall designate suitable wetlands within its territory for inclusion in a "List of Wetlands of International Importance". The guidance provided by the Convention text on identification of "wetlands of international importance is in Article 2.2, which refers to "international significance in terms of ecology, botany, zoology, limnology or hydrology" and indicates that "In the first instance, wetlands of international importance to waterfowl at any season should be included". The Criteria set out below, which have been approved by meetings of the Conference of the Contracting Parties, are for identifying wetlands of international importance.

### Criteria

A wetland is identified as being of international importance if it meets at least one of the criteria set out below:

#### 1. Criteria for representative or unique wetlands

A wetland should be considered internationally important if:

- (a) it is a particularly good representative example of a natural or near-natural wetland, characteristic of the appropriate biogeographical region;
- or (b) it is a particularly good representative example of a natural or near-natural wetland, common to more than one biogeographical region;
- or (c) it is a particularly good representative example of a wetland, which plays a substantial hydrological, biological or ecological role in the natural functioning of a major river basin or coastal system, especially where it is located in a trans-border position;
- or (d) it is an example of a specific type of wetland, rare or unusual in the appropriate biogeographical region.

#### 2. General criteria based on plants or animals

A wetland should be considered internationally important if:

- (a) it supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant or animal, or an appreciable number of individuals of any one or more of these species;

- or (b) it is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna;
- or (c) it is of special value as the habitat of plants or animals at a critical stage of their biological cycle;
- or (d) it is of special value for one or more endemic plant or animal species or communities.

### 3. Specific Criteria Based on Waterfowl

A wetland should be considered internationally important if:

- (a) it regularly supports 20,000 waterfowl;
- or (b) it regularly supports substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity;
- or (c) where data on populations are available, it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl.

### Guidelines for Application of the Criteria

To assist Contracting Parties in assessing the suitability of wetlands for inclusion on the List of Wetlands of International Importance, the Conference of the Contracting Parties has formulated the following guidelines for application of the Criteria:

- (a) A wetland could be considered of international importance under Criterion 1 if, because of its outstanding role in natural, biological, ecological or hydrological systems, it is of substantial value in supporting human communities dependent on the wetland. In this context, such support would include:
  - provision of food, fibre or fuel;
  - or maintenance of cultural values;
  - or support of food chains, water quality, flood control or climatic stability.

The support, in all its aspects, should remain within the framework of sustainable use and habitat conservation, and should not change the ecological character of the wetland.

- or (b) A wetland could be considered of international importance under Criterion 1, 2 or 3 if it conforms to additional guidelines developed at regional (e.g. Scandinavian or West African) or national level. Elaboration of such regional or national guidelines may be especially appropriate;

- where particular groups of animals (other than waterfowl) or plants are considered more suitable as a basis for evaluation;
- or where waterfowl and other animals do not occur in large concentrations (particularly in northern latitudes);
- or where collection of data is difficult (particularly in very large countries).

or (c) The "particular groups of waterfowl, indicative of wetland values, productivity or diversity" in Criterion 3 (b) include any of the following:

- loons or divers: Gaviidae;
- grebes: Podicipedidae;
- herons and bitterns: Ardeidae;
- storks: Ciconiidae;
- swans, geese and ducks (wildfowl): Anatidae;
- shorebirds or waders: Charadriidae; and
- terns: Sternidae.

or (d) The specific criteria based on waterfowl numbers will apply to wetlands of varying size in different Contracting Parties. While it is impossible to give precise guidance on the size of an area in which these numbers may occur, wetlands identified as being of international importance under Criterion 3 should form an ecological unit, and may thus be made up of one big area or a group of smaller wetlands. Consideration may also be given to turnover of waterfowl at migration periods, so that a cumulative total is reached, if such data is available.

APPENDIX 3. Climatic Data for proposed Ramsar sites (Average for the period 1981-1990)

A. SONGOR (ADA)

Mean Monthly Temp. (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	27.8	29.3	29.4	29.3	28.6	27.5	25.8	25.5	26.4	27.8	28.8	28.0
Mean Monthly Relative Humidity (%)												
0600h	87	88	89	89	90	91	93	94	92	90	89	90
1500h	65	69	72	73	74	77	79	78	77	75	72	70
Mean Monthly Rainfall (mm)												
	3.1	13.3	72.1	119.3	154.5	166.7	60.2	21.3	73.7	81.5	36.1	17.5

B. MUNI (APAH)

Mean Monthly Temp (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	26.8	27.9	28.3	28.6	27.7	26.2	25.1	25.0	26.0	26.6	27.0	26.9
Mean Monthly Rainfall (mm)												
	10.2	26.7	51.8	71.2	211.0	177.6	40.0	22.7	78.8	120.1	23.7	24.3

C. SAKUMO (TEMA)

Mean Monthly Temp. (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	27.4	28.2	28.4	28.4	27.8	26.6	25.3	25.0	25.6	26.8	27.8	27.4
Mean Monthly Relative Humidity (%)												
0600h	84	89	90	91	92	93	93	93	92	92	91	89
1500h	68	73	74	75	76	78	82	81	79	77	73	71
Mean Monthly Rainfall (mm)												
	2.8	18.6	36.7	63.0	109.6	131.3	43.2	16.2	65.1	56.3	10.2	25.4

## D. DENSU DELTA (ACCRA)

Mean Monthly Temp. (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	27.9	28.9	28.9	28.9	27.9	26.9	25.7	25.6	26.2	27.0	28.0	27.8
Mean Monthly Relative Humidity (%)												
0600h	89	91	92	93	93	94	94	94	93	95	94	91
1500h	54	60	62	66	69	75	75	73	72	71	67	62
Mean Monthly Rainfall (mm).												
	5.1	12.3	44.9	65.3	35.6	39.7	49.2	27.9	69.9	62.2	24.0	20.8

## E. KETA

Mean Monthly Temp. (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	27.3	28.4	28.5	28.9	27.9	26.4	25.9	25.9	26.9	27.1	27.4	27.5
Mean Monthly Relative Humidity (%)*												
0600h	82	80	78	77	79	84	81	83	82	79	80	80
1500h	67	65	65	67	71	76	73	74	74	70	69	67
Mean Monthly Rainfall (mm)												
	1.9	15.1	57.9	78.5	124.2	170.5	72.6	17.3	77.3	57.4	15.1	7.7

\* Relative humidity data for period 1969-1978.

APPENDIX 4. Population Data for Villages/Towns within the Proposed Ramsar Sites (1984 Census)

A. SONGOR

Town/Village	Total	Male	Female
Sege	1,955	957	998
Sege Mataheko	143	68	75
Sege Nakomkope	470	239	231
Akplabanya	2,771	1,328	1,443
Anyaman	2,739	1,232	1,507
Kposem	101	50	51
Goi (Okowesisi)	3,348	1,420	1,928
Abuanokope (Abuanor)	72	38	34
Lolonya	2,284	1,044	1,240
Kpotitse Korpe (Kpotise)	205	104	101
Kablevu	94	46	48
Agbedrafor	226	116	110
Bonikope (Boni)	706	319	387
Toflokpo - Salon	419	194	225
- Korblatserkope	55	24	20
- Kortkotser Kope	49	29	20
Kuluedor	2,572	1,256	1,316
Kuluedor (Mahiem)	319	147	172
Segese	385	177	208
Hwakpo	275	119	156
Luhuor	556	251	305
Luhuor Kponorwayo	109	49	60
Luhuor Kponorngua	73	33	40
Adokope (Addo korpe)	771	365	406
Amlakpo	698	330	368
Balekope (Bale)	103	48	55
Mangoase	29	15	14
Kopehem	167	79	88
Kaseh	2,550	1,194	1,356
Bedeku	809	394	415
Lufenya No.1 (Ayornuekope)	430	223	207
Lufenya Ahiaborkope No.2	42	25	17
Lufenya nwenekope	21	12	9
Midie	92	50	42
Aminapa	112	57	55
Totokpoe (Totope)	1,032	508	524
Pute	1,779	871	908
Kotobaabi	4	2	2
Tobloku	1,075	566	509
Kokusi	10	7	3
Wasakuse (Ngwa)	178	76	102
Dogo	541	258	283
Kunyanya	187	91	96
Totimekope	1,250	596	654
Kakintse Kope (Kakitse)	45	24	21
Dzabakukope (Dzabaku)	13	5	8
Atortokope (Atortor)	126	59	67
Tekpekope (Terkper)	14	6	8
Makatakope (Makata)	90	38	52



Tetsionye (Tetsonya)	36	18	18
Obane (New)	220	112	108
Obane (Old)	68	26	42
Luhuese	186	100	86
Kwalakpoyom	60	31	29
Alavanyo (Elavanya)	687	343	344
Patukope	399	175	224
Songutsokpar	462	217	245
Okisiekope (Okisse)	76	41	35
Ayikutsekope (Ayikutse)	12	7	5
Addedtselope (Adedetse)	206	98	108
Anyako (Anyakpor) (Nudakope)	603	260	343
Mataheko	82	43	39
Okansekope (Ocansey)	1,018	461	557
Otrokper	525	236	289
Adafoah	5,445	2,625	2,820
Big Ada	4,150	1,854	2,296
Gorm (Glome)	11	7	4
Dzetrokope (Dzeitro)	112	50	62
Senakikope (Senake)	26	16	10
Dikanya	69	31	38
Adonorkope (Addonor)	58	24	34
Matekope (Mate)	38	13	25
Dunukope (Dunu)	42	12	30

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**B. MUNI**


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Town/Village	Total	Male	Female
Winneba	27,105	12,429	14,676
Pomadze	458	217	241
Bewadze	195	91	104
Mankwadze	1,004	407	597
Onyadze	521	238	283
Gomoa Amamfi	85	53	32
Asebu	1,019	549	470
Ansaful	709	388	321
Mpota	151	67	84

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**C. SAKUMO**


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Town/Village	Total	Male	Female
Sakumono	1,386	685	701
Tema	100,052	49,066	60,986
Lashibi	507	246	261
Ashiaman	50,918	25,768	25,150
Tema Newtown	31,466	15,156	16,310

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## D. DENSU DELTA

Town/Village	Total	Male	Female
Aplaku	327	185	142
Bortianor	3,298	1,569	1,729
Chokome (Tsokome)	730	316	414
Dansoman	?	?	?
Faana	1,043	471	572
Gbegbeyise	?	?	?
Grefi	?	?	?
North Malam	299	162	137
Mendskrom	?	?	?
McCarthy Hill	630	323	307
Mpoase	?	?	?
Oblogo	625	327	298
Sampa	?	?	?
Tetegbu	938	454	484
Tunga	?	?	?
New Tetegbu	220	122	98
Weija	2,464	1,299	1,165
Mallam Quarry (Mallam)	4,943	2,536	2,407

## APPENDIX 5. List of common plant species recorded at Songor

**Grasses**

Andropogon gayanus  
Brachiaria falcifera  
Chloris barbata  
Heteropogon contortus  
Panicum maximum  
Rhynchelytrum repens  
Sporobolus robustus  
Vetiveria fulvibarbis

Aristida species  
Cenchrus echinatus  
Dactyloctenium aegyptium  
Imperata cylindrica  
Paspalum vaginatum  
Sporobolus pyramidalis  
Sporobolus. virginicus

**Sedges**

Cyperus articulatus  
Fimbristylis pilosa

Cyperus sp.  
Kylinga species

**Trees**

Azadirachta indica  
Diospyros mespiliformis  
Hyphaene thebaica  
Millettia thonningii

Dialium guineense  
Elaeophorbi drupifera  
Lonchocarpus cyanescens  
Zanthoxylum xanthoxyloides

**Shrubs**

Abutilon mauritianum  
Allophylus africanus  
Avicinnia africana  
Calotropis procera  
Cassia occidentalis  
Corchorus aestuans  
Dichrostachys cinerea  
Flacourtia indica  
G. mollis  
H. surattensis  
Jasminum dichotomum  
Opuntia species  
Pergularia daemia  
Sansevieria liberica  
Securinega virosa  
Sida acuta  
Triumfetta rhomboidea  
Uvaria chamae  
Vigna species

Agave sisalana  
Aloe buettneri  
Byrsocarpus coccineus  
Capparis erythrocarpos  
Chrysobalanus species  
Crotalaria retusa  
Ehretia cymosa  
Grewia carpinifolia  
Hibiscus micranthus  
Ipomoea pes-caprae  
Jatropha gossypifolia  
Passiflora glabra  
Ritchiea reflexa  
Schrankia leptocarpa  
Sesbania sesban  
Tephrosia purpurea  
Uraria picta  
Uvaria globosa  
Waltheria indica

**Herbs**

Acanthospermum hispidum  
Asystasia calycina  
Cassia mimosoides  
Cleome viscosa  
Croton lobatus  
Gloriosa superba

Alternanthera pungens  
Borreria species  
Cassia rotundifolia  
Commelina species  
Euphorbia heterophylla  
Gomphrena celosioides

Hyptis suaveolens  
Lemna purpusilla  
Merremia species  
Momordica charantia  
Nymphaea micrantha  
Polygala arenaria  
Pupalia lappacea  
Spigelia anthelmia  
Teramnus labialis  
Ludwigia species

Indigofera arrecta  
Indigofera hirsuta  
Mollugo nudicanlis  
Nymphaea lotus  
Physalis angulata  
Portulaca quadrifida  
Sesuvium portulacastrum  
Striga species  
Tribulus terrestris  
Zornia latifolia

APPENDIX 6. List of common species of plants recorded at Muni  
(Source: SSBP-G 1987)

**SEDGES**

Cyperus articulatus  
Cyperus maritimus  
Kyllinga sp.  
Pycneus polystachyos

Cyperus imbricatus  
Fimbristylis pilosa  
Mariscus alternifolius  
Remirea maritima

**GRASSES**

Brachiaria falcifera  
Eragrostis ciliaris  
Imperata cylindrica  
Panicum repens  
Rhynchelytrum repens  
Sporobolus pyramidalis  
Vetiveria fulvibarbis

Dactyloctenium aegyptium  
Heteropogon contortus  
Panicum maximum  
Paspalum vaginatum  
Setaria pallide-fusca  
Sporobolus virginicus

**FORBS**

Abrus precatorius  
Alternanthera maritima  
Asystasia calycina  
Canavalia rosea  
Cissus sp.  
Crinum sp.  
Euphorbia hirta  
Flagellaria guineensis  
Indigofera hirsuta  
Ipomoea turbinata  
Ludwigia octovalvis sp.  
brevisepala  
Oldenlandia corymbosa  
Passiflora glabra (foetida)  
Physalis angulata  
Rhynchosia sublobata

Abutilon mauritiamum  
Anchomanes difformis  
Borreria scabra  
Chromolaena odorata  
Commelina erecta  
Croton lobatus  
Exacum quinquenervium  
Gymnema sylvestre  
Ipomoea pes-caprae  
Ipomoea sp.  
Melothria sp.  
Paullinia pinnata  
Pedaliium murex  
Portulaca foliosa  
Sesuvium portulacastrum

**SHRUBS**

Allophylus africanus  
Byrsocarpus coccineus  
Clerodendrum  
Dichrostachys cinerea  
Flacourtia flavescens  
Hoslundia opposita  
Jatropha gossypifolia  
Mitragyna inermis  
Securinega virosa  
Vernonia amygdalina

Baphia nitida  
Chrysobalanus orbicularis  
Conocarpus erectus  
Ehretia cymosa  
Griffonia simplicifolia  
Jasminum dichotomum  
Mallotus oppositifolius  
Ritchiea reflexa  
Triumfetta rhomboidea

**TREES**

Azadirachta indica  
Phoenix reclinata

Cocos nucifera  
Zanthoxylum xanthoxyloides

APPENDIX 7. List of common plant species recorded at Sakumo  
(Source: SSBP-G 1987)

**SEDGES**

Cyperus articulatus  
Pycreus polystachyos

Kyllinga sp

**GRASSES**

Bothriochloa bladhii  
Chloris barbata  
Eriochla fatmensis  
Imperata cylindrica  
Paspalum orbiculare  
Sporobolus pyramidalis  
Vetiveria fulvibarbis

Brachiaria falcifera  
Dactyloctenium aegyptium  
Heteropogon contortus  
Panicum repens  
Paspalum vaginatum  
Sporobolus virginicus

**FORBS**

Alternanthera sessilis  
Indigofera sp.  
Ludwigia stolonifera  
Passiflora glabra  
(foetida)  
Physalis angulata  
Portulaca foliosa  
Sesbania sesban  
Talinum triangulare  
Vigna ambacensis

Canavalia rosea  
Ipomoea pes-caprae  
Melothria sp.  
Phyllanthus amarus

Pistia stratiotes  
Scoparia dulcis  
Sesuvium portulacastrum  
Typha domingensis  
Zornia latifolia

**SHRUBS**

Parkinsonia aculeata

**TREES**

Cocos nucifera

APPENDIX 8. List of common plant species recorded at Densu delta  
(Source: SSBP-G 1987)

**SEDGES**

Cyperus articulatus  
Cyperus rotundus  
Kyllinga sp

Cyperus imbtivsyud  
Fimbristylis pilosa  
Pycreus polystachyos

**GRASSES**

Andropogon gyanus  
Bothriochloa baladhii  
Cenchrus echinatus  
Cynodon dactylon  
Hyperthelia dissoluta  
Panicum maximum  
Setaria anceps  
Sporobolus robustus

Aristida adscensionis  
Brachiaria falcifera  
Chloris barbata  
Eragrostis ciliaris  
Imperata cylindrica  
Pennisetum subanqustum  
Sporobolus pyramidalis  
Vetiveria fulvibarbis

**FORBS**

Abutilon mauritianum  
Aspilia africana  
Cassia occidentalis  
Crinum sp.  
Euphorbia hirta  
Gloriosa superba  
Leptadenia hastata  
Phyllanthus amarus  
Schwenckia americana  
Sesuvium portulacastrum  
Sida cordifolia  
Vernonia cinerea

Alternanthera pungens  
Cassia mimosoides  
Cleome viscosa  
Croton lobatus  
Elagellaria guineensis  
Indigofera hirsuta  
Oldenlandia corymbosa  
Schrankia leptocarpa  
Sesbania sesban  
Sida alba  
Sida rhombifolia  
Waltheria indica

**SHRUBS**

Byrsocarpus coccineus  
Clausena anisata  
Dichrostachys cinerea  
Flacourtia flavescens  
Jasminum dichotomum  
Paullinia pinnata  
Ritchiea reflexa

Carissa edulis  
Dichapetalum madagascariense  
Ehretia cymosa  
Grewia carpinifolia  
Mitragyna inermis  
Rhizophora racemosa  
Securinega virosa

**TREES**

Azadirachta indica  
Cocos nucifera  
Phoenix reclinata

Borassus aethiopum  
Elaeis guineensis  
Zanthoxylum xanthoxyloides

**MAPS**



Fig.1 MAP OF COASTAL GHANA SHOWING THE SSB P-G SURVEY SITES

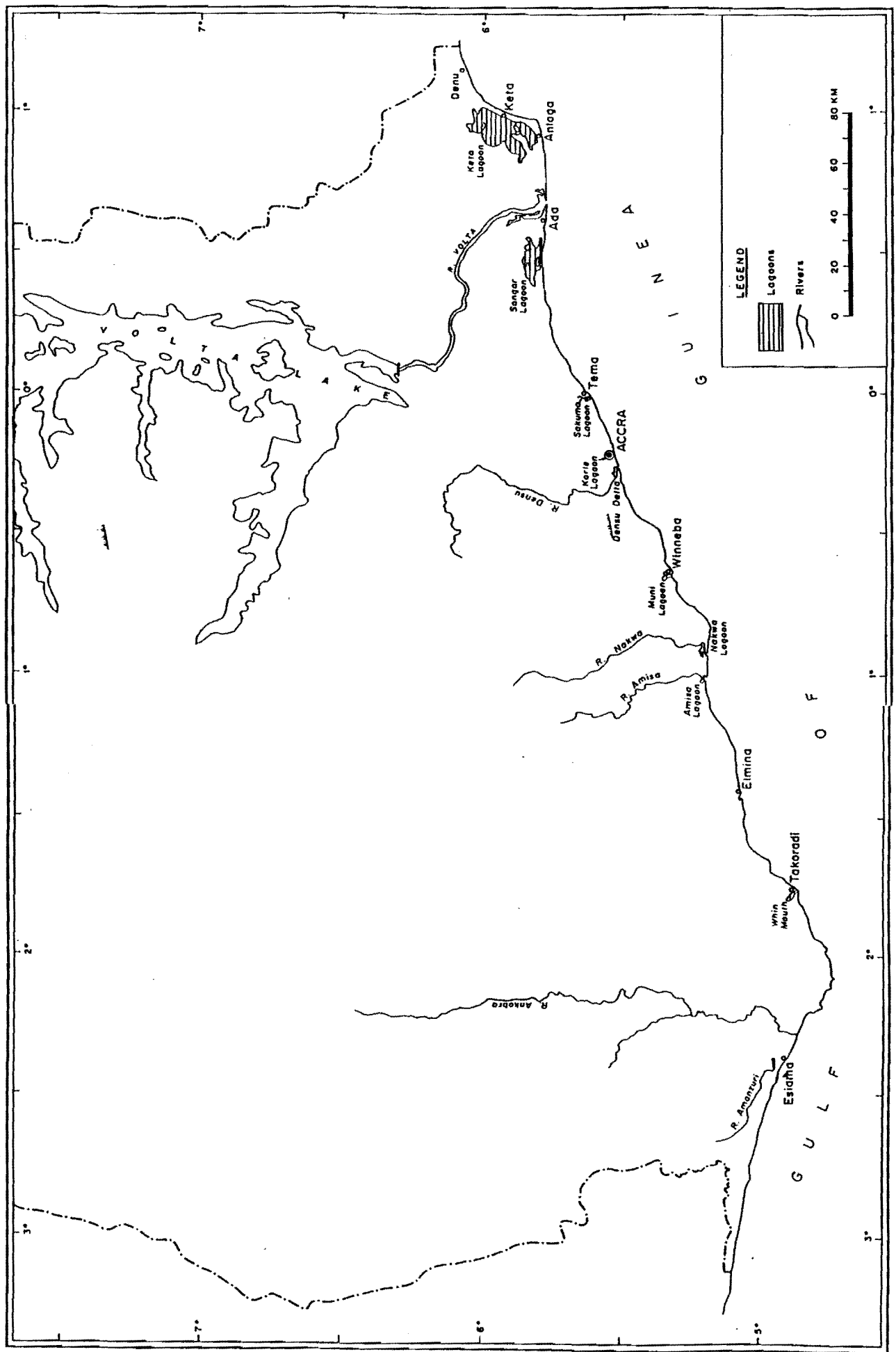


Fig.7. PROPOSED SONGOR RAMSAR SITE

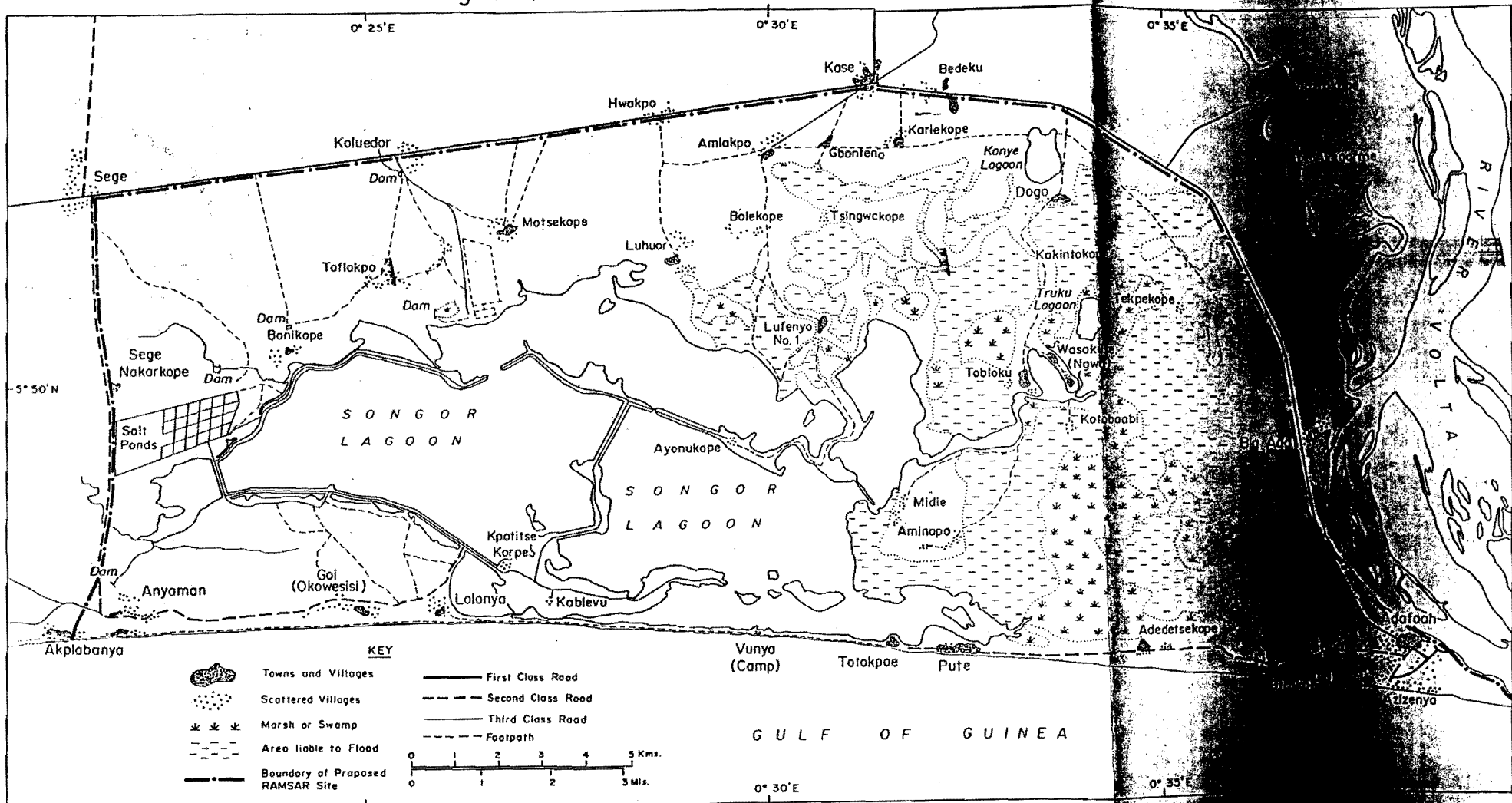
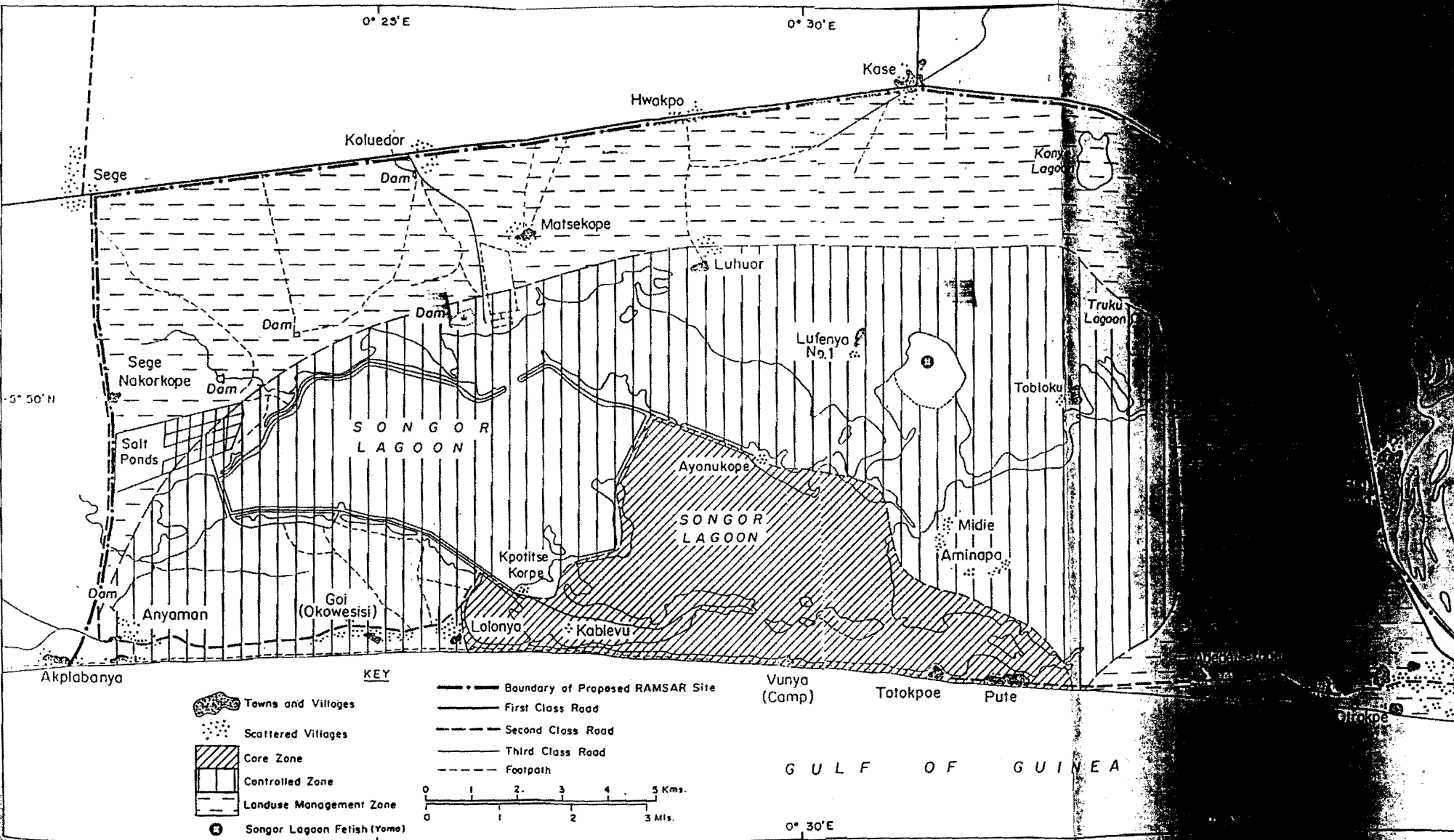
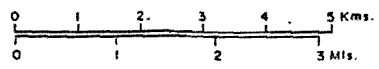


Fig. 8. PROPOSED SONGOR RAMSAR SITE ZONE



- KEY**
- Towns and Villages
  - Scattered Villages
  - Core Zone
  - Controlled Zone
  - Landuse Management Zone
  - Songor Lagoon Felish (Yome)
  - Boundary of Proposed Ramsar Site
  - First Class Road
  - Second Class Road
  - Third Class Road
  - Footpath



G U L F O F G U I N E A

0° 30' E

Fig. 9 PROPOSED MUNI RAMSAR SITE: SITUATION.

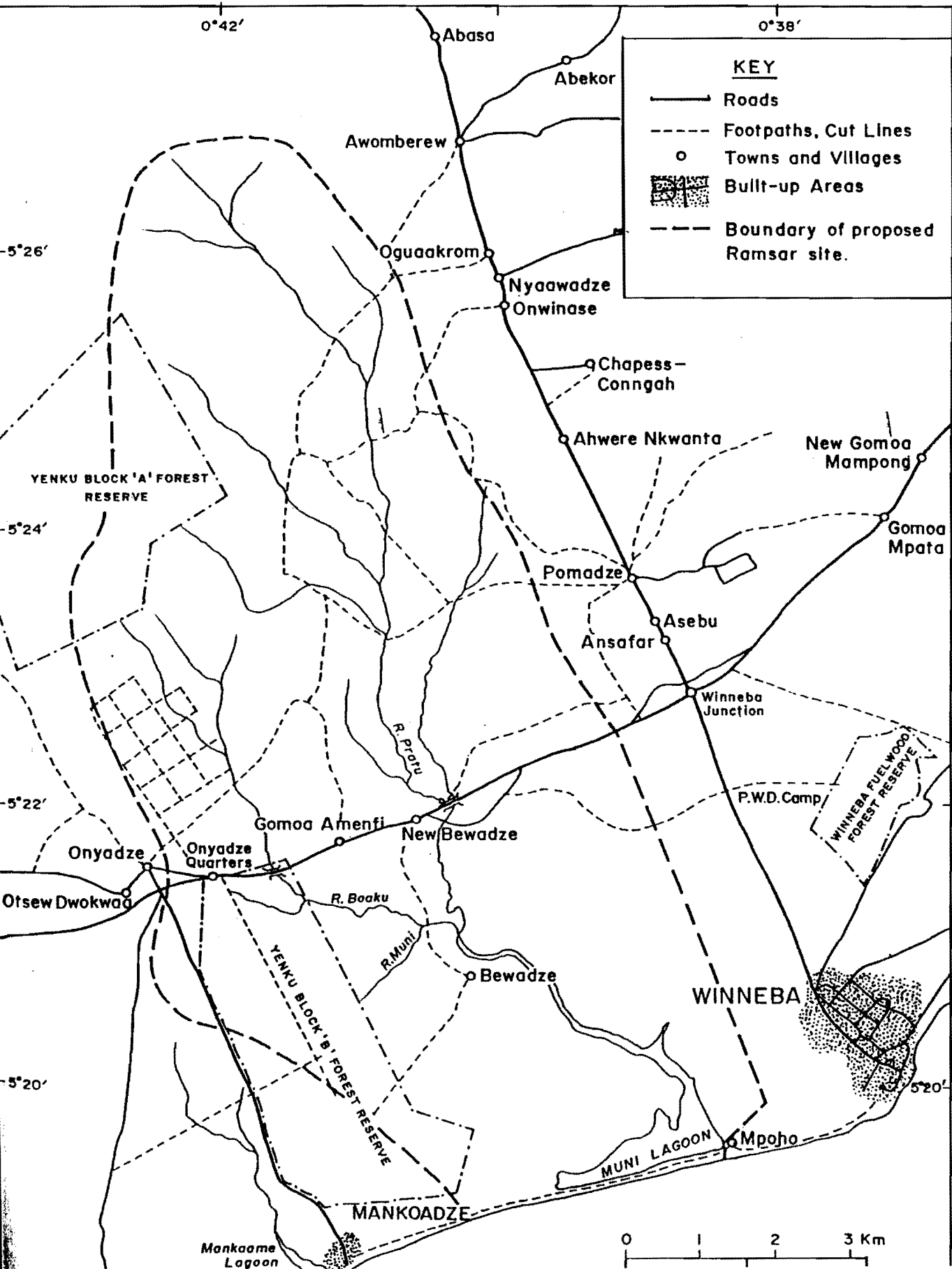


Fig. 10 PROPOSED MUNI RAMSAR SITE: ZONES

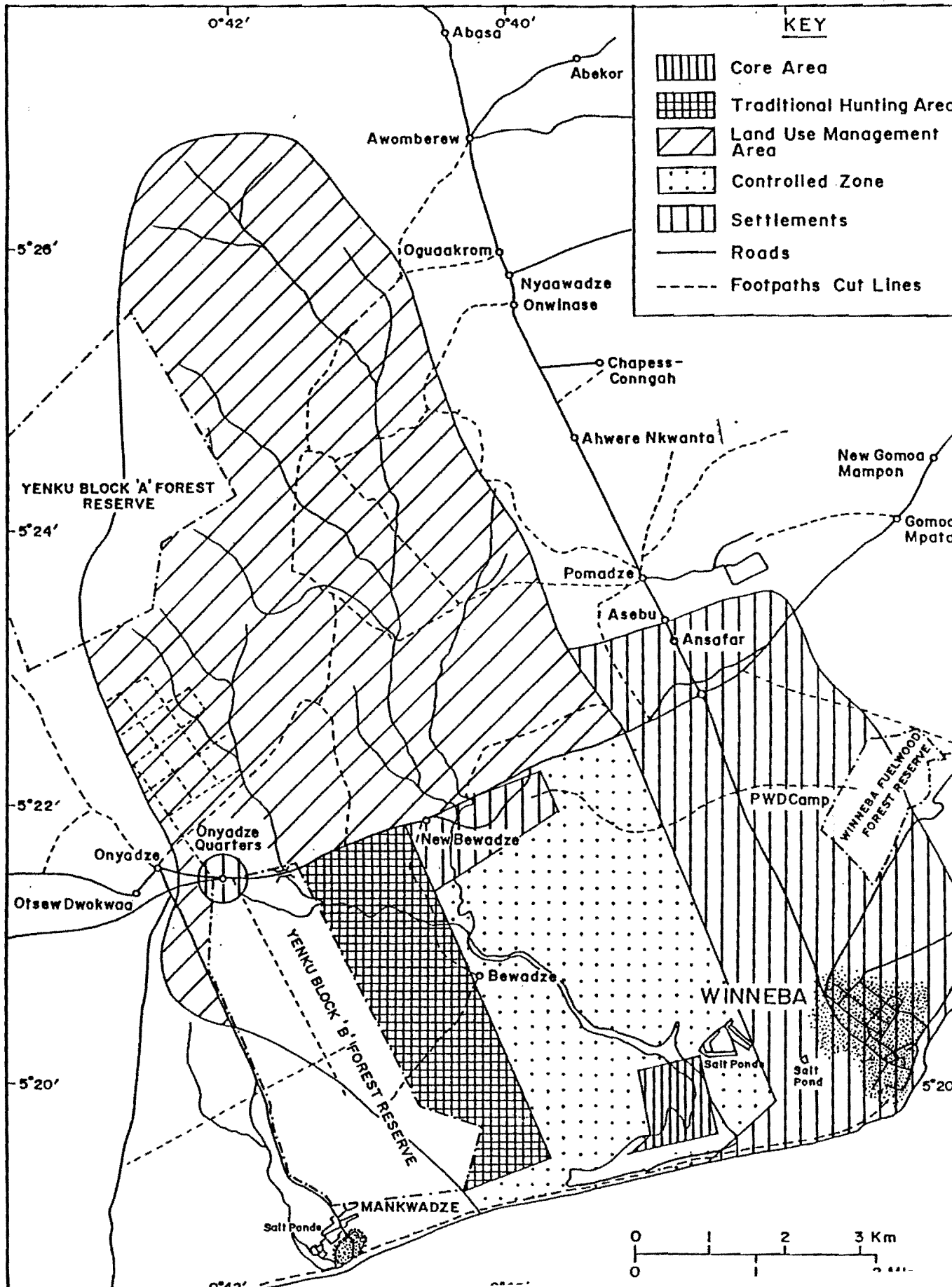
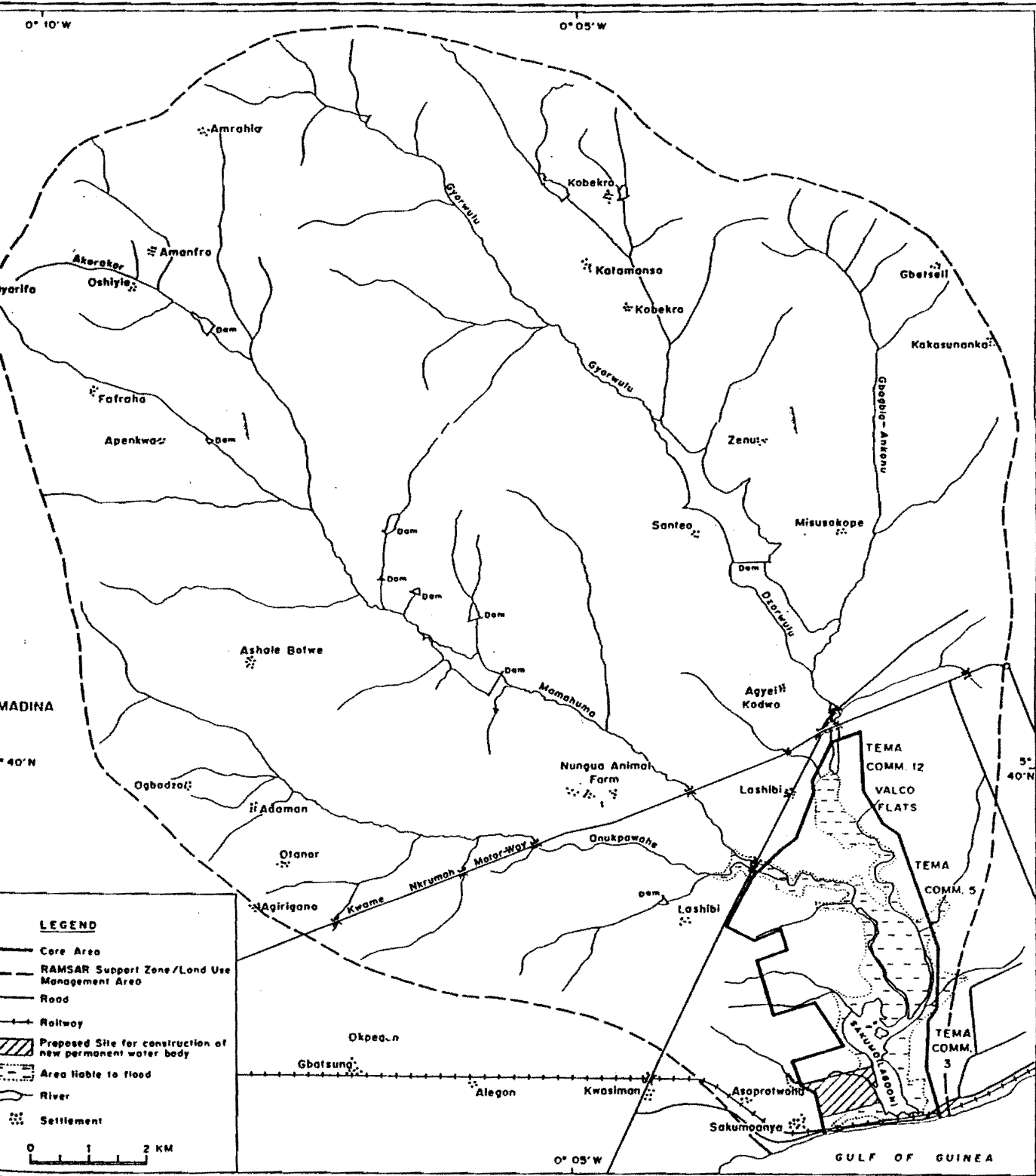


Fig. 11 PROPOSED SAKUMO RAMSAR SITE



**LEGEND**

- Core Area
- RAMSAR Support Zone/Land Use Management Area
- Road
- Railway
- Proposed Site for construction of new permanent water body
- Area liable to flood
- River
- Settlement



GULF OF GUINEA

Fig. 12 PROPOSED SAKUMO RAMSAR SITE (CORE AREA)

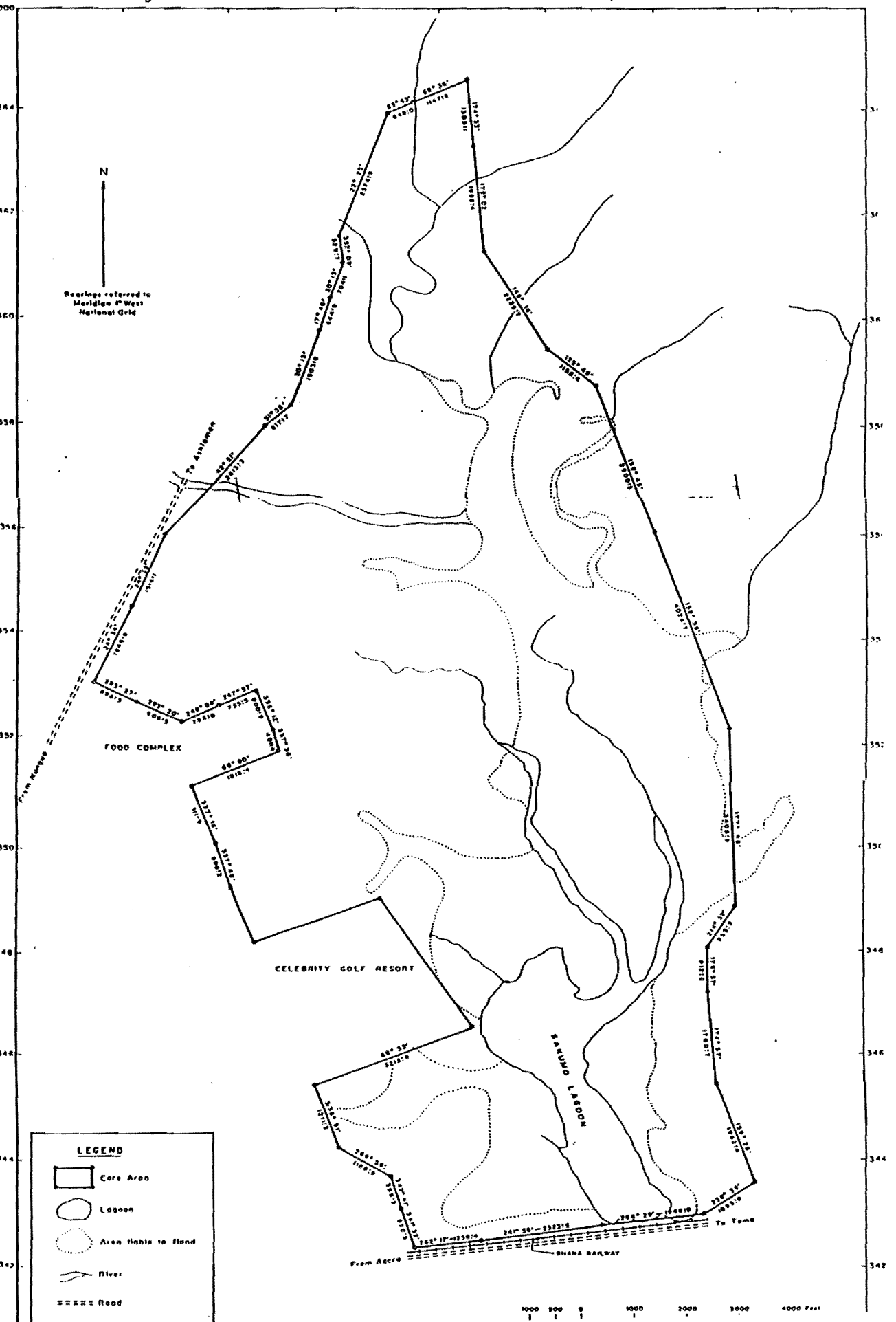


Fig.13 PROPOSED DENSU DELTA RAMSAR SITE

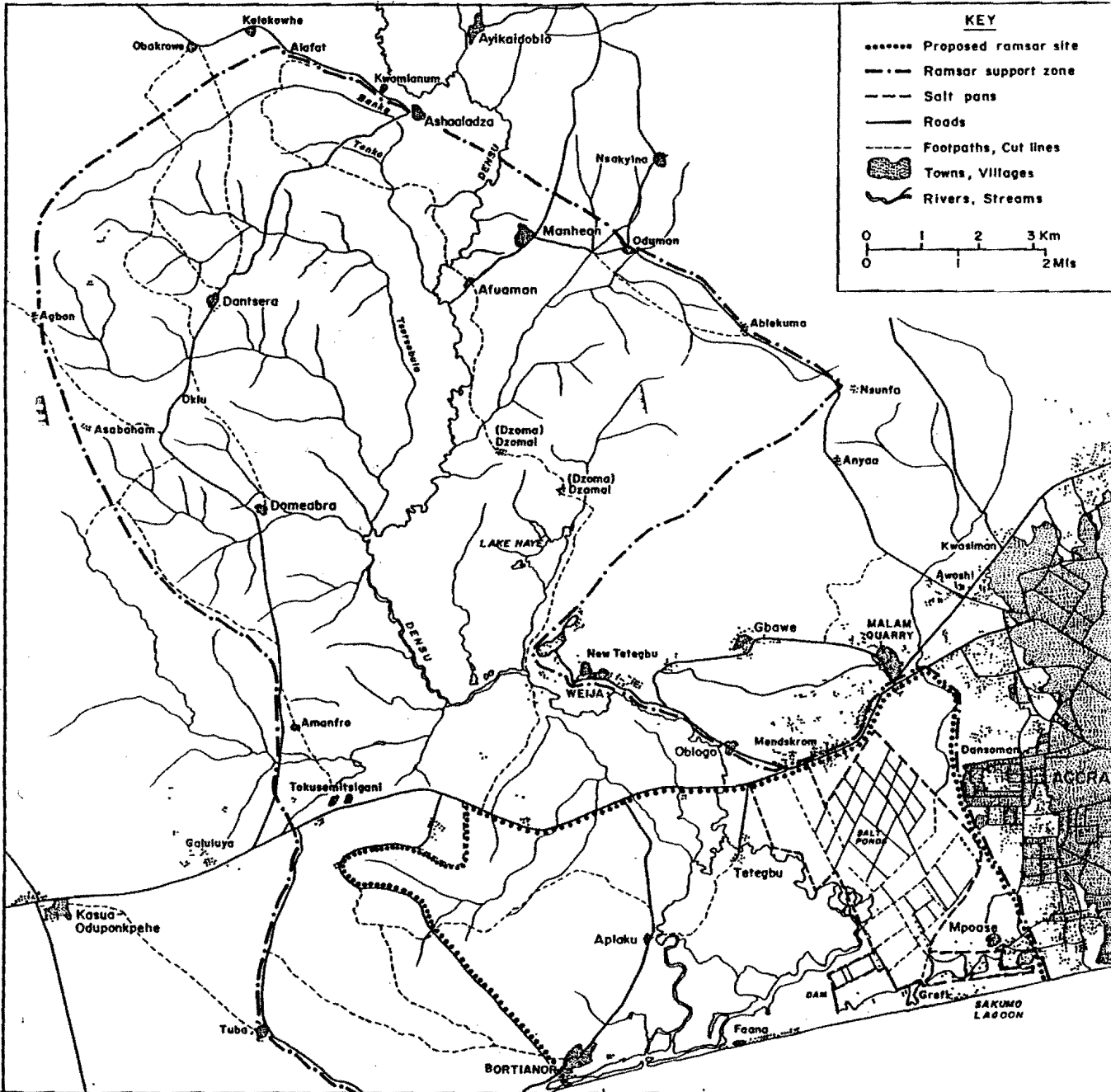




Fig.14 PROPOSED ANLO-KETA RAMSAR SITE

