WILDLIFE DEPARTMENT

COASTAL WETLANDS MANAGEMENT PROJECT
MANAGEMENT PLAN FOR SAKUMO RAMSAR SITE

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December, 1999

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EXECUTIVE SUMMARY

INTRODUCTION

The Sakumo Lagoon wetland, located between the Accra Metropolitan Area and the Tema Municipal Area is one of five coastal wetlands designated for management as a Ramsar Site – in Ghana. The Sakumo Site comprises the Sakumo lagoon and its immediate catchment area occupying a total area of 27,643 ha. The lagoon covers varying areas in the wet and dry -seasons.

The Sakumo Ramsar is rated as the third most important for seashore birds on the Ghana coast. More than sixty birds have been identified including six internationally important species. The need for management interventions arises from the degradation effects of rapid urbanization in the catchment of the Site.

The various Baseline Surveys conducted by the Wildlife Department and other agencies over the years provided the basis for the development of a Ramsar wise use management plan for the Site.

Three to five-year plan objectives, strategies, programs and project actions have been proposed on the basis of the review of baseline and current management information.

EVALUATION

The Sakumo Site contains a total population of 254,000 engaged in the traditional occupations of fishing, farming and animal rearing. Urban and urban-related employment (about 20%) has increased in the past two decades. The Eco-tourist, educational and the socio-economic development potential of the Site derives from its biophysical diversity, fisheries and tourist resources and the proximity to the Accra and Tema municipal areas.

The constraining factors include rapid urbanization, increasing pollution from urban and industrial sources and over-exploitation of resources.

OBJECTIVES

The long-term objective for the management of the Site should be to sustain and to enhance the ecological and the socio-economic values of the site in the national and international contexts.

The operational objectives seek to improve the biological diversity and productivity of the Sakumo site especially for lagoon fisheries, water birds and mangrove communities.

PLAN PROPOSALS

The management plan prescriptions include the identification of four management zones and the relevant management strategies and project actions. The strategies and project actions relate to improvements in the biophysical environments of the identified management zones, resources and environment enhancement, capacity development, socio-economic development as well as legal issues and research.

THE MINIMUM PROJECT ACTION PROPOSAL

To achieve minimum management objectives in the light of financial constraints the following combination of project actions are recommended with costs over a five years period.
Resources and Environment

- Coconut plant girdle around the floodable lagoonal plain
- Tree planting (woodlots) in the savanna, thicket and riverine forest areas.
- Live coconut buffer between lagoon and the sea.

Capacity Development

- Production and dissemination of informational materials such as flyers, manuals and guides for schools and visitors.
- Production of promotional brochure
- Public meetings and consultations.

Extension Education

- Crop farmers,
- Fishermen and
- Livestock farmers
- Aquaculture

RESEARCH AND MONITORING

- Improvement of fresh water delivery to the lagoon
- Impact of Typha and other aquatic weeds
- Mangrove rehabilitation experiments
- Community and stakeholder perceptions of wetland resources
- Habitat zone definition and mapping.

TERMS OF REFERENCE

1. Collate and evaluate biophysical information for the Sakumo Ramsar Site

2. Review existing site management plans for the Site with particular reference to:

- Staff strength, qualifications and deployment
- Job descriptions
- Implementation of management measures
- Public awareness and education
- Community participation in site management
- Community infrastructure development; and
- Management stakeholder collaboration for sustainable wetland resource exploitation.

3. Review the current involvement of the Wildlife Department, District Assemblies, NGOs, traditional authorities, major stakeholders and communities in the management of the Site and formulate strategies for improvement to ensure their long-term participation.

4. Formulate long-term objectives for the sustainable management of the Sakumo Ramsar Site according to the Ramsar wise use concept

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

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

COASTAL WETLANDS MANAGEMENT PROJECT
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PREAMBLE

Present action to control and mitigate the impacts of development on Ghana's wetland resources are based on the National Environmental Action Plan (EAP) which aims to ensure improvement and maintenance of a high quality of life for present and future generate through the sustainable management of environmental resources.

In connection with the implementation of the EAP the Ghana Environmental Resource Management Project (GERMP) was initiated with the aim of improving resource managers capability through reorganizing and strengthening of institutions. This project is also aimed supporting the adoption of improved management practices through community involvement the planning and implementation of measures to minimise environmental degradation.

The GERMP includes the Coastal Wetlands Management Project (CWMP), the main objective of which is to maintain the ecological integrity of five coastal wetland sites to b maintained as Ramsar Sites through a management system that involves the local communities and other stakeholders. Aspects of this project include compatible and wise use of resources, biodiversity conservation, and poverty alleviation and public education. The Sakumo lagoon, including its catchment, is one of the five designated Ramsar Sites.

PART 1: DESCRIPTION

1.1 General Information

1.1.1 Location

The Sakumo Ramsar Site is located within latitudes 5 36.5' N and 5 38.5"N and longitudes 1° 30' W and 2° 30' W. The lagoon and its catchment area fall entirely between the Accra -Tema Metropolitan Area. The lagoon itself is located about 3 km west of Tema and is separated from the sea by a narrow sand dune on which the Accra-Tema coastal road is built. It is connected to the sea by a broken-down sluice with direction of flow depending on the tide (Figs. 1 and 2).

1.1.2 Status

The total catchment area is about 27,634 ha (276 km^2) and stretches from Madina to Oyarifa on the West and to the Aburi highlands in the north (Amatekpor, 1994). It is bounded on the east by an approximate North-South line that also marks the western boundary of Tema municipality and on the south by the sea. The Sakumo Ramsar Site itself is about 1,365 ha and consists of a brackish water lagoon with a surface area of about 350 ha and a surrounding flood plain of about 700 ha.

The site was designated as a Ramsar Site under the International Convention on Wetlands (Ramsar, 1971). The Wildlife Department has since managed it along the wise-use concept of the Convention with funding from the Global Environment Facility (GEF). The site also exists under the Town and Country Planning Ordinance of 1948 as a greenbelt. Traditionally, the local people of Tema. Sakumono village and Teshie revere the lagoon as a god.

1.1.3 Land Tenure

The Tema, Sakumono and Teshie people traditionally owned the lagoon and its surrounding flood plain. Present!), land is privately or communally owned in the catchment area outside the Ramsar Site. However, until it was designated as a Ramsar Site, it was under the jurisdiction of the Tema Development Corporation (TDC). The current ownership and management of the confines of the Sakumo Ramsar Site are now vested in the Wildlife Department.

1.2 Physical Features

1.2.1 Climate

The wetland lies in the the semi-arid coastal savanna zone with mean annual rainfall of about 800mm occurring in two rainy seasons. The mean annual rainfall for the period 1954 to 1991 within the area was 734mm (Tumbulto and Bannerman, 1995). Run-off is normally recorded in only May (18.9mm) and June (3.1.mm) when monthly precipitation is in excess of evapo-transpiration. There is virtually no run-off for the rest of the months of the year when the latter exceeds the former. Mean atmospheric temperature for period 1958 to 1992 was 26.7^0C (Tumbulto and Bannerman. 1995).

1.2.2 Hydrology

The catchment of the Sakumo Ramsar Site is drained by a number of streams, which flow into the brackish water of the Sakumo lagoon. A number of freshwater marshes are present along most of the river course within the Ramsar Site. Four principal sub-drainage basins have been identified in the catchment. The major ones are the Mamahuma-Onukpawa (Western) and the Dworwulu-Gbagbla-Ankonu (Northern) sub-basins. The Eastern and Southern sub-basins constitute the minor ones. The catchment area has limited groundwater potentials because of low rainfall and the impermeability of the parent rocks (Tumbulto and Bannerman, 1995).

The main feeder streams, the Dzorwulu and Mamahuma are basically fresh with salinity) of less than 3‰. The two main rivers have been re-channeled for irrigation, resulting in very-little freshwater inflow into the lagoon during the dry season. The entire flood plain may, however, be inundated during the rainy season. As a result of the diverse anthropogenic influences that occur within their catchments, these streams have very high turbidities an: concentrations of suspended solids. At low tide, the effects of these inputs as well as other; from minor channels become evident in the northern sections of the lagoon. Thus, during the dry season, the water turbidity as well as suspended solids levels in the northwest are five-times higher than at the southwest of the lagoon. During the dry season, salinities at both low. and high tide vary within a narrow range of 30 to 41‰. With increased flow of fresh water during the wet season, salinities drop to 10‰ or less in the lagoon (Gordon, 1994).

1.2.3 Geology

The catchment area is underlain with Dahomeyan (Pre-Cambrian) acidic schists and gneisses with minor intrusive granite and pyroxenite basic gneisses and quartzite schists. The valleys of the streams are covered by recent alluvium with marine sands deposited in a narrow strip along the seashore (Amatekpor, 1994).

1.2.4 Geomorphology

The catchment area of the Sakumo Ramsar Site is generally undulating and low-lying with the highest point rising up to 87 m above sea level. The average elevation is about 46 m and the slopes are commonly up to 2% with a few rising up to 5%. Within the Ramsar Site, the alluvial soil in the flood plains of the Sakumo lagoon is generally flat and is about 15mr above sea level (Tumbulto and Bannerman, 1995).

1.2.5 Soils

Seven soil series have been delineated within the catchment area (Amatekpor, 1994). These are Oyarifa-Mamfe Complex (603ha); Nyigbenya-Hatso complex (6047ha); Nyigbenya consociation (1402ha); Simpa-Agawtaw com$_p$lex (16788ha) and Akuse-Ashaiman complex (1334ha). The others are Oyibi-Muni complex (1459ha) and Keta consociation *(<0.5°:* Five of the soil series are considered as sensitive soils with regard to potential credibility and closeness to the lagoon. These are Simpa, Agawtaw, Akuse, Oyibi and Muni and are responsible for the supply of the greater part of the site to the lagoon.

1.3 Biological Features

Four main habitat types exist in the Sakumo Catchment. These are:

- The open lagoon
- The surrounding flood-plains,
- The fresh water marsh and
- The coastal savanna grasslands and thickets vegetation.

1.3.1 Flora

The coastal savanna grasslands occur mainly in the northern sections of the catchment area (Oteng-Yeboah, 1995). Within the flood plains, the main vegetation zones are formed either by pure stands of *Sesuvium portulacastrum, Paspalum vaginatum, Cyperus articulatus Typha domingensis, Sporobolus virginicus,* and *Imperata cylindrica* or their associations The open fresh water within the streams in the wetland are most of the time covered with floating water plants such as *Pistia stratiotes, Nymphaea* sp. The rest of the coastal savanna is dominated by thicket clumps of mainly *Azadirachta indica;* others are *Adansonia digitata* and *Kigelia africana.* A common herb within the thickets is *Sansevera liberica* The dominant grasses are Andropogon *gayanus, Heteropogon contortus,* and *Sporobolus pyramidalis* (Appendix 1).

Eleven distinct vegetation zones (Fig. 3) have been delineated to constitute the terrestrial ecological zones of the Ramsar Site (Kpelle, D.G.,1996) and these are presented in Table 1) below.

Table 1: Area of Terrestrial Ecological Zones

Zone	Area (ha)	Percent cover
Neem thicket	568	30
Coastal grasslands	412	22
Typha-Cyperus	458	25
Sesuvium	50	2.7
Paspalum	35	2
Paspalum-Sesuvium	101	6
Mangrove	11	0.6
Water-lily	14	0.7
Coastal thicket	156	8.4
Pistia sp.	34	1.8
Coconut plantation	19	1.0
TOTAL	1.854	100

(Source, Kpelle D.G., 1996)

From the above, fixe distinct plant communities have been identified These *are Typh-Cyperus* Association (457 ha), *Paspalum* sp. (226 ha), *Sesuvium* sp. (49 *ha) Sesuvium-Paspalum* Association (101 ha) and Mangroves (11 ha). The first four plant communities cover extensive areas within the Ramsar Site as dominants or in association with others The

Typha-Cyperus Association, which is most extensive, occurs within the middle belt of Ramsar Site, in the freshwater areas. The rest however constitute the greater part of the : marshes around the lagoon.

1.3.2 Fauna

The Sakumo Ramsar Site is rated as the third most important for seashore birds on the Ghana Coast and more than sixty species of birds have been documented (GWS, 1999). These include six internationally important species, namely, the Spotted Redshanks, Greenshank Curlew Sandpiper, Little Stint, Black tailed Gotwit and Black-winged Stilt (Appendices and 3).

According to Koranteng (1995) a total of thirteen finfish species belonging to thirteen gen and eight families occur in the Sakumo Lagoon (Appendix 4). The annual catch is estimated to be about 114 tones or 327 kg/ha. The main species are *Sarotherodon melanother Oreochromis niloticus, Glorias anguilaris* and *Hemichromis bimaculatus.* Apart from *melanotheron,* which constitute about 97% of the total catch, the rest are freshwater spec which enter the lageon from the upstream riverine areas. Marine visitors include *Ger melanopterus, Lutjanus fulgens* and *Albula vulpes.* Shellfishes include the prawns *Parapenaeopsis atlantice* and *Penaeus duorarum.* Isolated species include the mollu *Tympanotonus fuscatus, Turitella* sp. and *Macoma cumana.* Three main-crab species found within the lagoon and its associated flood-plains. These are *Cardiosoma armati Callinectes amnicola* and *Uca tangeri.*

Other forms of animals life such as Polychaetes, Gastropods, Bivalves, Crustaceans, inst and Molluscs also occur at the Sakumo Ramsar Site as indicated in Appendices 5 an((Ntiamoah-Baidu and Gordon, 1991).

PART 2: 2.1 SOCIO-ECONOMIC FEATURES

2.1 Settlements and Population

The Sakumo Ramsar Site is made up of about 21 settlements, namely; Adjiringano, Amanfro, Amrahia, Amrahia Dairy Farm, Ashaley Botwe, Ashaiman, Damfa, Fafraha, Kakasunaka, Gbetsile, Katamanso, Kubekro No. 1, Kubekro No. 2, Lashibi, Lashibi (Klagon), Nungua Farm, Ogbodzo, Sakumono, Santeo, Tema Comm. 3, and Tema Comm. 12.

A socio-economic study carried out at the Site in 1995 (Dadson, J.A., 1995) estimated the population to be about 254,000. The population is expected to rise to about 300,000 by the year 2000, growing at a rate of about 4.4%.

2.2 Ethnicity and Religion

The ethnic composition of the Sakumo Ramsar Site is quite diverse and includes Ga (33.7%), Ewe (29.1%), Adangme (17.5%) and Akan (9.3%). The Ga ethnic group, which is the dominant group, is also the indigenous population of the Site (Dadson, 1995). The main religion practiced is Traditional African Religion, followed by Christianity and Islam.

2.3 Housing and Housing Characteristics

i. Housing Quality

The walls of most of the houses at the Sakumo Ramsar Site are built with cement blocks (48%) and mud (37%). The rest of the houses have walls built with corrugated sheets, coconut leaves, wood and brick or a combination of these. A greater number of the houses, about 57%, are roofed with corrugated iron sheets. The rest of the houses are roofed with asbestos (33%), thatch (9%) and thatch with corrugated sheets (1.2%) (Dadson, 1995).

The number of bedrooms per household ranges between 1 and 11, with an average of about 3 persons. Majority of the households, about 51%, have family size ranging between 5 and 8 while 22% have 4 or less; 11% have 9 or 10 and 16% have more than 10 members (Dadson, 1995).

Fifty-seven percent of houses at the Site have kitchens while an appreciable number of houses (33%) do not have kitchen facilities at all. The rest of the houses use shared kitchen facilities. About 20.9% of households have in-house bathroom facility used solely by its members while 42% use enclosures separated from the house and 2.3% share bathrooms. Seven percent use public bathrooms and 2.3% do not have bathrooms at all (Dadson, 1995).

Access to places of convenience and domestic waste disposal facilities are a major problem facing the communities in the Sakumo Ramsar Site. About 44.2% of households have no access to any form of toilet facilities and therefore resort to the use of the lagoon fringes, seashores and bushes as places of convenience. Only 8.3% of households have water closet toilets. The rest use either pan or pit latrines or public KVIPs. Most of the residents also dispose of their domestic waste recklessly into the surrounding bushes, streams, and lagoon or into drainage systems. This is particularly evident at Ashaiman and Sakumono.

Majority of the households in the Ramsar Site (80%) have access to pipe borne water while only 22% use other sources including public dams, public wells, bore holes and ponds.

The main cooking fuels used by households within the Site are firewood and charcoal. Most of the firewood and charcoal used are obtained from the surrounding forests and bushes. Only few people buy them from sellers. Other sources of household energy include gas and kerosene.

ii. Household Income and Expenditure Patterns

According to (Dadson. 1995), annual incomes ranged between ¢1,000 and ¢5,000,000. The lowest income group earned between ¢1,000 and ¢50, 000, which constituted about 11.6%. The highest earning group is only 1.2%, with majority of the people earning between ¢200, 000 and ¢500,000.
It appeared in that study that most people spent more than they reportedly earned. About 43% of households spent between ¢1,000, 000 and ¢2,000, 000 annually.

2.4 Education

Majority of the communities in the Sakumo Ramsar Site (33.3%) have no schools at all. While only 11.1% have primary schools, 27.8% have nursery, primary and junior secondary school (JSS). Communities with primary and junior secondary schools are 16.7%. The level of education is generally low, with 43% of the adult population having been educated only up to middle school level. About 16.5% of the people have either a secondary, commercial or technical education while 2.3% attained tertiary education. Those who have no formal education at all constitute about 24.4% (Dadson, 1995).

2.5 Health

Access to health services is one of the major problems facing the communities in the stud) area. About 38.9% of the communities have no access to any form of health services. Another 38.9% of the communities have only Traditional Birth Attendants who are onl\ trained to give antenatal care to pregnant women. The rest of the communities have a hospital, a clinic, or a qualified midwife.

The most common health complaints in these communities are malaria, measles and hazaro> from scorpions and snakes (Dadson, 1995).

2.6 Economic Activities and Employment Pattern

2.6.1 Agriculture

Although agricultural lands constitute about 49% of the demarcated Sakumo catchment area crop production in the area is very low. About 36% of the people are engaged in c: farming. Crops grown include vegetables, cassava, maize, rice, okro, pepper, tomato onions, melons and cowpea. Farm holdings are small between 0.5 and 2.0 ha. Most farmer (41.9%) do not own the land on which they farm while 16.3% own farmlands. The rest of the farmers cultivate family lands, stool lands, community lands, government lands and rented lands (Amatekpor. 1994).
Farm inputs used include hoes, cutlasses, tractors, chemical fertilizers, organic manure, weedicides, pesticides and improved seeds. Agricultural chemical pollution is not a serious threat

to the Ramsar Site because of the low levels of agrochemical usage by the subsistence farmers. However, the use of agrochemicals in the Sakumo catchment area is fairly high at the Ashaiman Irrigation Project area (Amatekpor, 1994).

2.6.2 **Fishing**

A fairly intensive fishing activity goes on in the Sakumo Lagoon with about 8.1% of the work force engaged in the industry. The methods used in fishing are mainly net casting and dragging. Some fishermen, especially children, use hook and line. Most fishermen have their own nets and other fishing gears. Tilapia is the dominant fish caught from the lagoon. Shell collection is also an important activity along the shores of the lagoon. Present fish catch is declining due to mostly probably, over fishing. Although a traditional ban period exists (from November to March I some illegal fishing still goes on (Amatekpor, 1994).

2.6.3 **Industry**

Salaried workers in the Site constitute about 20% of the total workforce and most of them are employees of the industries located in and around the Ramsar Site including Johnson Wax, which manufacture insecticides and detergents: Spintex which produces textiles; Coca Cola, a soft drinks maker and Poki. an ice cream manufacturer. Recently an abattoir has been built in the area.

2.6.4 **Fuel Wood Harvesting**

There is considerable fuel wood harvesting in and around the Sakumo catchment area, which coupled with the land rotation farming system, has almost destroyed the primary savanna vegetation. The fuelwood is normally sold for household cooking and for commercial uses such as fish smoking. Some of the wood cut is also used for commercial charcoal burning.

2 6 5 **Animal Production**

The cattie population in the catchment of the Ramsar Site is relatively low, with the folding up of the big ranches including the University of Ghana Ranch. Some private cattle rearing on semi-nomadic basis. however, occurs mainly in the northern outskirts of the wetland, especially in the Ashaiman area. Some of the cattle move down to graze along the shores of the lagoon, especially in the dry season.

2.6.6 **Sand / Gravel W inning**

The increase in residential development in the Sakumo catchment area has brought about a high demand for suitable sand and gravel for concrete block making for the building industry. The Santeo and Agbozume soil series, which happen to occur extensively around the wetland and the extended catchment area, are suitable for concrete block making. Excessive sand and gravel winning in the Site is causing severe erosion and considerable sedimentation of the lagoon. It is also destroying the aesthetic value of the fringes of the wetlands (Amatekpor.1994)

PART 4: EVALUATION

4.1 Size and Position

The Sakumo Ramsar Site occupies the water catchment areas of the Dzorwulu and Mamahuma streams along the eastern coast of Ghana. The catchment is hemmed in on the east by the Tema township, harbour and industrial area, on the West by Teshie-Nungua and on the north by residential, industrial and infrastructural developments. The size of the catchment is estimated at 27634 ha with the lagoon occupying about 350 ha. The small size of the lagoon and its location makes it very vulnerable to the pressure of the human population and activities within the catchment.

4.2 Habitats

Four main habitats are identified in the site as outlined in Section 2.3. These reflect the vegetation zonation in the catchment area.

4.3 Biological Diversity

4.3.1 Flora

The dominant plant species in the Sakumo Ramsar Site comprise *Seswium portulacastrum,* near the water. *Paspalum vaginatum, Sporobolus virginicus,* and *Imperata cylindrica* in pure stands or in associations. Others include clumps of *Cyperus articulatus. Bothriochloa blahdii* and *Typha domingensis,* and scattered plants of *Cleonie viscosa*. *Scoparia dulcis* and *Portulaca foliosa.*

4.3.2 Fauna

The Sakumo Ramsar Site supports a large number of seashore birds. A total of 66 seashore birds have been identified with a total population of 32500. The Site supports internationally important populations of six wader species and nationally important populations of at least 30 species of waterfowl. Over 80% of the birds are paleoarctic migrants. A large proportion (90%-100%) of the black heron, teal, black-tailed godwit and ruff occurring on the Ghana coast are seen at the Sakumo Ramsar Site. Resident birds include the sand plover, partincole. littletern, the pied kingfisher, the yellow-throated longclaw, the plain-backed pipit, the fantail warbler and the red bishop.

13 species of finfish, including tilapia *(S.melanotherori)* are present in the lagoon. Tilapia forms over 80% of the annual catch. 14 species of shellfish also occur but the catch is small. (Ntiamoa Baidu and Gordon, 1991)

4.4 Naturalness

The natural conditions of the Sakumo Ramsar Site have been considerably changed or modified. The lagoon remains open to the sea through culverts since 1977 rather than through the processes of bar formation and breaching at the seaward end. The salinity levels vary from less than 10 $‰_0$ to more than $40‰_0$ between the rainy season in June/July and the

4.9.2 Fisheries Development

Small-scale aquaculture may be developed in the freshwater marshes particularly where the streams enter the lagoon. The methods will be simple, basically involving the temporary ponding of the stream waters to allow the fish, mainly tilapia, to mature before capture. No new species will be introduced and no feeding is envisaged.

Lagoon fishery development will involve controls through the improved and modernized taboo system administration and the use of appropriate fishing gear and materials.

A licensing system to control the number of fishermen and to monitor fishing activities in the lagoon is considered necessary.

4.9.3 Agriculture

Traditional agriculture in the Sakumo Ramsar Site involves the cultivation of maize, cassava, okro, tomato and pepper There is increasing cultivation of vegetables for the urban market using water in the dams as well as chemical fertilizer. Vegetable cultivation has a good potential for development using organic instead of chemical fertilization.

4.9.4 Livestock rearing

Semi-intensive poultry production on a small to medium scale may be undertaken together with vegetable cultivation. Other animals that may be reared include snail and grass-cutter (Kanlisi 1998)

4.9.5 Ecotourism

Opportunities exist for low impact ecotourism to be developed based on the diversity of the bird population and the seasonal pattern of movement. Bird siting is a potential source of recreational tourism while research and teaching constitutes the basis for educational tourism. Facilities such as sighting platforms exist for these activities. Careful planning will need to be undertaken for the location of additional facilities in order to avoid any negative impacts (Glover and Kofigah. 1998)

The expansion of the Celebrity Golf Club to include hotel rooms will be a useful supplement to the facilities in the Site.

The Celebrity Golf Club is a private institution and must be recognized as one of the stakeholders in the development of the Sakumo Ramsar Site. It is therefore regrettable that some of its lands are being turned over for private residential development.

Careful schedules to control tourist numbers should be worked into the traditional taboo management system to increase the value of the Site and to avoid negative impacts. Hiking for educational tours and cycling provide opportunities for diversified use.

4.10 AESTHETIC, CULTURAL AND RELIGIOUS VALUE

The lagoon serves as the abode of a community god whose priest and priestess reside in the community and act as the custodians of the lagoon. They lead the observation of customary rites and practices such as festivals and consultations for community blessings that ultimately maintained and improved community ties. The cultural and religious values have however: decreased recently in importance as a result of an increasing cosmopolitan population.

4.11 Social and Economic Value

The social and economic value of the Site is high. The Sakumo Ramsar Site habours a lagoon fishery that is worth 15-20 million cedis annually. It shares a boundary with ar. important golf course in the west and adjoins large residential estates. The Site also border-residential estates in Tema and Nungua; industrial estates, communications infrastructure. -protected sea front. The Site is an important migratory bird destination. Commercial production of vegetables and rice is undertaken in the northern part of the lagoon catchment All these put together make the site to be of very high socio-economic value as it offers a lot of opportunities for income earning.

4.12 Education and Public Awareness

Considerable amount of public education has been undertaken in the area as part of the general environmental education programmes aimed at raising the awareness of the people towards the importance of the wetlands and the need for their participation in the management of the Ramsar Site. While the resident population enjoys the resources of the area such as fish and wood, it is not clear if they appreciate the need to conserve and protect: the resources. This is probably due to the problems associated with the management of the site as a common property and resource.

4.13 Recreation

Recreation within the Sakumo Ramsar Site is based on low impact tourist activities including bird watching and the use of the Celebrity Golf course nearby. This trend should also be encouraged with respect to future development.

4.14 Research

Research to understand the structure and the functioning of the wetland ecosystem as the basis for management including monitoring will be an important activity. Currently, water quality, fisheries and bird diversity are being monitored. Areas for further research should include:

1. Conditions for the rehabilitation of the mangrove
2. The nature and driving forces of environmental/socio-economic change

PART 5: REVIEW OF EXISTING MANAGEMENT PLAN

5.1 Site Survey and Demarcation

Like all the other Ramsar Sites, the boundary of the Site has been surveyed, demarcated and pillared by the Survey Department since 1995. Boundary trees planted between pillars. Wetland (Ramsar Sites) Regulations, 1999 passed, giving legal backing for law enforcement within the Site. The Regulations was formulated through open consultative process with local communities, District assemblies, Traditional Authorities, Ministry of Lands and Forestry. Legal Department of Government and gained approval Parliament in December, 1999.
Action required: Boundary trees to be refilled.

5.2 Research of Monitoring

Baseline research in eight disciplines has been completed for the site and the adjoining supporting/management zone. These are: Lagoon Fisheries, Socio-economic status of local communities, Soils, land use and land degradation, Water quality and faunal Diversity, Plant Ecology, Terrestrial Ecology and Development Option Study. Ecological monitoring programme, designed out of the recommendations of the baseline studies is being implemented on cost shearing basis with Ghana Wildlife society (GWS), Water Research Institute (WRI), and the Zoology Department of the University of Ghana. **Action required:** Other research and monitoring programmes are outlined in section 6.5. There is the need to establish effective mapping of the distribution of ground nesting/breeding birds and their habitat requirements.

5.3 Collaboration

The Site Management has collaborative link with GWS, WRI, Zoology Department, TDC, TMA, Fisheries Department, EPA and Celebrity Gulf Club.
Action required: There is the need to strengthen the links with the existing collaborators and with Celebrity Gulf Club, in particular. Management should exploit further collaboration with other government agencies within the Tema Municipality including, the Extension Services Department of Ministry of Food and Agriculture, Town Planning, Department of Co-operatives and the Police. Collaboration with the private sector e.g. Coca-Cola Bottling Company could be a very good step.

5.4 Local participation

There exist co-operation and involvement of the Chief and Fetish Priest of Tema Manhea, the local political representatives of Sakumono and Ashiaman and the local people who have benefited from the Community Investment Support Fund of the Coastal Wetlands Management Project.
Action required: There is the need to build and improve on co-operation with the people of Sakumono, Lashibi, Klagon and the residents of the Site boundary communities of Tema.

5.5 **Site Management**

A Warden, three other field staff, has managed the Site with support from a Site Management Committee (SMC). Representation of the SMC comprised of the Technical Director of CWMP, the Project Co-ordinator, the Site Warden, GWS, TDC, TMA, Celebrity Gulf Club, Fisheries Department, EPA, the Fetish Priest of Sakumo Lagoon and the Assembly members from Sakumono and Ashiaman. The Committee meets, at least, once a quarter and takes sitting allowance of £30,000.00/member/sitting. **Action required:** Need to re-organise the composition of the SMC to reflect more on community/local representation of fishermen, farmers, beneficiary groups of the Support Fund and the communities bordering the site at the Tema side.

5.6 **Education and Public Awareness**

Initially contracted to the Ghana Wildlife Society (GWS) (a local environmental NGO) and maintained for 5 years ending December, 1999. Under GWS, a number of Wildlife Clubs were formed in schools around the Site. Similarly, a number of community meetings on wetland conservation and education were held among the Site communities. Wildlife Division Staff has since the expiry of the contract with GWS been carrying out the Education and Public Awareness programmes. Directive sign posting from main roads to guide visitors to Observation posts and bird watching put in place. A number of information posts mounted within the core area of the Site on compatible land use practises.

Action required: Need to form' an maintain more Wildlife clubs in schools. Education and public awareness on turtle conservation, particularly, among the sea fishermen should be intensified.

5.7 **Community Investment Support Fund/Poverty Reduction**

Eight groups comprising of 152 individuals have benefited from a loan amount of ¢135,226.078.00 for their micro-economic activities. The groups are in fishing (1). food processing (2) and farming (5) micro-economic ventures.

Action required: There is the need to devise strategy for the sustainability of the support fund within the Site. It is advisable to limit support for crop farming groups whose farming practises on the sensitive soils in terms of credibility (Ametepor, 1995) could speed up soil deposition and siltation of the lagoon bed.

5.8 Habitat Enhancement

- A number of Nesting/Roosting structures for birds provided at the critical bird nesting areas.
- Three bird feeding/wading ponds constructed to linked to visitor use of the Site.
- Tema Sewerage Treatment Plant out-fall diverted to sea to avert pollution of the Sakumo Lagoon.
- Over 030,350,000.00 disbursed to the eight beneficiary groups of the Support Fund in the form of seedlings, land preparation and 'food for work' for the establishment of about 18 acres of tree/coconut planting within the Site.

  Action required: Need to involve local participation in more tree/coconut planting.

5.9 Civil Works

- 1 senior staff bungalow for Site Warden completed
- 1 caretaker's residence and 2 Observation Posts
- 1 flush toilet for Tema Manhea

Action required: Need to construct Site office/Education/Visitor Centre and a boardwalk to facilitate visitor use of the Site.

5.10 Site Protection and Law Enforcement

WD staff, members of a local voluntary task force, TDC task force, carries out site protection and law enforcement with the support from the Police.

5.11 Staff Strength, Qualification and Training

At Post	No. of Persons	Qualification	On-the-Job Training Acquired	Training Needed
Site Warden	1	Graduate (MSc) Natural Resources Management	Wetland Management; Computer; Participatory Rural Appraisal	
Ranger	1	'A' Level	Computer GIS	
Wildlife Assistant/ Labourer	2	Middle School Leaving Certificate	Data Collection	Computer
Driver	1	Middle School Leaving Certificate	Nil	Refresher course

Action required:

Position required	No. of Persons	Qualification	Responsibility
Conservation Education Assistant	1	Sixth Form/SSS	Conservation Education
Support Staff: Secretary/Accounts Clerk	I	Diploma in Business Studies	Secretarial and Accounting

5.12 **Job Description**

The main duties of staff are to ensure the conservation of wetland resources within the Site and the adjoining support/management zone.

Staff Position	**Responsibility**
Site Warden	• Oversees the general administration of the Site • Preparation of work plans, quarterly and annual reports • Staff supervision • Liaise between Project Management/Wildlife Division and collaborator agencies and the communities • Implementation of site management decisions • Organises meetings/workshops • Reviews Environmental Impact Assessments of proposed project developments within support/management zone • Conducts education and public awareness programmes
Ranger	• Deputises for Site Qarden • Oversees day-to-day implementation of work programmes • Preparation of monthly reports • Data collection • Mobilises resources and equipment for fieldwork • Lead in site patrols
Wildlife Assistant/Labourer	• Assists Ranger in fieldwork • Regular site patrols
Driver	• Drives site vehicle • Distributes information

5.13 Site Management Requirement

Equipment at Site	Equipment required
Basic office equipment	Computer/Printer/Photocopier and accessories
Monitoring equipment	-
1. Nissan 4WD double cabin pick-up; 2. Motor bicycles	3 motor bicycles

PART 6. MANAGEMENT OBJECTIVES

6.1 Long-Term Objectives

To sustain and enhance the socio-economic and ecological values of the Sakumo Ramsar Site and associated areas.

6.2 Operational Objectives

6.2.1 Ecological Operational Objectives

6.2.1.1 To improve the biological diversity and productivity of the Sakumo Ramsar Site, especially for lagoon fisheries, water birds and mangroves.

6.2.1.2 To enhance the general environmental quality of the Sakumo Ramsar Site through the control of activities that lead to pollution and degradation.

6.2.2 Socio-economic Operational Objectives

6.2.2.1 To establish and improve the socio-economic conditions of the people.

6.2.2.2 To develop and improve human and institutional capacity building and participation in the management of the Sakumo Ramsar Site.

6.3 Constraints

Constraints that may influence the long-term objective are basically due to the location of the Site. The intense development pressure directed from all sides of the Sakumo Ramsar Site has resulted in increased scarcity and value of land, increased demand for resources, deterioration in quality of resources and the general environment. Specifically, the major constraints arise from internal and external human-induced factors and include:

- Rapid urbanisation and population growth.
- Decreasing influence of traditional norms.
- Increasing pollution from domestic and industrial discharges.
- Discharges of untreated sewage into the sea , close to shore.
- Land degradation from poor agricultural practices.
- Overfishing.
- Conflicting landuse demands.
- Management capacity

6.4 Management Strategies/Actions Related to Operational Objectives

6.4.1 Ecology

Expected Outputs

- Adequate Vegetation cover in place
- Fuelwood plantation
- Enhanced Income
- Pollution reduction
- Increased biodiversity
- Improved Health and Sanitation for communities

6.4.1.1 Zoning

The basis for the zoning is the ecology and the anthropogenic pressure on the site and its resources. The Sakumo Ramsar Site may therefore be zoned using the four major ecological zones of the site.

The zones are:

(i) the open lagoon and streams (with the floating water lettuce, *Pistia stratiotes* as the major macro flora).

(ii) the surrounding floodable lagoonal plains (with the succulent forb *Sesuvium portulacastrum* and grasses *Paspalum vaginatum, Sporobolus virginicus).*

(iii) the freshwater streams and associated marshes (dominated by the cattail *Typha domingensis),* and

(iv) the coastal grasslands and thicket vegetation with gallery forests (with the grasses *P. vaginatum, S. virginicus, Imperata cylindrica,* scattered clumps of *Milletia thonningii, Parkinsonia aculeata, Baphia nitida* and trees *Azadirachta indica, Mangifera indica).*

6.4.1.2 Management Strategies for the Zones

The management strategies were formulated for each zone taking into cognisance the operational objectives and the anthropogenic activities and pressures on each zone. These are:

Zone 1 Open Lagoon and Streams

Improvement of plant cover

Education to increase public awareness

Enforcement of fishing regulations/taboos

Improvement of freshwater inputs into the lagoon

Control sources of pollution and sedimentation into the feeder streams and lagoon.

Control of water weed invasions of open waters.

Improvement of the productivity of lagoon fisheries.

Improvement in the processing and marketing of lagoon fisheries

Zone 2 Surrounding Floodable Lagoonal Plains

Maintenance and improvement of suitable habitats for waterfowl and mangrove regeneration.

Control of sources of pollution and sedimentation into the floodable plains.

Zone 3 Freshwater Streams and Associated Marshes

Control of sources of pollution and sedimentation into the zone.

Encouragement of environmentally friendly agricultural practices (organic farming, ridging for row crops).

Improvement of the processing and marketing of agricultural produce.

Discouragement of encroachment for housing and other infrastructure developments.

Zone 4 Coastal Grasslands and Thickets Vegetation with Gallery Forests

Control of sources of pollution and land degradation.

Regulation of housing development

Encouragement of environmentally friendly farming practices (e.g. Organic farming, controlled grazing).

Encouragement of the development of green open spaces.

Improvement of both human and Institutional Capacity in Environmental Management and Public Education.

6.4.1.3 Projects for Ecological Enhancement

i. Construction of domestic and industrial waste disposal structures and facilities

ii. Construction of water-based toilet facilities (Public and Private)

iii. Coconut plant girdle around the floodable zone.

iv. Other tree planting (woodlots) in the savanna woodland zone and around the SRS.

v. Planting of riverine forest along streams

vi. Mangrove planting in floodable lagoonal flood plain

vii. Life coconut buffer between lagoon on one hand and the sea, the road and rail.

viii. Diversion of drains on the eastern border of the lagoon into oxidation ponds or sea

ix. Rehabilitation of gullies and quarry pits

6.4.2 **Socio-economic**

Expected Outputs

- Increased Public awareness and sensitization on environmental issues
- Improved and effective management capacity
- Economic enablement/increased credit availability

6.4.2.1 Projects for Socio-economic Enhancement

i. Stakeholder Forum on Management Plans

Participants will include TMA, TDC, Forestry Services, MOFA, T and C Planning, Fisheries Dept, Sakumo Community Representatives, Estate Developers around Sakumono.

ii. General Education and Sensitization

Production and dissemination of materials such as:
flyers and brochures for the general public Guides and
manuals for schools
Presentation of radio and television programmes
Public meetings and consultations

iii. Staff Training

GIS training
Fisheries/Livestock extension education

iv. Extension education for crop farmers and gardeners covering:

Land preparation
Crop selection
Water and chemical use
Compost production and organic farming
Prevention of pollution

v. Extension education for animal rearing
cattle
Poultry

Extension education for aquaculture fresh
and brackish water

vi. Credit Provision and Administration
Construction and maintenance of residential and industrial waste disposal e.g. drain diversions.
Crop production investments
Aquaculture investments
Woodlot and coconut production investments

vii. Development of Sakumo Tour Guide/Brochure

viii. Widening and reconstruction of lagoon outlet

ix Development of Sakumo fish market near south-western tip of lagoon

x. Legal Issues

Formation of bye-laws by District Assemblies incorporating traditional ideas

Enforcement of fishing regulations.

6.4.3 Research And Monitoring

Expected Outputs

To be conducted by research institutions, universities, including student projects and environmental NGOs in the underlisted areas:

- Improved database for management
- Improved understanding of ecological situation

6.4.3.1 Hydrology

i. Improvement of freshwater inputs into lagoon
ii. Impact of Typha and other aquatic colonies

6.4.3.2 Water Quality

i. Lagoon
ii. Streams

6.4.3.3 Fishery stock assessment

i. Lagoon
ii. Upstream areas

6.4.3.4 History of environmental change and modification

i. Mangrove cover
ii. Biodiversity
iii. Shellfish mortality

6.4.3.5 Mangrove rehabilitation experiments

i. Physical Factors
ii. Socio-economic factors

6.4.3.6 Community and stakeholder perceptions of wetland resources

i. Traditional management systems
ii. Conflicts of ownership, use and administration of resources.

6.4.3.7 Habitat zone mapping

i. GIS database development using existing baseline studies.
ii. Monitoring and control of effluent discharges
iii. Control and monitoring of housing development in adjacent areas.

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Table 2:

MATRIX OF IMPLEMENTATION PROGRAMMES/PROJECTS
Ecological Enhancement

Projects/Programmes	Location	Direct Beneficiaries	Action(s) Required	Lead Agency Responsible	No. of Items Required	Estimated Total Cost	Remarks	Time Frame
2.0 Provision of domestic and industrial waste disposal facilities	Sakumono Lashibi Klagon Ashaiman Com 3, 5, 6, 10, 11,12	-						
2. 1.1 Refuse disposal facilities	-do-	Residents of the communities	Provision of skips	TMA	Skips		Expert Consultation	1st Year
2.1.2 Toilet facilities	Sakumono Lashibi Klagon Ashaiman	Residents of the communities	Provision of water-based toilets for (public) usage	TMA	Water-Based toilets		Expert Consultation	1st & 2nd Year
2.1.3 Light Industrial wastes (waste oils, scrap metals, waste waters etc)	Ashaiman	Crop farmers Fishermen	Provision of skips and construction of oxidation ponds	TMA	Skips Oxidation Ponds		Expert Consultation	1st & 2nd year 3rd year
2.2 Coconut Plant Girdle around the Floodable Zone	Periphery of floodable zone		Planting of coconut seedlings	WD	10,000	¢50m ($17,000)	Cost includes maintenance for up to 2 years	1st & 3rd years

Projects/Programmes	Location	Direct Beneficiaries	Action(s) Required	Lead Agency Responsible	No. of Items Required	Estimated Total Cost	Remarks	Time Frame
2.3 Woodland planting	Western-savanna woodland zone	Sakumono Klagon Lashibi Communities	Establishing nursery Planting of seedlings	WD/ Forestry Div	900-1000/acres i.e. 100,000 seedlings for 10 acres	060m $20,000	Cost includes maintenance/ labour etc	
2.4 Widening of lagoon Outlet		General public	Culvert Conservation	TMA			Expert Consultation	3, 4, & 5th year
2.5 Construction of Sakumono Fish Market	Within the site Seaward end of Lagoon	Fishing Commun-ity General Public	Site preparation Sheds construction Provision of Waste bins and Utilities	TMA			Expert Consultation	5th year

Table 3

MATRIX OF IMPLEMENTATION PROGRAMMES/PROJECTS

Scio-economic Enhancement

Projects/Programmes	Location	Direct Beneficiaries	Action(s) Required	Lead Agency Responsible	No. of Items Required	Estimated Total Cost	Remarks	Time Frame
3.1 General Education	Within and Outside the site	Communities						
3.1.1 Extension Education for Animal Rearing	Within Outside The site	Individual farmers	Census of farmers Training Fodder Production Credit Provision	MOFA MOFA MOFA WD/DA		$2000 $4250 $1000 $1500	20 farmers	1st and 2nd year
3.1.2 Extension Education for fresh Water Aquaculture	Within the site	Fish farmers	Training	1. Fishery Dept. 2. NGO		$1200 $2000	20 farmers	1st and 2nd year
3.1.3 Extension Education For Brackish Water Aquaculture	Within the site	Farmers	Training Cage Construction Credit Provision.	1. Fishery Dept 2. NGO	Cage Credit	$400 $600	20 farmers, 2 cages per one. 20 farmers	1st and 2nd year
3.1.4 Extension Education for crop farmers	Within the Site	Crop farmers	Census of farmers Training Input	MOFA MOFA		$3000 $6375 $6000	30 Farmers	1st and 2nd year
3.2 Production and dissemination of materials								2nd year

Projects/Programmes	Location	Direct Beneficiaries	Action(s) Required	Lead Agency Responsible	No. of Items Required	Estimated Total Cost	Remarks	Time Frame
1.2.1 Flyers 3.2.2 Brochure		Communities and the General Public	Designing and printing Design, drafting and publishing	WD WD	Printing Printing	¢1,500,000 ($500) ¢250,000 ($85,000		2nd year
3.2.3Guide/Manual		Researchers Students General Public	Design, drafting Publishing	WD	Printing	¢15,000,000 ($5,000)		2nd year
5.2.4 Public meetings and consultations		Communities Developers TMA/TDC Forestry Dept.	Organization and coordination	WD TMA/TDC Forestry Dept Fisheries Planning	Transport Stationery Fees for resource persons Refreshments	06,000,00 0 ($2000)		1st -5th year

Table 4
MATRIX OF IMPLEMENTATION PROGRAMMES/PROJECTS (Capacity Development)

Projects/Programmes	Location	Direct Beneficiaries	Action(s) Required	Lead Agency Responsible	No. of Items Required	Estimated Total Cost	Remarks	Time Frame
4.1 GIS Training		WD Staff	Training	WD	Fees	¢6,000,000 ($2,000)	Training for two staff	1st and 2nd year
4.2 GIS Equipment Procurement/Installation		WD	Purchase and installation of computers	WD	1 Computer Software	¢10,000,000 ($3,400) ¢5,000,000 ($1,700)	Arc View	1st and 2nd year

Table 5
MATRIX OF IMPLEMENTATION PROGRAMMES/PROJECTS
Research and Monitoring

Projects/Programmes	Location	Direct Beneficiaries	Action(s) Required	Lead Agency Responsible	No. of Items Required	Estimated Total Cost	Remarks	Time Frame
5.1 Hydrology and Water Quality	Catchment Area	Environmental Managers Wildlife Department	Surveys Data Analysis Reporting	WD	-	20,000	-	1-5th year
5.2 Fishery Stock Assessment	Lagoon Area				-	20,000	-	1-5th year
5.3 Environmental Change and Rehabilitation Studies	Catchment Area				-	20,000	-	1-5th year
5.4 Community and Stakeholder Perceptions					-	20,000	-	1st & 2nd year
5.5 Habitat Zone Mapping					-	20,000	-	1st year

***** **NB**

Very little information is available in the various reports to provide reliable cost estimates. Surveys will be needed to determine the Specific location and numbers of skips, oxidation ponds, toilets, seedlings and other items.

US$ 1 - ¢3,000

THE MINIMUM PROJECT ACTION PROPOSAL

To achieve minimum management objectives in the light of any possible financial constraints the following combination of project actions are recommended with costs over a three to five year period to arrest further deterioration in conditions of the Site.

Resources and Environment	Cost US$
• Coconut plant girdle around the floodable lagoonal plain	17,000
• Tree planting (woodlots) in the savanna, thicket and riverine forest areas.	20,000
• Provision of waste disposal structures and facilities.	
Sub Total I	37,000
Capacity Development	
• Production and dissemination of informational materials such as flyers, manuals and guides for schools and visitors.	5,500
• Production of promotional brochure	5,000
• Public meetings and consultations.	2,000
Sub Total II	92,5000
Extension Education	
• Crop farmers,	24.375
• Fishermen and Aquaculturists	41,200
• Livestock farmers	8,725
Sub Total III	37,300
RESEARCH AND MONITORING	
• Hydrology and Water quality	20,000
• Fishery stock assessment	20,000
• Environmental change and Rehabilitation studies	20,000
• Community and stakeholder perceptions of wetland resources	20,000
• Habitat zone definition and mapping.	20,000
Sub Total IV	100,000
Grand Total I + II + HI + IV	**266,500**

APPENDICES

Appendix 1: List of plant species recorded in the Sakumo Ramsar Site (Oteng-Yeboah, 1994)

1. Flood Plain Elements

1. *Bothriochloa bladhii*
2. *Calotropis pro cera*
3. *Cassia rotundifolia*
4. *Chloris barbata*
5. *Croton lobatus*
6. *Heteropogon contortus*
7. *Indigofera hirsute*
8. *Paspalum orbiculare*
9. *Sporobolus pyramidalis*
10. *Vernonia cineria*

2. Saltmarshes

1. *Cyperus articulatus*
2. *Imperata cylrindrica*
3. *Paspalum vaginatum*
4. *Philoxerus vermicularis*
5. *Sesuvium portulacastrum*
6. *Sporobolus virginicus*

3. Estuarine Brackish/Freshwater Marsh

1. *Cyperus articulatus*
2. *Imperata cylindrica*
3. *Paspalum vaginatum*
4. *Philoxerus vermicularis*
5. *Sesbania sesban*
6. *Sesuvium portulacastrum*
7. *Sporobolus virginicus*
8. *Typha domingensis*

4. **Grassland Elements**

1. *Bothriochloa bladhii*
2. *Calotropis procera*
3. *Cassia rotundifolia*
4. *Chloris barbata*
5. *Crotonlobatus*
6. *Heteropogon contortus*
7. *Indigofera hirsute*
8. *Paspalum orbiculare*
9. *Sporobols pyramidalis*
10. *Vernonia cinerea*

5. Mangrove Swamp

I. Avicennia africana

6. Thicket Element

1. Adansonia digitata

Appendix 2: International Importance of Waders Count at the Sakumo Ramsar Site.
Source: Ntiamoa-Baidu and Gordon (1991)

Species	**1% of estimated** East Atlantic Flyway **Population***	**Peak Count** Recorded at Sakumono **Ramsar Site****
Spotted redshank	**300**	**3,280**
Greenshank	**500**	**1,180**
Ringed plover	**2,000**	**-**
Curlew Sandpiper	**4,500**	**3,270**
Sanderling	**1,000**	**-**
Little Stint	**2,000**	**2,570**
Black-tailed godwit	**1,500**	**1,500**
Avocet	**700**	**-**
Black-winged stilt* **	**60**	**900**

- criteria is bases on Altenburg et. al (1982); Smith and Piersma (1989)

** Peak count as at 30/06/1991

* ** Partial migrant, number recorded comprises of 55% palaearctic; 45% residents

Appendix 3: Species and status of animal life recorded in Sakumo Lagoon in the 1970s (Source, Pauly 1975).

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

Appendix 5: 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
SHOREBIRDS			
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 p lover	110	20	8.2
Kittlitz's sand plover	480	100	20.8
Grey plover	2,780	300	10.8
Knot	2,360	210	8.9
Sander1ing	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
TERNS			
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
OTHER WATERFOWLS			
Long-tailed Cormorant	790	60	7.6
Squaccoheron	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
*Ga*rganey	7,450	830	11.3
Teal	140	140	100
Black headed gull	280	30	10.7
Lesser black-Backed gull	760	10	1.3

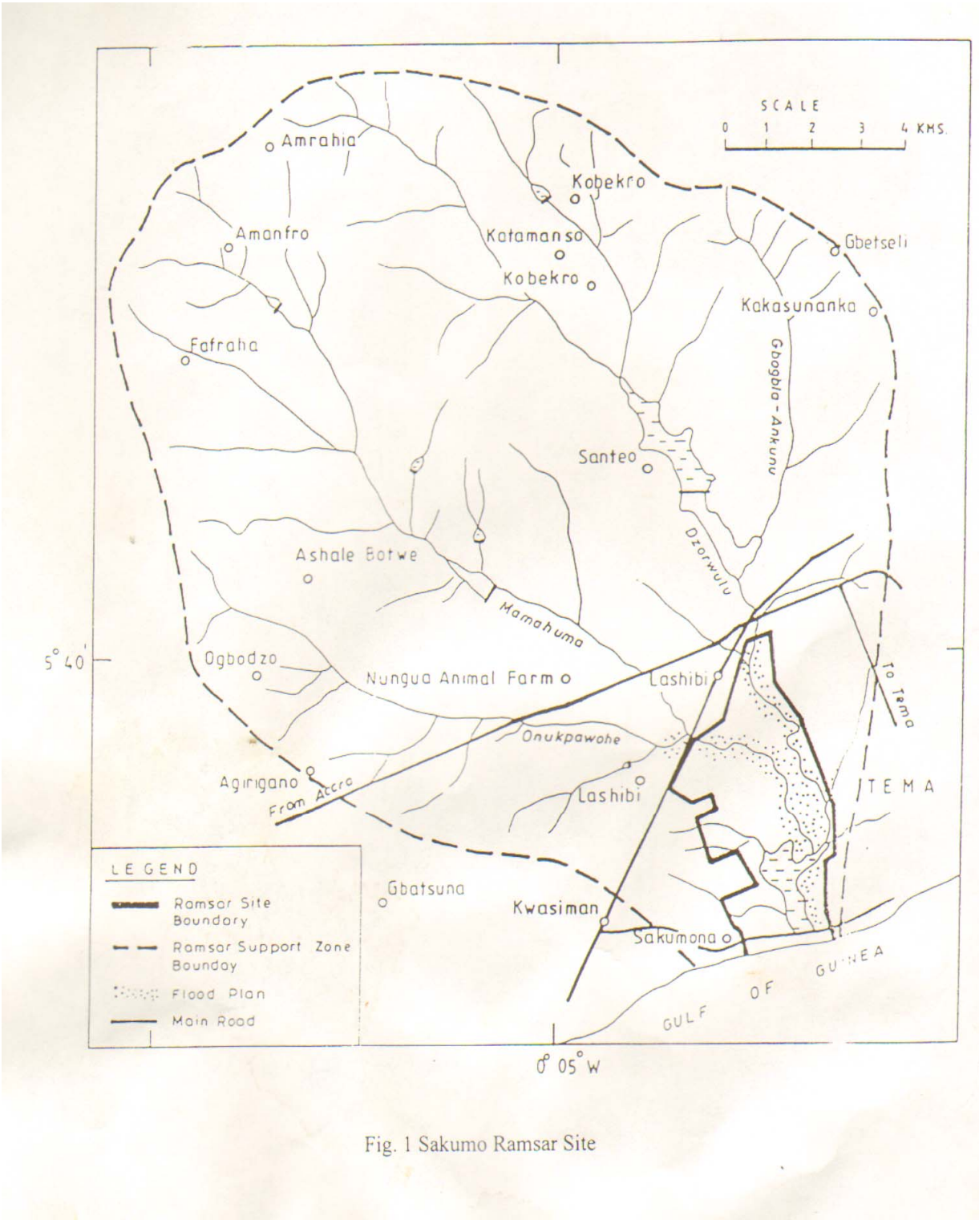
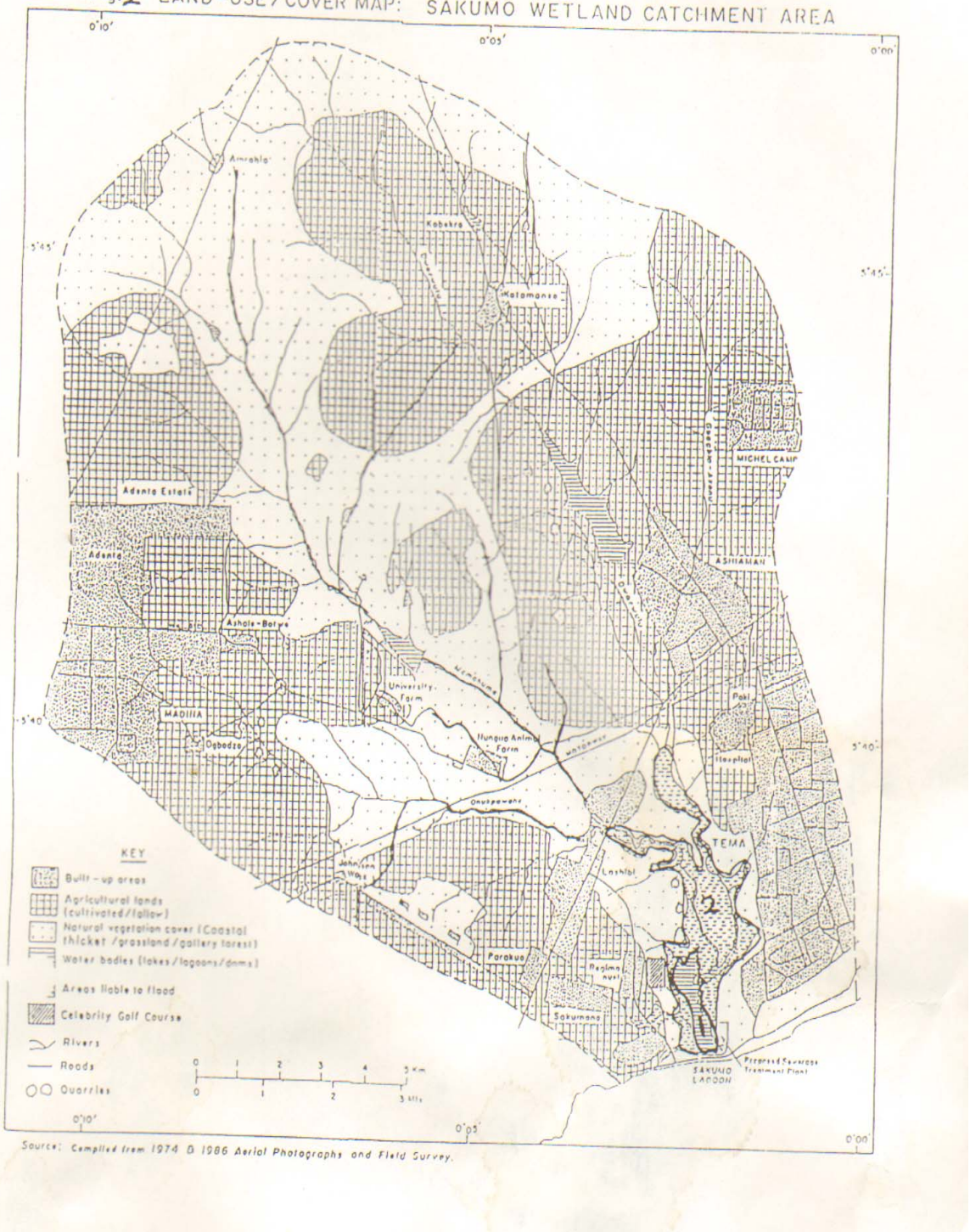


Fig. 1 Sakumo Ramsar Site

Fig. 2 LAND-USE / COVER MAP: SAKUMO WETLAND CATCHMENT AREA



Source: Compiled from 1974 & 1986 Aerial Photographs and Field Survey.