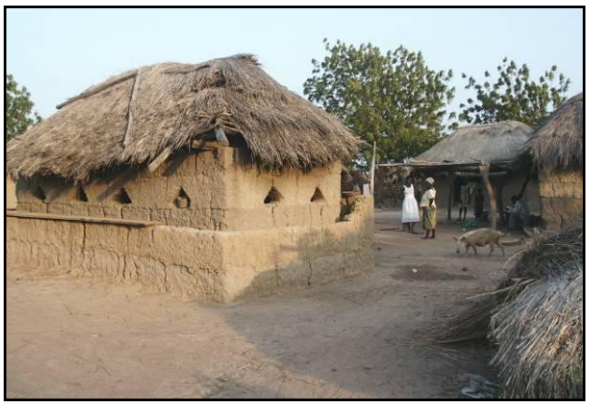
NATURE CONSERVATION RESEARCH CENTRE
*Conserving the Environment; Developing Communities.*

EARTHWATCH INSTITUTE
FINDING SOLUTIONS FOR A SUSTAINABLE FUTURE

# Enhancing Conservation of the West African Manatee in Ghana

## 2007 Annual Report

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## Executive Summary

This is the 2007 Annual Report of the Nature Conservation Research Centre (NCRC) and our partners' progress in the West African Manatee Conservation Initiative on the Afram Arm of the Volta Lake in Ghana. This project has been supported by the Earthwatch Institute (Europe) and Clark Sustainable Resource Developments Ltd (CSRD).

The project hosted one Earthwatch research team over a period of two weeks, during which time data was collected on four research aspects:

- Detect and determine the seasonal distribution of manatee within the project area.
- Obtain data on morphometrics (size and shape), cranial measurements and reproduction of the species to support its taxonomy and genetics.
- Document habitat factors affecting manatee in the study area.
- Investigate food sources and critical feeding sites of manatee within the study area.

Three manatees were sighted over the period. Throughout the season, water pH was near neutral while mean secchi-disc (a tool used to measure turbidity of the water from the surface) visibility values were high, ranging between 0.96-1.19 meters. A total of 9 aquatic plant species were found to be associated with manatee feeding habitats. The occurrence of a wide variety of aquatic vegetation food sources, with the particular presence of *Brachiaria mutica* (para grass), is considered favourable for the growth of manatee populations, but the continued human related manatee conflicts, especially related to fishing activities, raises concerns about the capacity of the overall population to remain stable.

The Earthwatch project provided an opportunity for 10 students from across West Africa to share their experiences and work with Principal Investigator Prof. Patrick Ofori-Danson. Local villagers who were engaged as field guides and boat men also took the opportunity to gain insight into the concept of the project. It is anticipated that, through this exposure, local personnel will want to and be able to become guides in nature interpretation when the ecotourism aspect of this project begins.

Much of the data from the 2007 field season are still being analyzed, but eventually will inform the preparation of management plans to enhance conservation efforts and the development of ecotourism in future.

In order to enhance effective community involvement in the project, conservation awareness sessions were conducted for a selected number of communities to demonstrate the ecological processes that support their livelihoods and create awareness and support for the project.

In 2008, the project will focus on 4 main aspects of research. Further data will be collected to support our research objectives using Earthwatch teams. We will extend our capacity building activities to include efforts towards ensuring greater community involvement, especially in making decisions about the future management status of the project area. A detailed socioeconomic survey will be conducted in all project communities to provide the basis for developing social investment strategies and exploring enhanced economic opportunities for project communities. Strategies will be developed to address potable water and lake safety challenges facing the target communities. Our final activity will review farming and fishing practices aimed at developing strategies to reduce human related conflicts with manatees.

# Chapter 1: Introduction

## 1.1 Introduction to the Project

The overall aim of the project is to support the growing collaboration between NCRC, Earthwatch Institute, Wildlife Division, CSRD and local communities to enhance conservation of the West African manatee (*Trichechus senegalensis*) in the Afram Arm of the Volta Lake, while enhancing socioeconomic opportunities for local communities.

There are four outcomes to this initiative, as follows:

Outcome 1: Increased knowledge of the West African manatee population in the Afram arm of the Volta Lake.

Outcome 2: Reduced conflict between manatees and local communities in the Afram arm of the Volta Lake.

Outcome 3: Enhanced local capacity and sub-regional expertise for the conservation and management of West African manatee populations.

Outcome 4: Improved economic and social conditions in target project communities at the Afram arm of the Volta Lake.

Outcome 1 is being achieved through the collection of data on behavioural ecology, population distribution and habitat studies with the assistance of Earthwatch volunteers.

Outcome 2 will be achieved by reviewing lake user practices with local communities, aimed at defining best practices and encourage communities to implement them.

Outcome 3 is being achieved with the involvement of local community members and Ghanaian university students in data collection and analysis. In future the project will encourage and facilitate the formation of Manatee Conservation groups in communities and also provide practical training to conservation groups in environmental management.

To achieve objective 4, the project will conduct detailed socioeconomic and ethnographic studies of all project communities to develop strategies for improving the lives of communities through the aspects of access to potable water, access to education, access to affordable solar lighting equipment and other social amenities.

The impacts of this project, in the long term, can be grouped as follows:

*Community Impacts*
- Increased cohesion among communities
- Increased national and international profile for communities
- Greater access to potable drinking water
- Safer transport on the Volta Lake

*Long term Impacts,*
- Improved educational and health facilities for communities
- Improved road access and transport to communities
- Improved agricultural activities leading to increased food security
- Increased revenue to communities through tourism

*Conservation Impacts*

- Increased plant populations and improved forest cover for wild animals;
- Greater protection for the shoreline of the Afram Arm through reforestation activities;
- Greater protection for riverbank forests through reduction in wildfires and sustainable agricultural practices;
- Mammal, avian and reptile populations increased from natural growth and in-migration;
- Greater community awareness and protection for wildlife and forest resources.

## 1.2 Background to the Project

In 1964 the Akosombo hydroelectric dam was constructed to provide 768,000 kilowatts of electricity for Ghana and neighboring Togo and Benin. While this pioneering hydroelectric project has brought great advantages to Ghana and her neighbours, there are socioeconomic and environmental challenges to such a reservoir. The resultant Volta Lake submerged 8,515km$^2$ of forest area and displaced some 78,000 people.

The flooded lands above the dam include the lowlands surrounding one of the Volta's tributaries, the Afram River. The resulting submerged forest offers a unique flooded forest habitat that supports the co-existence of manatees and humans. This distinctive situation restricts the use and speed of motorized boats, restricts the fishing methods that will be successful, and provides a reasonably safe haven for manatees. Manatees are well known to the fishing communities along the Afram Arm of the Volta, known as 'laale' or 'enor' in Ewe, 'laluuko' in Dangbe. Fishermen come in contact with them regularly through their fishing practices, which include swimming under water in the setting and removal of fishing nets, and the use of non-motorized, dugout canoes.

Internationally, it is accepted that the Volta Lake hosts one of the most important populations of the West African manatee remaining in its range. Information available from surveys completed by Ofori-Danson and Agbogah (1995) and NCRC (2004 & 2006) also suggest that the population upstream of the dam is critical for the global conservation of this species of manatee.

Preliminary surveys have been completed on the Afram Arm of the Volta Lake (in the eastern region of Ghana) to establish West African manatee prevalence in that area of the Volta Lake. A preliminary core use area for manatees was defined and mapped using GPS and the initial conservation status of manatees was established.

Fishing practices, such as the removal of floating vegetation for fish harvesting, alter the aquatic habitat. Manatees and fishermen are in direct competition for access to this aquatic vegetation and the conflict may have adverse effects on the long-term survival of manatees in the area.

Legal protection has been established for manatees in Ghana, and the Wildlife Division prohibits trade and hunting of manatees. However, the enforcement of wildlife laws protecting manatees is frustrated by lack of resources, manpower, and limited awareness of existing regulations. NCRC has documented historic evidence that a small number of people have hunted manatees in the Afram catchments. Thus manatee hunting is not a major livelihood strategy, and may be brought under control by working with these individuals. Through education and awareness, local people can be supported to make adjustments in their fishing and hunting practices to reduce conflict with the species.

**The Order Sirenia:** West African manatees (*Trichechus senegalensis*) belong to the Order Sirenia, an ancient and diverse group of aquatic mammals dating back over 50 million years. Extinct species, known from the fossil record, number ~50 in four families (Self-Sullivan

2005). However, there are only four species in two families remaining today. The family *Trichechidae* includes the West African, West Indian (*T. manatus*), and Amazonian (*T. inunguis*) manatees. The Family Dugongidae includes the Indo-Pacific dugong (*Dugong dugon*) and recently wiped-out (1768) Steller's sea cow (*Hydrodamalis gigas*). See Figure 1 for historic distribution of the species. Despite convergent traits due to their shared status as 'marine mammals', sirenians are not related to other modern aquatic mammals such as cetaceans (whales and dolphins) or pinnipeds (seals, sea lions, and walruses). In fact, the closest living relatives of the Sirenia are old world terrestrial mammals in the Orders *Proboscidae* (the elephants) and *Hyracoidea* (the hyraxes).


Figure 1. Historic distribution of the five modern sirenians; currently populations are severely fragmented due to local extirpation events. Image © Sirenian International, www.sirenian.org.

As the only herbivorous fluviatile/marine mammals (Hershkovitz, 1969), the 4 extant (living species of) sirenians fill a unique ecological niche in tropical lakes, rivers, and coastal regions around the world. Unfortunately, all four sirenian species are endangered — threatened with extinction despite their protected status under local and international laws. In addition to their ecological importance, sirenians have persisted in human culture and mythology for thousands of years (Self-Sullivan and LaCommare, 2005). So much so that the taxonomic order is named after the Sirens of ancient Greek mythology. Over time, some authors appear to have confused Homer's Sirens with mermaids, perhaps leading to naming of the scientific

Order Sirenia by Illiger in 1811. Mermaid legends are ubiquitous and most indigenous cultures in Asia, Africa, Australia, and the Americas each have their own creation story about how manatees and dugongs "came to be." Some cultures continue to associate manatees and dugongs with good or evil spirits associated with water; in such cases the spirit and the animal have similar names in local languages.

***Trichechus senegalensis*:** The West African manatee, the least studied sirenian species, is widely distributed in coastal regions, rivers, estuaries, and lagoons from southern Mauritania to southern Angola, and as far inland as 2,000 km, often trapped above dams (Powell, 1996). Most West African manatee populations are thought to be small, fragmented, and in continuous decline, and the species is listed as 'vulnerable' on the IUCN Red List of

Threatened Species (categories A3cd; C1*). Available data is extremely limited with little new information since the last IUCN Assessment in 1996. It appears that illegal hunting continues to increase throughout the species range—at high rates in some regions due to human poverty levels, lack of awareness, and limited enforcement by local authorities. In Nigeria, limited take has been legalized for cultural festivals, but illegal hunting continues (Ita, 2005). Indirect threats, including destruction of habitat for development, mangrove harvesting, siltation of lakes, and damming of rivers for hydroelectric power, are also increasing. Unless immediate actions are taken, the total population will continue to decline with extirpation of fragmented and isolated populations expected. The seriousness of this threat has gained international attention over the past 15 years (see Perrin, 2001; Diop, 2005; Van Lavieren 2005; Ita, 2005); however effective conservation measures for the species have been very slow in progression.

The species' cultural significance is evidenced by wide spread association between manatees and the Mami Water (aka *Maame Water*, *Mammy Wata*) spirit, stories, songs, and indigenous practices (Ita, 2005).

## 1.3 Project Area Description

The project location is the Afram arm of the Volta Lake and its surrounding catchments. It is within latitude $6^0$ 300'N – $7^0$ 00' and longitude $0^0$ 10' – $1^0$ 00'. The River Afram was one of the many tributaries of the River Volta before it was dammed in 1964 at Akosombo, which resulted in the flooding of a large portion of the river basin above the dam (including the Afram River and its tributaries) to form the Volta Lake. The flooded Afram River and its tributaries now constitute the Afram arm of the Volta Lake. The Kwahu Escarpment runs along the southern bank of the Afram and constitutes an imposing geological feature of the area. In contrast, the north bank is a flat fluvial plain.

Human settlements are found on the immediate catchments of the Afram on both the southern and northern banks. These villages and towns range from small fishing villages of about 50 inhabitants to towns of over 5,000 people. The inhabitants are mostly fishermen and farmers of the alluvial plain and adjacent savanna land. In addition, cattle herding is extensive throughout the area and has been a source of conflict between different settler tribes wanting to use the land for differing purposes.

There are three major settlements in the area: Kotoso and Adawso on the south bank and Ekye-Amanfrom on the north bank. Adawso and Ekye-Amanfrom are the terminus points for a public ferry service with daily crossings linking the south and north shores and providing access to motorized and pedestrian traffic. The population of Adawso is about 2000 people, while Ekye-Amanfrom has approximately 5000 people. Adawso is the gateway to the Afram Plains and Ekye-Amanfrom is host to an important market transit centre for foodstuff. Kotoso town site, on the south bank, is the only other large settlement with road access. The town contains an important regional water treatment plant and also offers an alternative market transit centre for north bank villages lacking road access. Market days occur twice a week here and are bustling affairs with abundant boat traffic full of charcoal and farm produce being transferred to waiting Lorries destined for Accra markets.

* A3 = Section 3 under criteria A for "Vulnerable" status: A population size reduction of ≥ 30%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.
cd = Sections c and d under criteria A1: An observed, estimated, inferred or suspected population size reduction of ≥ 50% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are: clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
(a) direct observation; (b) an index of abundance appropriate to the taxon; (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat; (d) actual or potential levels of exploitation; (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.
C1 = Section 1 under criteria C for "Vulnerable" status: An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, (up to a maximum of 100 years in the future)

Specific locations of interest to a manatee conservation project include three potential research bases ideally situated for maximum access to manatee feeding grounds and waterways. The fishing and farming villages of Gadorkorpe, Samankwae (also known as Gavorkorpe), and Bompata are situated at the mouth of important Volta Lake tributaries. Gadorkorpe has a population of approximately 500 people. Each of the other two sites has a population estimated at about 1,000 inhabitants. Samankwae, which is connected to the tarred Afram Plains road by a well-maintained bush road, is only 15 minutes from the supply town of Ekye-Amanfrom. This picturesque and friendly village appears to be an ideal start up location for more extensive manatee field activities due to ease of access for field base construction and for use by research teams.

# Chapter 2: Biological Studies

## 2.1 Expected Outputs

The primary objective of the project is to support collaboration among NCRC, Earthwatch Institute and the local communities to enhance conservation of the West African manatee (*Trichechus senegalensis*) in the Afram Arm of the Volta Lake, Ghana and increase knowledge and build local, national and sub-regional manatee conservation capacity.

The specific objectives are:

Objective 1**:** Detect and determine the seasonal distribution of manatee within the project area
Objective 2: Obtain data on morphometric, meristic, cranial and reproduction of the species to support its taxonomy and genetics
Objective 3: Document habitat factors affecting manatee in the study area
Objective 4: Investigate the food sources and critical feeding sites of manatees within the study area.

## 2.2 Earthwatch Expedition

### 2.1.1 Methods

Detection and seasonal distribution of manatees
Three fixed boat transects were mapped out using GPS for running during the flood, transitional and dry seasons. One line followed the main channel (i.e. the flooded river that existed prior to 1964) and the other 2 ran along the main channel in the vicinity of the villages Gavorkope and Adakponu (near Gadorkope). Three scanning stations at least 100m apart were selected along a given transect. The location of the fixed transects were determined through guidance from local manatee hunters. The stations were identified as waypoints and their geographical position translated from GPS. From the project boat, the Earthwatch volunteers scanned the area for 30 minutes at each station to spot manatee. For each station scanned, the time, lake state, cloud cover, water temperature and air temperature were also recorded.

The Earthwatch observers approached all groups of fishermen within 100m of the transect line and interacted with them, asking questions such as whether they had seen a manatee that day. Fishing effort data and GPS positions for the fishing boats sighted were recorded on designed data sheets. As expected, it was initially difficult for Earthwatch volunteers to successfully detect manatee during line transects. It is anticipated that a comparison between animals detected by the volunteers will be made with future side-scan sonar studies to facilitate determination of the seasonal distribution of the manatees.

Cranial, morphometric and cranial data

Cranial, morphometric and cranial data were obtained from skulls collected from local hunters and from the PI's collection of 15 skulls. Vernier calipers and relevant equipment were used to take cranial measurements using standard methodologies. Training and assistance in this component of the research was provided by Dr. Caryn Self-Sullivan, lead PI from the Earthwatch Manatee Project in Belize.

Habitat factors

A wide variety of environmental data were collected during each transect. The physical and chemical measurements included: sea state, air and water temperature, pH, turbidity, transparency, depth and nature of the lake bottom. Using the HACH kit (water quality testing instruments), the following chemical parameters of the water were measured: nitrates, biological oxygen demand (BOD), conductivity, phosphates, nitrogen-ammonia and sulphates.

Food sources and critical and feeding sites of the manatee

Knowledge from local hunters and fishermen was used to identify feeding sites and target vegetation food species. The taxonomy of identified plants was completed following the guidance and illustrations in Hall *et al*., (1975). Vegetation cover and abundance along line transects at identified feeding sites and the frequency of occurrence of food species were recorded on designed data sheets. The Shannon-Weiner Diversity index (given as $H' = n\log n - \sum f_i \log f_i / n$ in Zar, 1974) will be used to assess the seasonal diversity of food species at the feeding sites.

### 2.2.2 Preliminary Results

***Plate 1: Volunteers on water transects***

*Objective 1 (Detect and determine the seasonal distribution of manatee within the project area)*

Boat scans for manatees were carried out along the Gavorkope and Adakponu transects during 21 – 28 November, 2007 (dry season). A total of 3 manatee were sighted during these surveys; 2 on the Gavorkope transect and 1 on the Adakponu transect. Table 1 presents relevant information obtained from the surveys. Generally, the manatee were observed when the water state was zero i.e. the waves were flat with zero wind action.

**Table 1. Summary of manatee sighting from transect surveys**

| Date | Transect | Station Waypoint | Latitude/ Longitude | No sighted | Sighting type | Sea state | Time (GMT) |
|---|---|---|---|---|---|---|---|
| 21/11/07 | Adakponu | 122 | 74259/44679 | 1 | Scan | 0 | 1100-1130 |
| 22/11/07 | Adakponu | 122 | 74259/44679 | 0 | Scan | 0 | 1000-1100 |
| 22/11/07 | Adakponu | 126 | 74607/44566 | 0 | Scan | 1 | 1150-1220 |
| 23/11/07 | Adakponu | 132 | 74225/44691 | 0 | Scan | 1 | 0630-7000 |
| 26/11/07 | Gavorkope | 140 | 79234/53293 | 0 | Scan | 1 | 0720-0750 |
| 26/11/07 | Gavorkope | 136 | 77530/520101 | 0 | Scan | 1 | 0607-0630 |
| 28/11/07 | Gavorkope | 153 | 77950/52921 | 2 | Opportunistic | 0 | 1000-1030 |
| **Total** | | | | **3** | | | |

*Objective 2 (Morphometric cranial measurements in support of manatee taxonomy and genetics)*

***Plate 2: Taking cranial measurements***

The number of bones in the manatee skeleton as a whole varies for several reasons. As the skeleton develops, some bones combine or fuse together (ankylose) to form compound bones. Attempt was made to determine the approximate age of the bones from the sequence of fusion (closure) of four synchondroses. From these studies the skulls collected were generally found to be below the 3 year known age of first maturity for manatee. This implies that the manatee being caught could be juveniles.

Detailed morphometric and cranial measurement were made by Earthwatch team members under guidance of Dr. Caryn Self-Sullivan, the Project Advisor.

*Objective 3 (Document habitat factors affecting manatee in the study area)*

The mean values for the various factors related to the water quality at Adakponu (near Gadokorpe) and Gavorkope respectively are presented in Table 2.

***Plate 3: Taking limnological measurements***


***Plate 4: Scene from the Volta Lake***


***Plate 5: Vegetation at the banks of the water***

Generally, the water quality parameters at the two stations were comparable (Table 2). The water quality was near neutral (6.42-7.11 pH range) which portrays suitable freshwater medium. This range fell within pH values (6.8-8.5) reported for Volta Lake by Baijot *et al.*, (1997). The mean Secchi disc visibility (transparency) of the water was quite high with visibility between 0.96-1.19m). During the period under review (dry season), this should facilitate manatee sightings close to the surface of the water.

**Table 2. Mean values of water quality parameters measured during November 2007**

| Limnological factor | Gadokorpe/Adakponu | Gavorkope |
|---|---|---|
| Temperature $^0$C (Air) | 29.9 | 27.8 |
| Temperature $^0$C (water) | 30.8 | 30.5 |
| BOD ($mgl^{-1}$) | 3.53 | 3.63 |
| Conductivity ($\mu Scm^{-1}$) | 83.11 | 84.66 |
| Mean depth (m) | 5.33 | 5.27 |
| Nitrates ($mgl^{-1}$) | 0.72 | 0.88 |
| Surface Ph | 7.11 | 6.42 |
| Phosphates ($mgl^{-1}$) | 0.62 | 0.24 |
| Nitrogen-ammonia ($mgl^{-1}$) | 0.08 | 0.16 |
| Sulphates ($mgl^{-1}$) | 2.8 | 1.0 |
| Transparency (m) | 1.19 | 0.96 |
| Turbidity (NTU) | 6.30 | 6.85 |

*Objective 4 (Food sources and critical feeding sites of manatees within the study area)*

The list of vegetative species associated with manatee feeding habitat encountered during the line transect surveys, and their respective frequencies of occurrence, is presented in Table 3.

**Table 3. List of species associated with manatee feeding habitats during November 2007**

| No | Species | Indicated as local food source | Frequency of occurrence(f) | % Frequency of occurrence |
|---|---|---|---|---|
| 1 | *Brachiaria mutica* | Yes | 54 | 36 |
| 2 | *Polygonium sp* | No | 17 | 11.3 |
| 3 | *Echinochloea stagnia* | Yes | 18 | 12.0 |
| 4 | *Neptunia sp* | Yes | 12 | 8.0 |
| 5 | *Ultricularia sp* | Yes | 21 | 14.0 |
| 6 | *Nymphaea sp* | Yes | 5 | 3.3 |
| 7 | *Ceratophyllum sp* | Yes | 3 | 2.0 |
| 8 | *Alternanthera sessilis* | Yes | 15 | 10.0 |
| 9 | *Azolla sp* | Yes | 5 | 3.3 |
| | **TOTAL** | | **150** | **99.9** |

***Plate6: Potential food source for manatees***

***Plate 7: Plant to be identified***

A total of 9 different aquatic plant species were encountered at the feeding site (Table 3). With the exception of *Polygonium sp* (11.3% of all species encountered), all species were identified by local hunters as potential food sources for manatees in the habitat. This implies that a wide range (about 90%) of the aquatic vegetation in the feeding sites could be considered as suitable food sources for the manatee. However, this needs to be confirmed in

the future by manatee stomach content analysis. The dominant vegetation food source was *Brachiaria mutica*, which formed 36% of the vegetation encountered at the feeding site.

### 2.2.3 Discussion of Results

The local fishers complained of net damage caused by the manatee. The observation of 3 manatee during the expedition coupled with reported manatee kills and the claims of net damage by local hunters/fishers give an idea of the occurrence of manatee in the study area. However, the population would probably find it difficult to sustain further removals through hunting operations. This is expected because manatee populations throughout the range of the species have been reduced by hunting for their meat and destruction or modification of their habitat (Husar, 1977).

The transparency of the water (ranging between 0.96- 1.19 m) in the dry season apparently facilitated ease of sightings during the expedition. It is noteworthy that the observations were made when the lake state was zero (i.e. little or no wind action). This could indicate possible preference by the manatee for a serene and quiet environment for social activities or rather that calm lake conditions increase the likelihood of sightings. This kind of serene habitat could be rare in an environment with a wide range of fishing techniques, with too much noise from people and moving boats with propeller engines.

The continued high level of human-related manatee conflict, particularly due to fishing activity in the study area, raises concern about the capacity of the overall population to grow or at least remain stable. This scenario will continue to highlight the animals as rare and elusive in the study area. Unfortunately, protection of this scant manatee population is still hampered because of the lack of enforcement of existing laws, lack of funds and difficult logistics. In view of the long history of human-manatee conflict in the Volta Lake, sighting manatees will continue to be a difficult task. Thus, the ability to identify the animal will require the continued involvement of experienced manatee fishers or hunters to guide and improve the probability of manatee sightings.

The occurrence of a wide variety of potential aquatic vegetation food sources, particularly *Brachiaria mutica*, in the study area is considered favourable for the growth of the manatee population. One apparent habitat factor that could affect the availability of the aquatic floating vegetation food source for the manatee is the water level change. During the study period (November), the banks were flooded causing affluent soil deposition and increased floating aquatic vegetation. Tributaries of the Afram arm have these characteristics, and this may in part explain the apparent abundance of manatee present at the location. General changes in productivity in the lake, related to seasonal flooding patterns, influence the growth of bank vegetation and floating habitat, which means that changes to these cycles could have a secondary impact on manatees through their food supply.

It is expected that the energy expenditure of manatee to reach their food source will be lower during the flooded seasons. As a result, manatee are more likely to be attracted by vegetation (used as baits in traps) by the hunters during the non-flooded season than the flooded season. This appears to be supported by the local hunters who normally attract manatee by providing vegetation food in some areas during the non-flooded season. This activity could be continued and used as basis for encouraging former manatee hunters to become guides for the proposed manatee ecotourism viewing.

### 2.2.4 Significance of Research

Internationally, this project will help bring Ghana into conformity with acceptable initiatives of manatee conservation and further attract funding to manatee conservation; hence a contribution to global protection of manatees.

Nationally, the project will provide training to local biologists to help in the collection of baseline data on the manatee to improve knowledge about the animal and enhance effective management and conservation under the L.I. 685 (Ghana Government Legislation covering species protection). The project will therefore help Ghana fulfill her obligation under the Convention on Biological Diversity (CBD).

Locally, the project will engage local fishermen to find appropriate fishing methods that are environmentally friendly, economically sustainable, and culturally acceptable and which reduce conflict with manatees. There will also be public education to create awareness of the need to protect the mammal which will lead to reduced conflict between manatees and local communities in the Afram Arm of the Volta Lake. The promotion of 'manatee watching' ecotourism is an important component. The tourism component of the project will improve the economic and social conditions in target local communities. This will bring direct revenue to local communities through river safaris, sale of souvenirs, vehicle and canoe rentals, accommodation fees and food sales.

The project will take on young Ghanaian students from the University, who are studying conservation theory, to participate in data collection and understudy the research methods. This will provide them with the needed capacity to design and undertake their own research in the future.

### 2.2.5 Dissemination of Results

The data obtained from this project will be used to prepare a Tourism Development Plan towards the development of an ecotourism enterprise in the project site. Awareness creation sessions are being implemented and will be emphasised in the coming years.

### 2.2.6 Project Development

*Genetic and telemetric studies*

Data on morphometry and cranial measurements are currently being analysed by Dr. Caryn Self-Sullivan for submission to the Ghana project. Meanwhile, specimens of bone tissues (ear bone, squamosal (a bone in the skull) and teeth) have been collected and shipped to the Sirenian Project on Manatee Genetics in Gainsville, Florida, USA, to enable sectioning of the bones for genetic and age studies. The local hunters demonstrated the ability to capture the manatee live with minimum injury. If this is feasible, the introduction of telemetry in future surveys may need to be considered for funding. For instance, manatees could be tagged with a satellite/VHF transmitter or radio-tagged with time-depth recorders to facilitate genetic, population and migratory assessment studies of the manatee in the study area.

*Information on manatee distribution from side-scan sonar operations of the CSRD Timber Salvaging Project*

Clark Sustainable Resource Developments (CSRD) Ltd is developing a major project to recover submerged trees from Volta Lake under an agreement with the Government of Ghana and the Volta River Authority (CSRD, 2007). Working with many Ghanaian constituents, CSRD proposes to salvage timber from areas of the lake (including the Afram Arm), process it at regional facilities and take it to market as a premium wood product, providing economic benefits to Ghana and local communities. An Environmental and Social Impact Assessment (ESIA) is being undertaken at the Afram Arm. It is anticipated that extra information on manatee distribution will be obtained from side-scan sonar operations by CSRD. Further discussions with CSRD will be undertaken on this activity in 2008.

### 2.2.7 Educational Opportunities

- A total of seven Earthwatch team members from across West Africa were trained in new methodologies. There was also a sharing of knowledge in the field of manatee conservation.
- The Principal Investigator traveled to Belize among other countries to build his capacity before the research started.
- Many other opportunities will in the near future be availed for many young conservationists to build their capacity in the manatee conservation.

### 2.2.8 Volunteer Tasks and Accomplishments

*Training*

On arrival at the camp near Gavorkope, volunteers were given a tour. On the first day of work, volunteers were made to complete the Expected Learning Form which was discussed. Volunteers were also trained in the application of field equipment such as hand held GPS and the water quality measuring HACH Kit. They were trained in detail on how to undertake morphometric and meristic measurements from a manatee cranium using standard equipment. Most Volunteers were delighted to experience the hands-on opportunity to use this equipment. The staff conducted one-on-one demonstration and equipment application tests with volunteers.

***Plate 8: Project advisor take team members through a training session***

The first day with volunteers in the field was devoted to an introduction to boat based field work. A short visit was also made by boat to the Gadokorpe fishing village (one of the research stations). Volunteers were briefed on methods and research. The teams were divided into two groups for week 1 research activities: Group 1 commenced with the cranial measurements based at the camp while group 2 went on boat surveys. This alternated in subsequent days for the first week.

*Data collection*

***Plate 9: Volunteers going for data collection***

Volunteers participated in data collection both in the field (on boat surveys) and at the camp (for cranial and water quality measurements). They diligently scanned for manatee silently at the selected manatee feeding sites and participated in aquatic bank vegetation food source investigation. Data was entered into laptop computers back at camp. During boat surveys, volunteers were assigned individual tasks, supported by the PI and his assistants. The PI directly supervised volunteers to ensure that there was accuracy and consistency in observations and use of field instruments.

*Presentations and debriefing*

***Plate 10: Evening presentations***

There were scheduled meetings at the camp during which volunteers were given the opportunity to give presentations on their involvement with resource conservation. There were also regular debriefings in the evening, at the end of each field day. Individuals reported on experiences and observations from the field or morphometric measurements taken at camp. After the field debriefing, one or two of the volunteers gave a personal profile, including their career and educational ambitions. At the end of the expedition the team held a final debriefing session with the Gavorkope community leaders. This final debriefing allowed volunteers to comments to the community on their experiences in the community and in the field, and to provide useful recommendations for enhancement of the project.

### 2.2.9 Local community involvement

The local communities were involvement in the project in the following capacities:

- One guide from Ekye Amanfrom
- One guide from Gadokorpe
- Boatman from Ekye Amanfrom
- Navigator from Akyeamanfrom
- Two cooks from Gavorkope
- One camp keeper from Gavorkope
- In addition, community members were hired in the construction of the camp.
- The women of Gavorkope were tasked to collect water for the team.

### 2.2.10 Camp standards

Camp infrastructure

***Plate 11: Camp infrastructure***

The camp consisted of temporal structures including a kitchen, dining area, toilet, bathroom and tents for lodging. Local materials were used in the form of straw, tree branches etc. were used in the construction of camp facilities.

Health and sanitation

The health status at camp was very good because strict hygienic practices were employed and also because team members were from the West African sub region and thus adapted to general conditions.

Recreation
A football match was held between the Gavorkorpe community and the Earthwatch team which resulted in a 1-0 win for the Earthwatch team.

A traditional dance performance was also showcased in which the team fully participated and enjoyed too.

Staff conduct
The staff conduct for the whole duration of the program can be described as unique and very good.

***Plate 12: A volunteer dribbles his way to a goal***

# Chapter 3: Conservation Awareness Sessions

## 3.1 Background

The success of any conservation program requires the understanding and support of the local communities living in close association with natural resources. It is therefore important for local communities to understand how their daily activities are impacting on the environment and how the strive to improve living conditions could paradoxically reduce prospects for a better life. With this approach in mind conservation education was conducted for communities within the project area.

The main purpose of the program was to improve natural resource management and reduce environmental damage to enhance conservation of the West African manatee within the project area. We were guided by 3 objectives:

- Help communities to become aware of the value of natural resources and the ecological processes that maintain them.
- Help communities understand the threats to their environment and how they can act to improve environmental management.
- Motivate communities to take an active interest in protecting the manatees within the project area.

Meeting these objectives meant getting the local communities to understand the concept of community protected areas thoroughly and to review their attitudes towards the environment, leading to a change in behavior.

## 3.2 Audience and educational strategy

Local leaders
Local leaders affect environmental management by passing and enforcing laws at the community level. They are the custodians of the land and its resources and therefore determine the land tenure system and affect the decisions individuals make on a daily basis with regards to the use of natural resources.

Discussions with local leaders aimed to determine the level of influence they have on resource users and their concerns and make suggestions as to how differently resources could be managed to enhance

***Plate 13: Local leaders at Gavorkope***

manatee conservation. It was also intended to help them identify environmental problems and find solutions within the limits of the communities' capacity. A simple exercise was employed to demonstrate the importance of resources:

- Identify as many natural resources as possible within the community.
- Determine present and potential uses of some of the resources identified.
- Determine which resources are considered less important to the community.
- What will be the consequence if the less important resources disappear from the community?

This exercise was meant to demonstrate to community leaders that the most valued resources require the presence of the less valued resources to survive. For example, if all the tall trees in the community were to disappear there will be no nesting places for birds of prey, thus we will have fewer or no birds of prey within the community. The consequence will be an increase in the number of snakes due to fewer predators (birds of prey). An increase in the number of snakes will result in more snake bites, and snakes finding their way into hen coops to eat eggs and chicks, thus affecting poultry production.

School children

Posters were used to address school children. It was demonstrated to school children how life on earth is impossible without vegetation and hence illustrate the need to protect the environment. The children identified environmental problems around the school premises and suggested ways of solving them. The problems included erosion and too few trees on the school compound. They suggested the use of stones to check the movement of rainwater to reduce erosion and the planting of more trees on the school compound. They were encouraged to share what they had learnt with their parents at home.

***Plate 14: A poster being nailed to a tree***

General Community


***Plate 15: A classroom session at Pitiku***

General community meetings were organised to respond to general concerns and questions that were drawn to our attention by community leaders. These meetings targeted everybody in the community and were thus held early in the morning before people departed for their various places of work. At these meetings, community leaders took part in explaining the issues to the community and answering some of the questions.

Three different strategies were used to convey the message to community members. These involved classroom sessions, the use of community representatives and posters.

Classroom sessions were employed to demonstrate ecological processes and how these processes support life and livelihoods, including ecotourism. It provided an opportunity for community members to re-examine the consequences of their daily activities.

Those who understood the context and rationale of the conservation awareness program were encouraged to take the lead in explaining the issues to the rest of the community. This gave more credibility to the process and a deeper understanding as community members are able to explain issues in a manner that the community understands best.

Posters were used to reinforce the message. At the end of the sessions a number of posters were posted at vantage points on trees and wall. Posters would also draw the attention of other community members who had not made it to the meetings, and other members would then explain to them what they had learnt.

# Chapter 4: Plan for 2008

## 4.1 Biological studies

We will continue to collect data on the four main objectives of the biological studies using Earthwatch teams. We will review our methods based on experiences from past field sessions as well as team member's experiences and comments.

## 4.2 Capacity building

We are working closely with 2 local community members on all activities in 2008 to afford them the opportunity to understudy and understand the project concept.

The project will continue to identify and engage Ghanaian university students in Earthwatch teams. Individual presentations and evening discussions on specific conservation topics have proved to be a useful learning experience for Volunteers in the past. The project will adopt the same approaches for the next year and facilitate greater interaction with communities during Earthwatch teams.

In the latter part of the year, the project will engage community leaders and representatives of user groups in the formation of a Management Board. This will be the first step to foster cohesion among communities and to encourage communities to view manatees as a communal resource that require the collective attention of all involved communities.

## 4.3 Socioeconomic survey

In order to establish the basis for developing social investment strategies and exploring enhanced economic opportunities for the communities, we will collect basic socioeconomic and livelihood information about communities located in the project area. In doing so, we will carefully review earlier socioeconomic studies that included communities in the project area to avoid unnecessary repetition.

As part of this work we will carry out field survey and analysis on two critical human community issues in the area: potable water supply and lake safety. We will work with partner organizations with particular expertise in these areas to assess the situation and develop appropriate strategies to address these challenges.

## 4.4 Review farming and fishing practices

Aimed at developing the best strategies for enhancing protection for shoreline habitat and to reduce conflict with manatees, we will identify and document all farming and fishing practices within the project area. We will review farming and fishing practices with farmers

and fishermen in all project communities. This will be done through group appraisals and one-on-one interactions with selected individuals.

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