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Evaluation of present distribution and condition of the African manatee (*Trichechus senegalensis*) in the Cuanza River in Angola

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SUMMARY

The vast distribution of the african manatees (Trichechus senegalensis) differs from the low level of information about the species' biology as well as from the lack of data about its presence and current condition, particularly in Angola.

It must be noted that the manatee is included in Annex I of the Hunting Regulation, currently in force in the country, which gives the species total protection. The manatee is also included in the IUCN's Red List (in category V), described as species which are vulnerable to extinction (Annex I) by the Convention on International Trade of Threatened Species (CITES).

The implementation of this project was carried out in the lower course of Cuanza River, as well as its effluents and lagoons for eight months, where the primary objectives were the evaluation of the manatee's condition in Cuanza River, its effluents and lagoons, therefore increasing the knowledge on its status, distribution and natural history. The information acquired will help in the establishment of protection measures for the manatee and in the establishing of management plans for ecosystems, which the species is part of.

From that data and information and with the desire of acquiring more information about the greatest part of the survey area, there was the need for fluvial and terrestrial interventions, because the accesses to population communities who lived in the area were conditioned by the physiography of the terrain and by the rainy season.

Local members of communities were recruited in order to introduce representation of all survey area and at the same time, informal questionnaires were carried out in local communities, which included governmental and traditional authorities and direct users of the ecosystem where manatees are present, namely traditional and sports fishermen, hunters, farmers, boat crews among others. Information was also collected in primary schools in different villages, with direct involvement of local teachers and students.

From trips made, 512 people were interviewed, in a casual and random manner and the results allowed us to have an effective knowledge of the manatee's distribution throughout the Cuanza River and adjacent areas, as well as to establish the species' status. They also allowed the development of a outlook on relevant pressures, which became important in the mentioning of pertinent aspects for the establishing of a management plan for the manatee and its habitat, involving local communities acting as protection and benefiting entities so as to assure the safeguard of the species.

1. INTRODUCTION

The vast distribution of the African manatee (*Trichechus senegalensis*) differs from the low level of information about the species' biology as well as from the lack of data about its presence and current condition, particularly in Angola where it fundamentally, if not exclusively, lives in interior waters.

Generally, these species are considered to be present in the coastal regions, rivers and estuaries in the African western coast, since the south of Mauritania until Cuanza River in Angola (Dorst & Dandelot, 1972; Husar, 1978; Nishiwaki, *et al.*, 1982; Powell, 1996). However, Huntley (1974) in his report Nr.28 for the Veterinary Services indicates its distribution until Longa River, located at the south of Cuanza River.

However, although the geographical distribution area is extensive, the existence of the species throughout this interval is discontinuous and it is possible that some populational centres are currently extinct (Nishiwaki, 1984 *in* Silva, *et al.*, 1999).

Manatees are very shy animals and have no means of defence. They can remain for a long time in an area which gives them good conditions of nourishment and shelter. They are a species that is very difficult to observe which justifies the very little information we have about their habits: locations, reproduction places and periods, gestation, longevity, etc., in Angolan waters. The first descriptions of the existence and condition of the African manatee in Cuanza River date from 1680 and were reported by António de Oliveira de Cadornega, who was a retired captain and citizen of the São Paulo da Assunção city, today called Luanda. According to this author, ancient explorers called the manatee woman fish, cungi or angulo fish, which means pig for its fatness. Cadornega described the presence of manatees as plentiful throughout the river, as well as their observation facility, mainly in the Angolomem lagoon, which is called Ngolombe today which had the more animals in the whole Cuanza system.

Although not quantified, it is considered that there has been a significant decrease in the population of manatees living in lagoons and rivers where there is a greater number of marginal fishing communities, which are directly related to food scarcity and poverty

(HIPO, 1996). In 1998, a fisherman from a community at a lagoon on the Bengo River, which is located to the north of Cuanza river, reported 77 manatees killed during 1998 (Ron, 1998). It was also noted strong pressure on manatees from living in some lagoons of Cuanza River.

Generally, the greatest threats to the manatees continuity are due to human exploration (illegal hunting), to degradation and/or loss of habitat, to accidental capture in the fisherman's nets and on a smaller scale, due to accidents with boats' engines (Morais, Torres & Martins, 2006).

It needs to underline that the African manatee has a legal statute and protection in many countries, including Angola and is also protected by the following international conventions:

- Washington Convention: The Washington Convention or "Convention on International Trade of Endangered Species of the Wild Fauna and Flora (CITES)" aims to protect the wild fauna and flora species from excessive exploitation and prevent the international trade of those which are in danger of extinction. Angola has not effectively joined this Convention.

The African manatee is inserted in the annex II of the CITES, which means that it is not currently in danger of extinction, but it may be in the future, if its trade is not strictly controlled.

- African Convention for the Conservation of Nature and Natural Resources: This convention is intended to encourage individual and joint actions which aim for the conservation, use and development of natural resources, with the intention of contributing to the well being of humanity, "from an economic, nutritional, scientific, educative, cultural and aesthetic point of view". Angola is not a signatory to this Convention.

The African manatee is completely protected under Class A of the African Convention for Nature Conservation.

- US Marine Mammal Protection Act: This Act grants protection to the marine mammals species, which are considered to be "in danger" or "threatened" of extinction. According to this Act, the African manatee belongs to the "in danger" or "threatened" category, being that their capture, trade and transport is forbidden in the United States.

On the other hand, the IUCN – The World Conservation Union – promotes the sustainable protection and use of natural resources. This organization is responsible for the publication of the Red List which aims to catalogue species that are considered to be globally threatened, according to the conservation statutes set by the organization. The African manatee is currently classified as "vulnerable" in the Red List of threatened animals (Baillie, Hilton-Taylor & Stuart, 2004), which means that is not "threatened of extinction" or "seriously threatened of extinction", but it presents an high risk of extinction in the wild state in the medium term.

In Angola it is included in Annex I of the Hunting Law currently in force and in the Aquatic Biological Resources Law, which give the species full protection. The penalty for its slaughter is approximately 1000 USD. (para ser finalizado quando terminar o parágrafo em português).

The manatee is considered to have a great socio-economic and cultural value for the traditional riparian populations in many countries. As a result, information received from local populations, who have much knowledge about the manatee's life and habits will have great value for the preparation of any management programme. According to references, the manatee is hunted by many communities who have done so as part of their culture. Such cultural interaction needs to be respected, studied and integrated into management plans (HIPO, 1996).

In terms of conservation it is not possible to protect the manatee without also protecting its habitat, which has its own dynamics and is subject to both natural changes and those imposed by different usages. The manatee in Angola feeds on aquatic or marginal plants. This means that any conservation programme has to include, in addition to the management of the animal populations, management of water bodies where they live and the marginal fauna and flora.

In order to be truly viable, a management plan should include benefits for local communities, through the creation of jobs and through the development of activities related to tourism and the controlled authorization for the use of natural resources to be protected.

The objective of this Project was the evaluation of the current condition and distribution of the manatee throughout Cuanza River, its tributaries and adjacent lagoons, as well as to acquire information on its natural history. The project also sought to evaluate the dangers that impact the manatee's survival, in particular, the hunting pressure which they are subject to, in order to develop mechanisms with local communities to reduce pressures, and to engage villagers in the manatees' protection with the expectation of receiving future community benefits. Another objective of this project is to supply information which would be used in the development of a management and conservation plan to protect the manatees and their ecosystems.

Results obtained provided good data of the manatee's current distribution throughout Cuanza River and adjacent areas as well as to establish the species' status. Information obtained also highlighted relevant pressures, which need to be taken into account in a management plan. Such a plan should involve local communities as protectors and beneficiary, to assure the species' safeguard.

2. CHARATERIZATION OF THE SURVEY AREA

2.1 GEOGRAPHICAL SITUATION

The study area consisted of the lower section of the Cuanza River's hydrographic basin, between Cambambe (9° 44.638' S e 14° 29.056' E), which is the East extent of the waterways system and Cuanza River's mouth (9° 20.857' S e 13° 09.300' E), also known as Barra do Cuanza and comprises a river distance of approximately 200 Km (Figure 1).

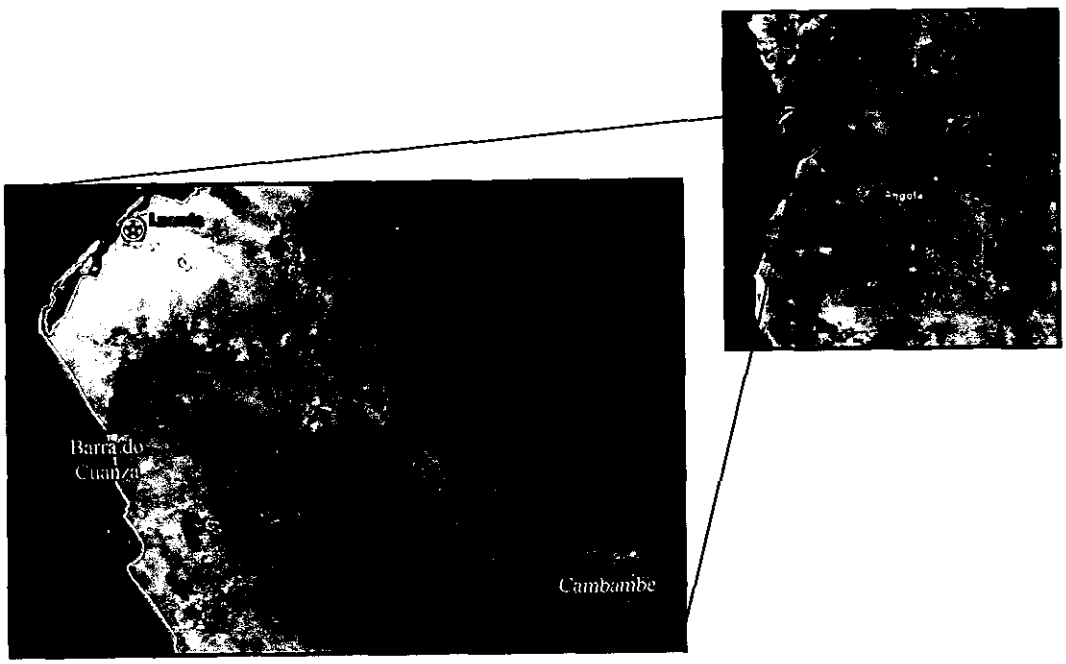


Figure 1: Study area which corresponds to the lower section of the Cuanza River's hydrographic basin. From Google Earth 2005.

Administrively, the area is composed by the municipalities of Cambambe, Icolo, Viana and Muxima. The three first municipalities lay to the north of Cuanza River and the last one lays to south. Cambambe belongs to the Kuanza-Norte province, Icolo-e-Bengo belongs and Muxima belongs to Bengo and Viana to the province of Luanda (Figure 2).

Between the Mouth of Cuanza River and the Muxima village, Cuanza defines the north area of the Quiçama National Park; an extension of approximately 100 Km.

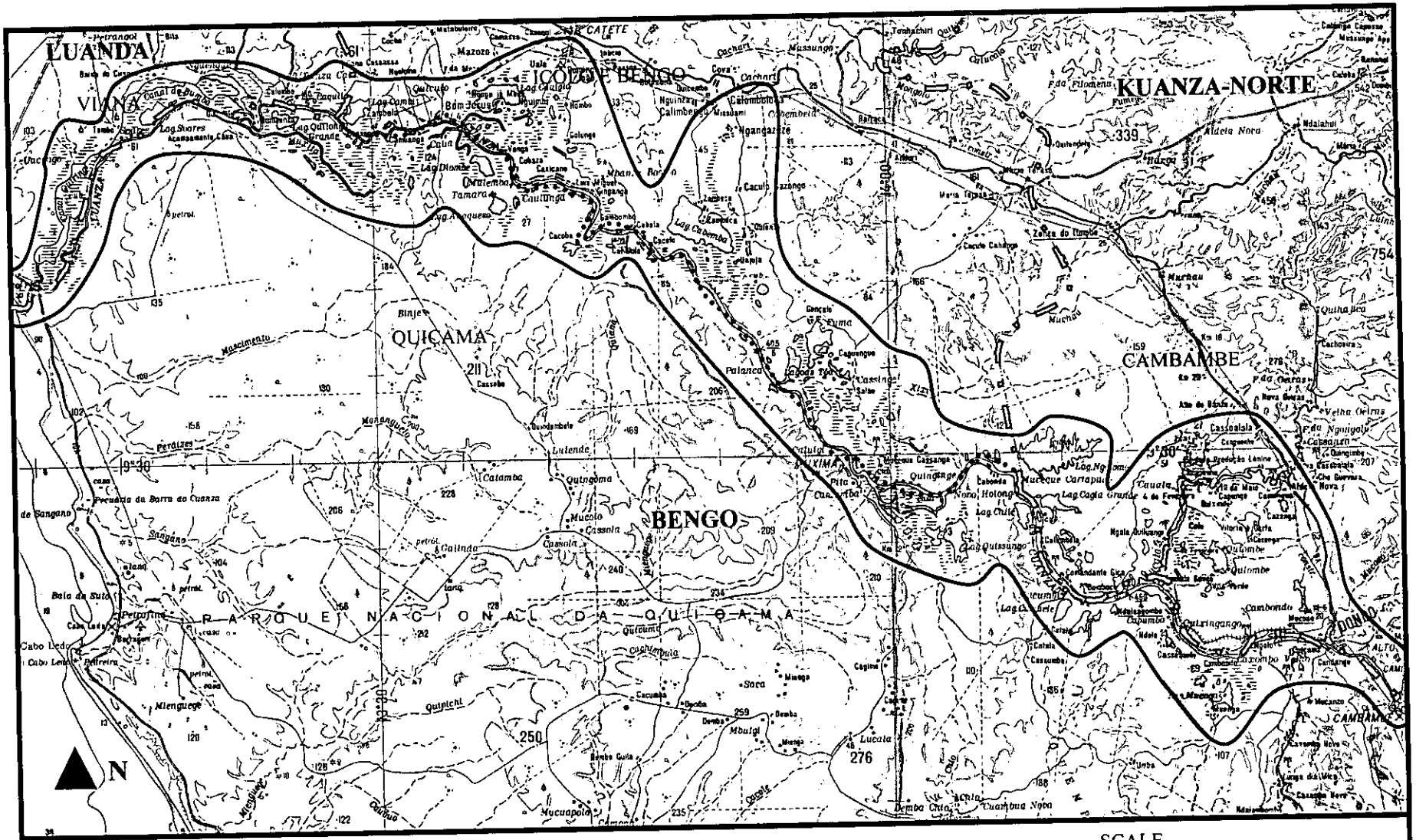


Figure 2: Survey Area.
Province Limit
Township Limit

Adapted from charter N. SC-33/C-I 1:500 000 of the Angolan Geodesy and Cartography Institute (1986)

2.2 ABIOTIC ENVIRONMENT

2.2.1 CLIMATE

According to the Thornthwaite's climatic classification indicated by Azevedo *et al.*, (1972), the climate from the greater part of the Lower Cuanza is semi-dry, mega thermal with very little significative water excess. At the coast dryness is evident and downstream climate becomes arid and mega thermal. According to Köppen's climatic classification, climate is BSw type, in other words, it is steppe dry and rainy during summer.

2.2.1.1 Precipitation

According to Diniz (2002) and Azevedo *et al.*, (1972), the total annual rainfall average ranges between 700/750 mm to the east and between 400/450 mm to the west, with a rainy semester from November to April and a dry semester from May to October. At the rainy period, the greater precipitation months are March and April with the months of lower precipitation corresponding to December to February.

2.2.1.2 Temperature

The average maximum annual temperature varies between 30 and 31°C, reaching a maximum of 32-34°C in February and March. The minimum temperatures are reached in July and August which is 26-27°C. The average minimum annual temperature varies between 20 and 21°C, with maximum temperature in March and April (22-25°C) and a minimum temperature of 17°C in July and August (Diniz, 2002; Azevedo, *et al.*, 1972).

The annual average temperature varies between 25 and 26°C. Median rates of 27 to 28°C occur at the rainy semester and of 23 to 24°C at the dry period (Azevedo, *et al.*, 1972), with annual amplitude ranging at around 6°C.

2.2.1.3 Relative Humidity

The annual average humidity rate varies between 80 and 87%, which remains more or less the same throughout the year, with a minimum variation between the rainy and dry

periods, slightly higher at the dry periods and the annual amplitude ranges from 5 to 6% (Diniz, 2002).

2.2.2 PHYSIOGRAPHY

The study region is part of the Cuanza Sedimentary Basin (Brognon & Verrier, 1955), and the Cuanza River passes through this basin and disoriented generally in a more E-W direction (Diniz, 2002). It traverses the sedimentary basin without delineating an expressive valley and most of its route circulates on a level plane. Towards the end of the river (Figure 3), it develops into an alluvial plain of large extension (Figure 4), whose continuity is interrupted at the crossing of hard greek-calcareous formations: for example the Dalangombe; Hulongo and Bom Jesus strangling (Figure 5). Throughout the alluvial plane, the presence of meanders are flanked by prominent marginal slopes covered by palm trees and other different types of trees from the original forest gallery.

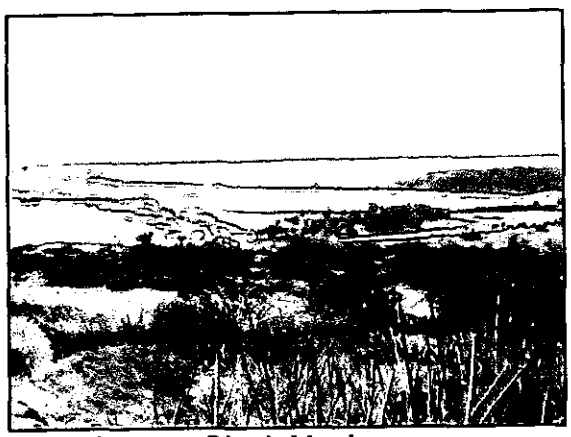


Figure 3: Cuanza River's Mouth.

Figure 4: Alluvial Plain in the course of Cuanza River

The fluvial plane constitutes a large reservoir of streams and lagoons caused by floods where rising river water flows into lagoons through small channels ("muiges") (Figure 6). All low lying areas become flooded leaving only some elevated marginal borders and some prominent rises or platforms above water.

Figure 5: Holongo's hard greek-calcareous formation.

Figure 6: Muíge which connects Cuanza River to the Cauigia Lagoon.

2.2.3 SOILS

In most of the surrounding water courses, soils are little developed and are originated from fluvial, unitextural and pluritextural deposits. They can present themselves distinctly affected by phenomena of hydromorphism, salinization or alkalization or even show vertico characteristics, in some cases with accumulations of calcium carbonate (Diniz, 2002).

2.3 BIOTIC ENVIRONMENT

2.3.1 PHYTOCENOSIS

Within a general scene (Diniz, 1973 & 2002; Barbosa, 1970; Teixeira, Matos & Sousa, 1967), vegetable formations belong to the herbaceous type which cover the vast fluvial plains, bordering the river while on the hillside lignaceous communities typically become dominant on drier surfaces, constituting bushy brushwood in certain places, and in other places dry thick wood, and even savanna with bush or afforested savanna.

In the fluvial lows the gramineous species prevail. However, the floristic composition varies according to water level oscillations due to long term submersion and persistence. This is how the dense gramineous formation, from the herby savanna type, covers the areas which are usually dry or occasionally affected by the water excess, abounding the *Panicum maximum* and species of the Urochloa, *Sorghum*, *Brachiaria*, *Orysa* and

Eleusine types, while in the more damp areas or where sometimes there is water retention, the formations of swampy meadows covered by *Echinocloa pyramidalis*, *E. crus-pavonis* and *Oryza stapfii* (Figure 7) are characteristic.

From these herbaceous communities, besides the gramineous, there are other components, such as the *Indigofera*, *Cyperus*, *Crotalaria*tipes types and the *Mimosa pigra* species. At the permanently submersed areas, which take up large extensions in the lower streams, communities of *Cyperus papirus* are characteristic, as well as large agglomerates of *Pistia stratiotes*, *Ludwigia sedioides*, *Nymphaea lotus* (Figure 8), *N. Caerulea* and *Eichhornia crassipes* (Figure 9). The latter results from the human introduction in the 1970s. Some branches of the river are defined by large arboreous concentrations, vestiges of the primitive dense forestal gallery which covered the more prominent marginal border. Here there are specimens of *Ceiba pentandra*, *Albizzia* sp., *Pterocarpus tinctorius* and *Lonchocarpos sericeus* and a large numbers of palm trees (*Elaies guineensis*).

At the Cuanza estuary (Barbosa, 1970), a dense mango grove can be seen, lining the margins on both sides of the river, as well as other channels (Figure 10). This extends for about 15 km and it is usually populated by a *Rhizophora* sp. which extends itself to the daily tides and is flooded twice a day. There is another zone, which is characterized by the existence of *Avicenia* sp. which is flooded by the spring-tides and this happen twice a month. At the *Rhizophora* sp. zone there usually are three subzones, each of them dominated by characteristic species. At the more intermediate external subzone, there is *R. harrisonii* and at the internal subzone we can find the *R. harrisonii*. The *R. racemosa* subzone plants can exceed 20m of height but others are smaller. Further inland there is the *Avicenia* sp. zone followed by the halophytes or vegetation which are tolerant of the saltwater. These are associated with the mangroves.

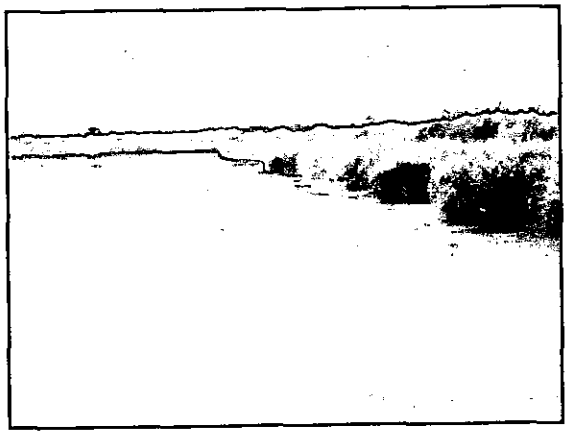


Figure 7: Swampy meadows dominated by *Echinocloa Pyramidalis* e *E. crus-pavonis.*

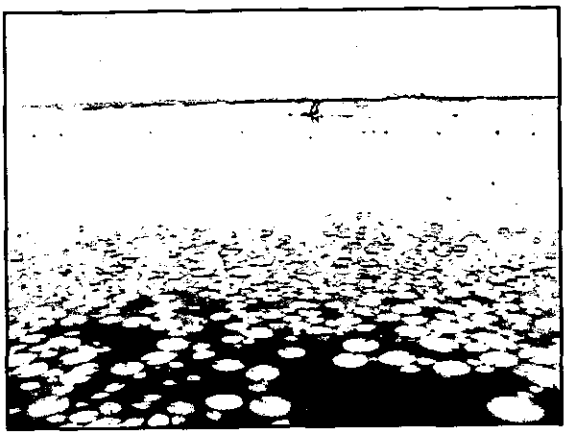


Figure 8: *Nymphaea lotus* in a Cuanza lagoon.

Figure 9: Echhornia crassipes at the Caua River – Cuanza.

Figure 10: Mango-grove zone.

2.3.2 ZOOCENOSIS

The identified waterway systems accommodate a biodiversity and include a great number of taxonomical positions. We can highlight the existence of hippopotamus (*Hippopotamus amphibius*) from the Mammalia class, which cohabit with the manatees in some locations. However the hippopotami are present in a very restricted way and in small numbers. This varies from the information given by Cadornega (1680), where numbers were higher, although they faced a long time of armed conflict. In the Reptilia Class, there are turtles (*Trionyx triunguis*), crocodiles (*Crocodylus niloticus*) (Figure 11) and "sengue" (*Varanus* sp.) (Figure 12) as well as different species of snakes. The system also present a large number of birds, many of them are migratory and directly

related to the aquatic environment plus a high fish diversity, which brings a high economic value for the region.

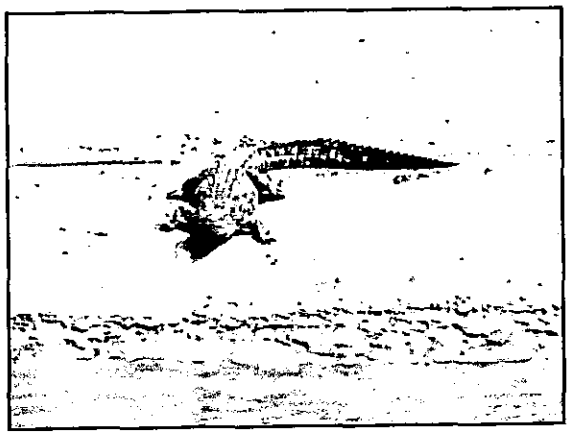


Figure 11: Specimen of Crocodylus niloticus at the bank of Cuanza River.

Figure 12: Specimen of the sengue (Varanus sp.) at the bank of Cuanza River.

2.3.3 HUMAN POPULATION

There is a large concentration of humans throughout the course of the Cuanza River, as well as at the adjacent lagoons. In its majority, the population is constituted by fishermen and farmers, who use the banks to produce corn, sweet potato, beans, peanuts, tomatoes among other products at a specific time of the year (June-December).

Agriculture depends upon the river's level and for this reason the population annually changes its residence (making temporary constructions) to accompany the rise and fall of the water level.

It should be noted that a large part of the population comes from different parts of the country because of the insecurity brought by the country's situation in recent years of internal conflict. This has resulted in the introduction of new cultures and ways of life and in the use of ecosystems.

Here we may note small villages throughout the system, now with substantial population concentrations. These include villages such as Tombo, Calumbo, Bom Jesus, Caxixane, Cabala, Muxima and Dondo (Figure 13). In these villages, there is a significant flow of

commodities, fish and agrarian products, as well as the replenishment of other products carried by small boats (Figure 14) from and to the different villages and populations distributed throughout the river and lagoons.

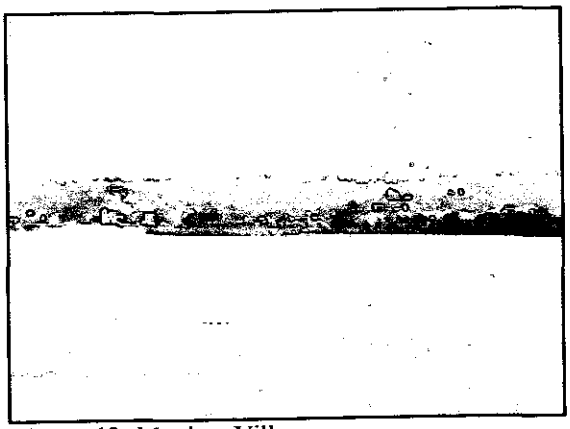


Figure 13: Muxima Village.

Figure 14: Boat used in the commodities transport throughout Cuanza River.

2.4 ECONOMIC ACTIVITY

In addition to farming and fishing (Figure 15), we can also find some industrial networks, which utilise the Cuanza River or unload their effluents to the river. As examples we have, the Coca-Cola factory and some mineral companies (Figure 16), which are located at the Bom Jesus region. There is also a new project underway for the extensive cultivation of rice in the Caquengue region.

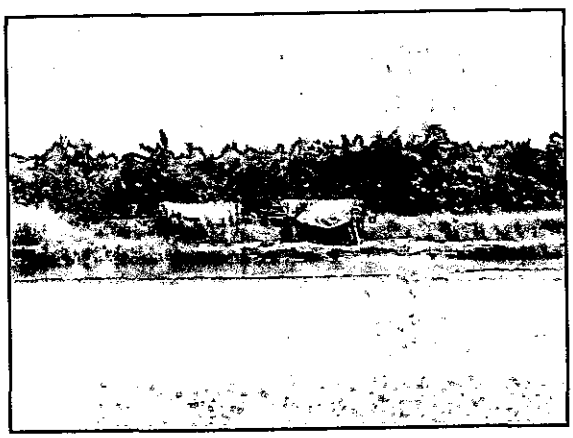


Figure 15: Fishermen occupying the banks.

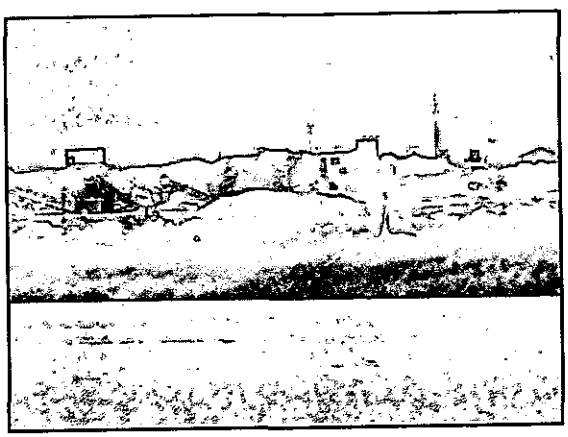


Figure 16: Mineral exploration at the Cuanza's banks.

It must be highlighted that there are very few touristic projects and they are mainly located at the Cuanza River's Mouth.

However, the nature of the economic activity needs to be assessed and analysis of the real impact which may affect the manatees or their environment should be carried out.

3. METHODOLOGY

Initially a literature survey of previous research was carried out for the region resulting in studies noted from (Silva, *et al*, 1999; Ron, 1998; HIPO, 1996; Grigioni, 1996; Powell, 1996; Marsh & Lefebvre, 1994). Some contacts with experts in manatees were also established. This information provided details on methodologies for data acquisition so that the objectives of the project could be met. A bibliographic survey was also carried out, on the ecology and distribution of the African manatee including data from the survey area (Dorst & Dandelot, 1972; Caldwell & Caldwell, 1985 *in* Ridgway & Harrison 1985; Reynolds, 1981; Reynolds & Odell, 1991).

From the baseline data and information, in order to acquire information about the majority of the survey area, it was evident that it would be necessary to conduct surveys on land and by water. This was conducted between May and December of 2005, - the dry season, in order to coincide with population movements and favourable soil conditions.

In an initial approach, 15 people from local communities were recruited, in order to obtain representation of the extended survey area. Education and awareness information was provided, to help train these observers on data collection. The objectives were to determine the presence of manatees, record observation frequency and establish capture frequency by populations, either directly or indirectly (Annex esI and II).

In parallel, informal surveys (Annex III and Figure 17) were carried out at local communities, which included governmental and traditional authorities, sportsmen, hunters, farmers, and boat crews (Figures 18 and 19). In addition information was also collected at some primary schools in different villages with the direct involvement of local teachers and students.

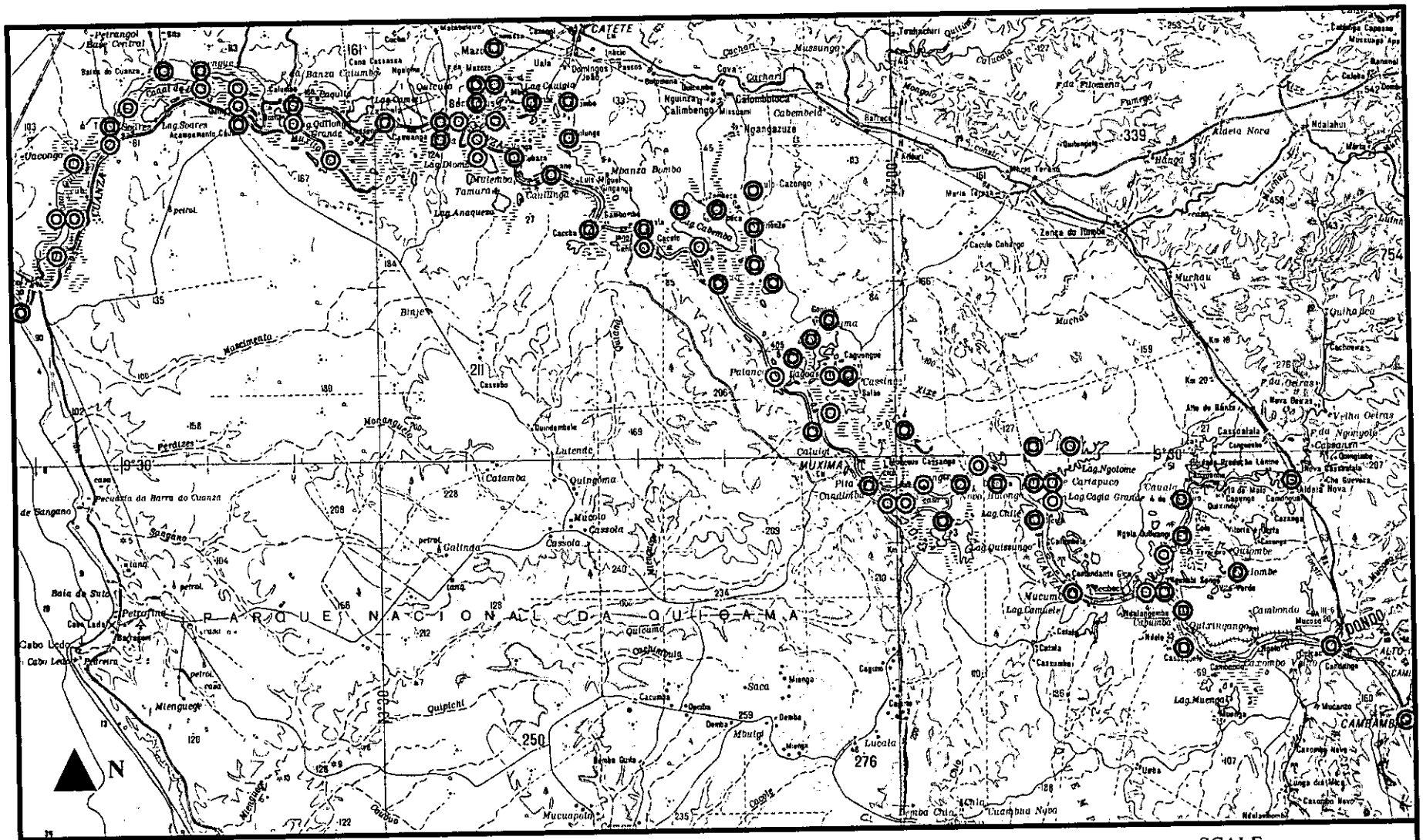


Figure 17: Informal surveys throughout the villages and wards
Informal surveys throughout the river and lagoons

Map adapted from the chart n. SC-33/C-I 1:500 000 of the Angolan Geodesy and Cartography Institute (1986)

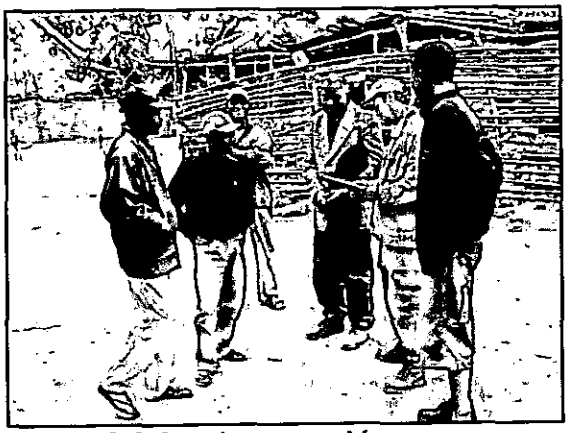


Figure 18: Informal surveys at Massangano.

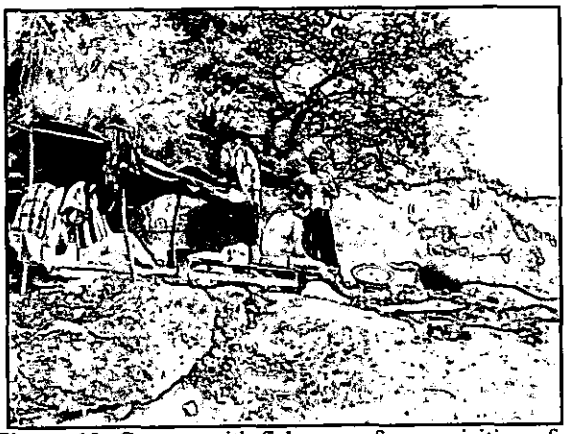


Figure 19: Contact with fishermen for acquisition of information.

The surveys were directed to people of different ages and to both sexes, from the elderly to children aged 5 and 6.The children were extremely important in providing information on hunting activities.

As part of the fieldwork, surveys were carried out in order to cross reference and confirm some of the data obtained In most cases, these surveys were performed with the support of small boats, - canoes and kayaks (Figures 20 and 21) which both enabled navigation in small channels and reduce noise levels to minimise disturbance. Surveys were determined based in observations in animals, in tracks of food activity and hunting practices. For that, dislocations were carried out, either during the day or during the night; during the night period, nightly vision instruments were used (Figures 22 and 23).

Using the above mentioned methods, and in particular the information from resident communities, preliminary information on the presence of manatees and its distribution in the study area was established. This included an estimate of manatee numbers, establishing where they are very common, common, frequent, rare, very rare or where they are nonexistent. Estimates were given on a probability scale where 'very common' rated a probability of 100%, 'common' between 50-100%, 'frequent' between 10-50%, 'rare' between 1-10% and 'very rare' when there is a probability of less than 1%. In addition, so as not to provide incorrect information, where the collation of data was not possible or where the information was doubtful, an entry of 'uncertain' was recorded.

Figure 20: Data collection with the help of small boats Cassaque Lagoon.

Figure 21: Data collection with the help of small boats Quiombe Lagoon.

Figure 22: Data collection with the help of nightly vision instruments. Cabemba Lagoon

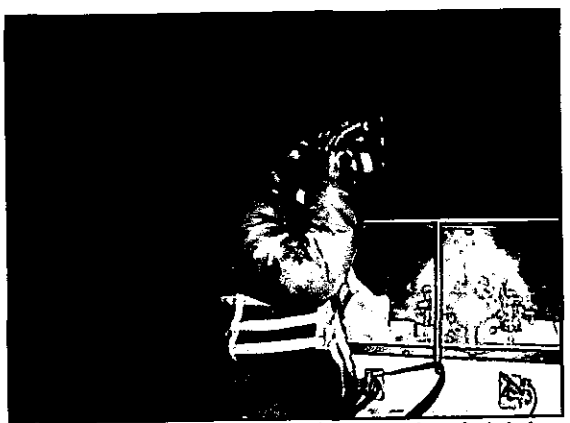


Figure 23: Data collection with the help of nightly vision instruments. Caua River

From direct observation and from data acquired, it was also possible to examine the habitat preferences and collect important information on manatee behaviour, as well as evaluate direct hazards that would impact manatee survival in the region, - particularly hunting.

Lastly, in an attempt to increase the probability of acquiring evidence on manatees, disposable cameras were distributed to the members of community, who were hired for the project.

4. RESULTS AND DISCUSSION

The project was successful in studying the Cuanza River and associated flood plane, streams and lagoons from the river mouth Barra do Cuanza at the southern Atlantic Ocean up to the Cambambe dam. This included visiting 52 locations which were connected to the system (villages and small quarters), where relevant information was collected (Annex IV).

From the excursions, about 512 people were questioned in a random and casual way throughout all intervention area, who were distributed in the following age ranges: 16% between 5 and 15 years of age, 39% between 16 and 30 years old, 36% between 31 and 46% between 46 and 60 and only 2% above 60 years old.

4.1 AFRICAN MANATEE STATUTE IN THE CUANZA RIVER

4.1.1 KNOWLEDGE OF THE SPECIES

From a total of 512 people questioned, 99.6% provided evidence of knowing the species, and 99.2% said to have eaten manatee's meat at least once. However, only 44.5% said to have observed the manatees in its natural environment. Observation of dead manatees occurred at places where shipment and unshipping of goods takes place and comprised 96.6% of the people questioned.

Generally, throughout the region, the manatee is called a 'seal' in English and "dikunji" in the Kimbundu dialect. Other less used terms described by Cardonega (1680) are *woman fish* (mermaid) and *angulo fish* (which is a synonym of pig for the large amount of fat). The term manatee, as the species are globally known, was only known by 5% of the questioned.

Manatees are generally described as animals which live in rivers and lagoons, and have tremendous strength, although they are very shy and prefer nightly habits. The young are very dark (almost black) and the bigger animals are greyish with fur. Many compare the female manatee to women (hence the name woman fish) for the presence of genital

organs and breasts. We were told some stories where it was stated that when they are hunted they die hiding their genital organ with their upper members.

4.1.2 EXISTENCE AND DISTRIBUTION

According to the information acquired from the questionnaires, in relation to observations and records of captured animals, as well as from clues observed on surveys it was determined that the species was present throughout all the examined system, from the Cuanza river's mouth until the Cambambe dam (Figure 24). It must also be noted that prior to the construction of the dam, the Cambambe area was characterised by steep rapids which would have presented an insurmountable barrier for the species; a natural ecological barrier. The manatee's distribution also extends to Lucala River for at least 30 Km upstream from the Cuanza River. According to information received from the questionnaire, manatees were present in all Cuanza influenced lagoons (Figure 24), but never beyond its mouth.

Evidence of the presence of animals, from visual observation and tracks left in the vegetation caused by feeding activities relates to seasonal movements. From our observations, they can be considered common in: the Bom Jesus region (Cauigia Lagoon), around the Cabemba Lagoon, at the Tôa Lagoons, which extend until the Caquengue and Salão region; at the Cuanza's arm and dank soils attached to the Quissungo Lagoon; as well as at a small extension of the Ngolome Lagoon (Figure 24). The latter is described by Cadornega (1680), as being the location of the largest concentration of manatees in the whole of the system, but it must be noted that this information contrasts with the current information.

Manatees can be considered frequent in the adjacent areas of Caua River and at the Massangano region and the remaining examined system can be considered rare (Figure 24).

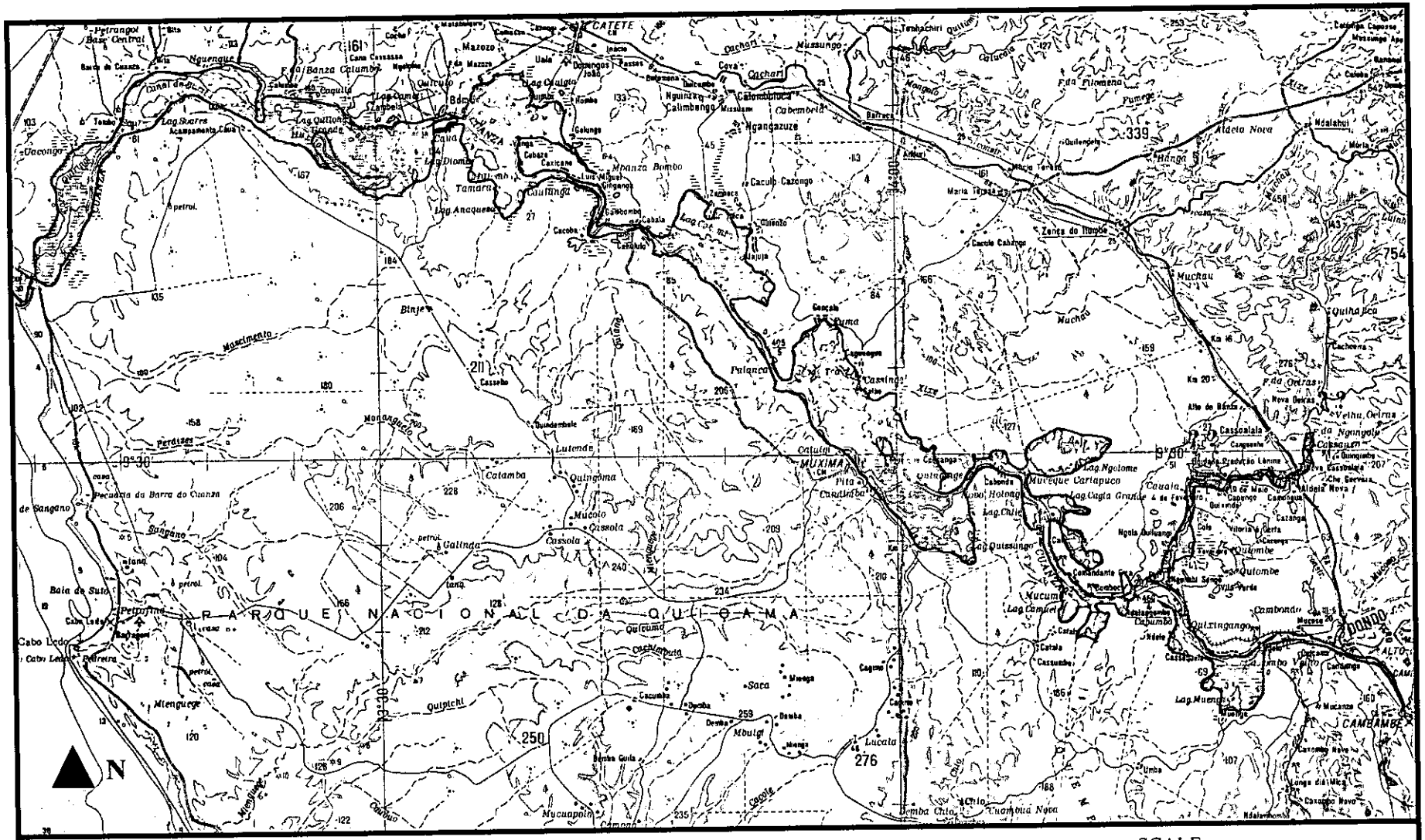


Figure 24: Manatee's current distribution throughout Cuanza River; Common observation; Frequent observation; Absence of manatees; Uncertain presence ?.

SCALE
0.5 cm corresponds to 3 km

Adapted from charter N. SC-33/C-I 1:500 000 of the Angolan Geodesy and Cartography Institute (1986)

Of the people questionned, who were above 30 years old, 98% (n=322) were unanimous in saying that the animal's observation is rare i.e. under 10% of probability. This in some way expresses a reduction of the population when compared to information received by the same questionaires. Previously the animal was considered 'common' which indicated 50-100% (n=322) probability throughout all the system some twenty years ago. This aspect agrees with the findings of Thomas Carr, who visited Angola between the years 1983 and 1985, and made observations on the presence of the African manatee in Cuanza River. He too considered them to be common (Reynolds & Odell, 1991).

4.1.3 SEASONALITY

It is noted that generally, manatees may be observed throughout all the examined system. However, according to the data received (94% de n=322), the greatest probability of observation occurs at the beginning of floods, during the rainy season, when small groups of animals may be seen swimming together, feeding at the river's banks and in smalls channels (muíges) and lagoons. Occasionally, they can still be seen having small brawls. This in part might be because of increased availability or acess to the feeding areas alongside the feeding range and also because the increased water level brings increases the animals' movements.

In the dry season, observations are generally confined to dank areas that are adjacent to the large systems of lagoons, throughout the Cuanza River and associated flooded areas.

4.1.4 FEEDING HABITS, REPRODUCTION AND BEHAVIOUR

From the questionnaire results, it was possible to select food preferences of the African manatees in the Cuanza River. These include the herbaceous species *Echinocloa pyramidalis* and *E. crus-pavonis.* However, in the lagoons where they resides for much of the year, they have been seen, (and confirmed in a survey) feeding on roots and *Nymphaea lótus* leaves and on *Pistia stratiotes* and *Eichhornia crassipes* roots (Figures 25 and 26). Information given by hunters and experts of the manatee's habits indicate they also feed on *Cyperus papirus* roots, as well as on silts and muds in the bottom of

small water basins, which are formed during the dry season. This last feeding habit is also mentioned by Silva *et al.* (1999) in Guinea, Powell (1996) in Mali in Nigéria and Chad.

Figure 25: Tracks of manatees' food *Echinocloa* sp

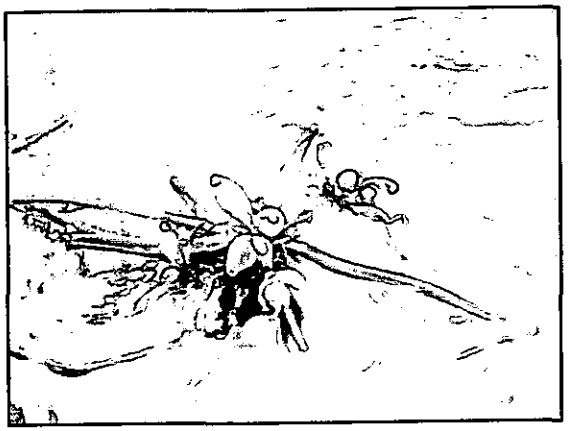


Figure 26: Tracks of manatee's food *Echhornia crassipes.*

In the estuary region of the Cuanza River, survey information indicated that, while not their greatest preference, manatees do feed on mango leaves. This finding is also noted in some other countries of Eastern Africa (Silva, *et al.*, 1999).

There is no conclusive information about the reproduction of the African manatee, though there are some presuppositions that their biology may be similar to the American manatee, for which there is more available information. Equally, the study results did not provide a definite seasonality, though there was evidence of captured females which were at the end of their gestation, as well as recently born youngs. In addition a particular aspect is noted during the flooding period (rainy season), when the observation of couples is more frequent, as well as disputes over females by different males, so indicating greater sexual activity during this period.

The African manatee is considered to be extremelly pacific and very shy, moving away at the smallest noise, - a fact confirmed by the majority of questioned hunters and fishermen who also stating they were more active at night. This fact is probably due to the increasing disturbance of its natural habitat. However, this shyness disappears when the

animals are involved in brawling or courtship acts, and occurring at flood periods (rainy season) and many times at daylight.

From the greater frequency of observations indicated by the surveys, comes a record of an average of 2 animals at a time, i.e. female and young, or male and female, as well as groups of up to 12 animals. The frequency of the largest groupings observed, happened in the dry season, when the water level is relatively low at locations with access to the best food and rest points. Caldwell and Caldwell (1985) make reference to a similar fact, where they state that frequently, animals gather in places of greater food availability during winter, in areas where the temperature is higher, but without any consistency and without any apparent social unity, with congregations occurring more to do with environmental conditions. According to Hartman (1979) and Reynolds (1981), manatees are essencially solitary animals and do not form consistent, stable and lasting social groups. The basic social unit is that formed between a female and her young which can last to up 3 years in the Florida manatees (Hartman, 1979).

During the survey, it is important to stress that a group of 5 animals was followed in the dry season (August to September 2005), in one of the lagoons adjacent to the great Tôa Lagoon, near the Caquengue region. The group was made up of a male and 4 other animals which included at least one female and one young. Their habits were essentially nocturnal and they seemed to be united during the observation period (4 consecutive months). The research team noticed that after a few hours of pasture, they always returned to the same resting place to spend the day. It was also noticed that the male was always the last to exhale, replying to the smallest commotion caused by us, as if it was an alert sign for the group to retreat from danger. Exhaling as a means of communication is mentioned by Silva *et al* (1999) in Guinea Bissau.

4.1.5 DEMOGRAPHIC EVOLUTION

From the 512 questioned, 234 over the age of 30 answered questions related to the evolution of the manatee's populational density throughout the Cuanza's system. 92% of the questioned said that there has been a considerable decrease in the manatee's population, when comparing the numbers from the 1980's. One of the main causes seems

to be hunting. Members of the various communities stated that the influx of non native people throughout the river and lagoon system who obviously have different approaches to the ecosystem, elevated this practice.

Only 8% stated that there is a continuity in the animals population, reasoning that every year the population renews itself from new births, therefore counterbalancing the mortality rates. This can considered an attempt to justify the pratice of hunting, because some think that the resource is infinite.

4.1.6 MORTALITY

In spite of the manatees being protected by the country's laws, the reality is that the hunting is the main cause for the mortality of these animals. During the period in which the study took place, we received information that throughout the system, 22 manatees died, all captured from dedicated mantee nets (Figures 27 and 28). During the same period, only 3 animals were said to be found at the banks of the Cambemba, Tôa and Camuele Lagoons respectively.

It is not easy to make a realistic analysis of manatee mortality, due to the fact that hunting is illegal and the majority of hunters/fishermen hide almost all cases of death. However, and because of the extent of examples which could hardly be hidden, the survey indicated some instances of mass mortality, which resulted from clandestine hunting, at least in the eyes of the law, and which involved members of the community with the traditional authorities' permission. Information was obtained that in the 1950's, 99 animals died within a week in the Caquengue region, which probably coincided with the completion of the Cambambe dam, which at a certain point brought a reduction to the river's water volume; 65 animals dead in two days in the same region in 2001; 24 animals dead within a week at Cabemba Lagoon and 22 animals dead at the Muenga Lagoon in 2002; and many other dead, in slightly less numbers but throughout all system in the same periods.

Figure 27: Captured manatee through the use of a net in a lagoon which is adjacent to Cuanza River.

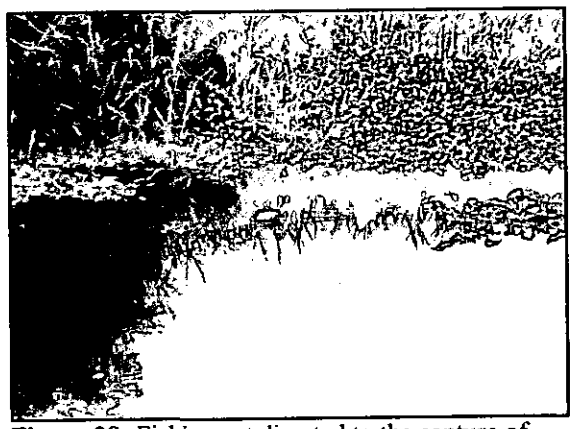


Figure 28: Fishing net directed to the capture of manatees.

These events all happened because of the considerable decrease of the Cuanza's water level, exposing the animals to easy capture. In analysing these "slaughters" and correlating them to the the construction of the Cambambe dam, we can clearly identify this and the dry season as the primary cause in the water level reduction, so allowed illegal hunting at certain times. This is compounded by the lack of fiscalization and administrative control.

4.1.7 HUNTING – WHO PRACTICES THE ACTIVITY? – HUNTING TECHNIQUES

According to information supplied by the interviewees (100%, n=55), manatee hunting goes back many years ago and follows traditional techniques and knowledge which were passed on from parents to children, all of whom were natives and who are or have been directly related to manatee hunting. Information recorded by Cadornega (1680) supports this and also mentions that hunting was done using 'eelspears'. It must be observed that evidence from manatee's remains found during the surveys provide hard evidence that

today this practice continues to be carried out with the areas of greater concern being Quingolo, Bom Jesus, Cabemba, Cacua-Caquengue, Quissungo and the surrondings of Novo Holongo, and Muenga (Figure 29).

From the survey's results and from the observations carried out, it was noticed that the use of eelspears and nets are currently the most commonly used tools. Generally, eelspears are made from a metallic tip and are very sharp; they are attached to a pole, connected to a signalling buoy (Figure 30). This method demands a great deal of shrewdness and time availability, therefore, new habits brought from other parts of the Country started to be used on a larger scale, including the use of large nets (Figures 31, 32 and 33). This practice allows any member of the community, - of different ages and with the minimum knowledge of the species to easly capture manatees.

Generally, nets are placed in such way that they obstruct small channels, connecting to lagoons, or to feeding or resting areas. Unlike using eelspears this is an efficient, effective and time saving hunting methos. Once entangled in the net, an eelspread or a similar tool is then used to kill the animal.

It must be noted that this practice, although being carried out throughout the year, is more effective at the begining of flood and at the end of the dry season. In the first case, because it allows the capture of animals which previouisly sheltered in places of difficult access in the dry season and in the second case, because there is a considerable decrease in the water level, which limits the passage ways used by the animals.

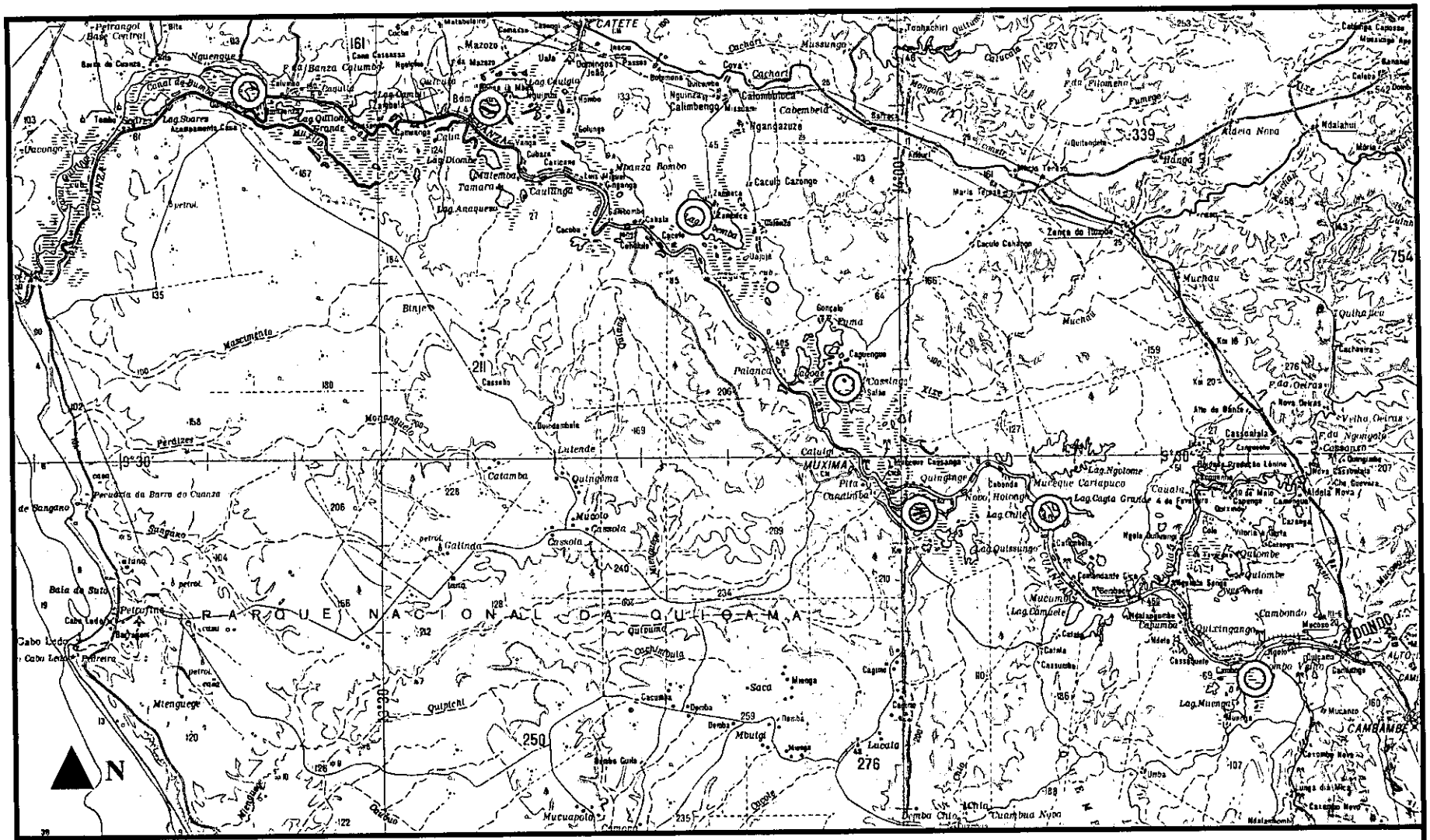
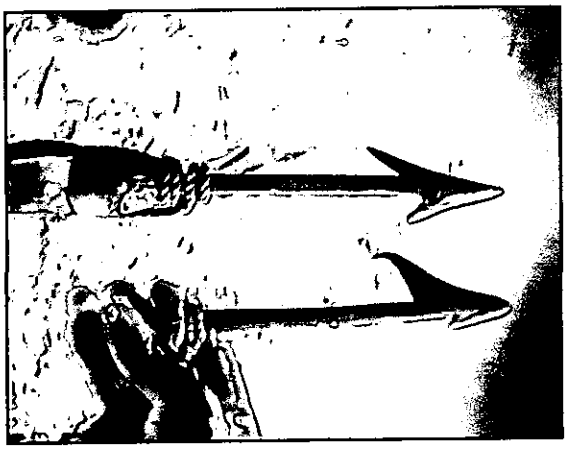


Figure 29: Areas of greater anthropic (hunting) pressure towards manatees throughout the Cuanza River

Adapted from charter N. SC-33/C-I 1:500 000 of the Angolan Geodesy and Cartography Institute (1986)

Figure 30: Hunter in the Zambeca region.

Figure 31: Eelspread tips used to hunt manatees.



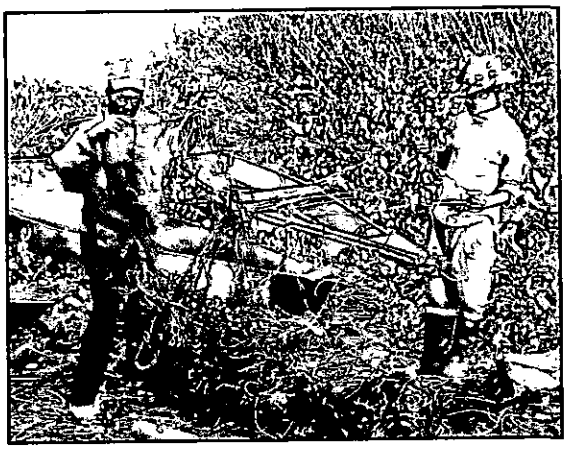


Figure 32: Fishing manatee net.

Figure 33: Fishing net for manatees in Canquengue.

It was witnessed the death of a manatee by a 45 years old lady who was carrying out cleaning operations in a small swamp during the dry season, so providing proof of the species' fragility and their predicament owards of their enviroment. Another example of techniques for the hunting of the manatee, which is only found at the mouth of the river, is based upon the use of nets, from the coast line with the support of small boats (Figures 34 and 35).

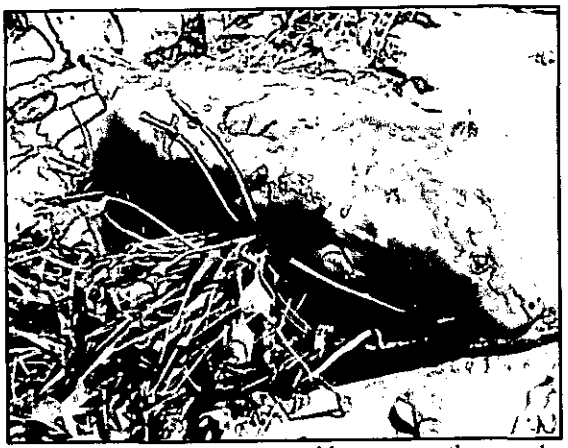


Figure 34: Manatee captured by a net at the mouth of Cuanza River. The photograph was kindly supplied by Mr. António Oliveira.

Figure 35: *The same manatee in another prespective* and with the upper members tied up.

However, it is important to note that 59% of the questioned (n=55), who were from the higher age range, described that in past, people used stick barriers in small channels which gave access to small lagoons, at the end of the dry season, therefore capturing a great number of animals. This allowed an easy way of hunting a great number of animals.

4.1.8 USE – REMAINS AND RITUAL CEREMONIES

From the 512 people interviewed, 98% stated that the manatee is both a feeding and a revenue resource based upon the trade of its meat. Only 2% considered the importance of the species from the ecological and touristic point of view. However, although it was noted that the manatees are generally used as a food source and as trade subsidy, we verified that the manatees are not primary or crucial for the quality of life for those people hunt them.

The resulting benefit is limited to a small group of people who do the hunting and share a part of the product and includes families, helpers and on some occasions the traditional authorities. The remaining is then traded between citizens of the villages or sent to the large markets in Luanda where it is sold at around US$ 2/Kg. When an animal is captured almost everything in his body is used, except for intestines, a small part of the hide and the bones. The information acquired also reveals that in the past, the species was also used to provide oil.

We were not able to get any information relating to ritual ceremonies of any great interest, even among the people in the higher age range. The most common tradition noted, involved the passing of hunting knowledge from fathers to sons. However, due to the influx of newcomers, resulting from the populational changes from different areas of the analysed system, and the introduction of new hunting habits, this tradition is becoming less common.

From the survey, the only other ritual involving the manatee, which is rare, based on the probability of its knowledge (0.6%, n=512), relates to the infidelity between men and women. According to this story, infidelity carried out by women can be avoided through a ritual where the hunter and his wife eat the dead animal's heart before the sharing or the selling of the meat.

4.1.9 CONFLICTS WITH HUMAN POPULATIONS

During the course of the survey and by the information acquired from 88% of the questioned (n=322), there has been no record of impacts caused by the animals to the local population throughout the survey range. However, 12% (n=322) stated that their fishing nets had been destroyed by movements of these animals. Concerning the last subject, it should be noticed that the practice of immoderate fishing is visible throughout the system, where fishing nets are extensively utilised to block channels or lagoons.

4.2 THREATS TO THE SURVIVAL OF THE SPECIES THROUGHOUT THE CUANZA

4.2.1 IMMEDIATE THREATS

4.2.1.1 Directed Hunting

Direct hunting is without doubt the most immediate threat to the survival of the species in Cuanza River (Figures 36 and 37). This has seen by the population decrease expressed in the results of the surveys, where they have been increased pressure in recent years. The capture rates are apparently decreasing, but this is not due to conservation politics, but rather due to ever decreasing appearance of the animals. This is due to human

populational increase and the introduction to new techniques combined with the lack of regulatory control and protection measures.

According to Blancou (1960) and Poche (1973) *in* (Silva, *et al.*, 1999), the problem with direct hunting is globally considered to be the main factor for the decrease of the species, as well as by the extinction of some populational centers in the world. Although nowadays there are many international conventions, which in some ways contribute to a decrease in hunting, manatee slaughter continues (Nishiwaki, 1984; Reeves *et al.*, 1988; Powell, 1996; Silva *et al*, 1999; HIPO, 1996; Ron, 1998). In some countries, the manatee is considered a threat and the population even hires hunters to kill them (Reeves, *et al.*, 1988 *in* Silva *et al.*, 1999).

Figure 36: Manatee captured in a net.

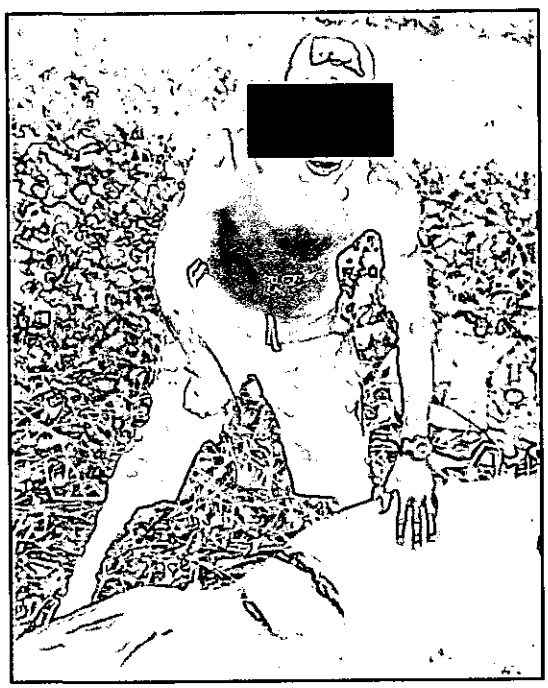


Figure 37: The same manatee minutes after.

4.2.1.2 Accidental capture in fishing

The accidental capture in fishing nets or traps seems to be one of the more important threats to the survival of the African manatees' population (Silva, *et al.*, 1999). There are

many types of fishing which are capable of capturing animals and causing its drowning. Anti sharks fixed nets, which are placed in some beaches for the protection of swimmers are an example (Cadenat, 1957, *in* Silva *et al.*, 1999). Pawell (1996) states that funnel shapped nets for the capture of shrimp, used in the Ivory Coast, cause the manatees' death and Reeves, *et al.* (1988) refers to the nets as being one of the most problematic in Sierra Leon.

Although there was no accidental capture of manatee throughout the analysed system, an emphasis falls upon Cuanza River, since this is the only place where nets are used in an arbitrary manner, not really directed to manatees, but capable of capturing them.

Another type of accidental capture described in the analysed system and which is not very common, is sports fishing such as trawling, which is very common practice in the Cuanza estuary.

4.2.2 MEDIUM TERM THREATS

4.2.2.1 Change and destruction of habitat

4.2.2.1.1 By exploration of forestal resources and erosion

Areas where manatees were present are considered to be particularly vulnerable to human activity. Human populational increase throughout the Cuanza River and adjacent lagoons has been significant in the last two decades and resulted in an increase in pressure related to the exploitation of biological resources. One of the most evident examples is the use of the Mangroves as a fuel and for construction material source (Figures 38 and 39), so causing a significant loss in sensitive areas.

Agricultural practices noted throughout the system (Figures 40 and 41), although still relatively undeveloped can contribute to erosion effects in the manatee's natural habitat, and indicates that special attention should be taken.

Mining explorations found throughout the system, like in Sierra Leon (Reeves *et al.*, 1988), can cause significant changes in the animal's habitat, although their real impact is not yet known.

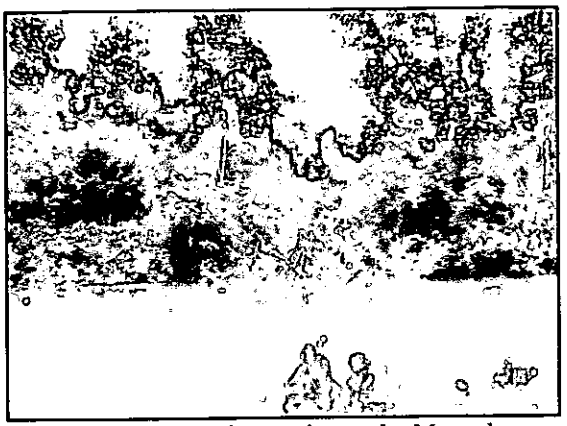


Figure 38: Evident destruction at the Mangal areas

Figure 39: Wood from mangroves for contruction and coal.

Figure 40: Land preparation in plain areas for agriculture.

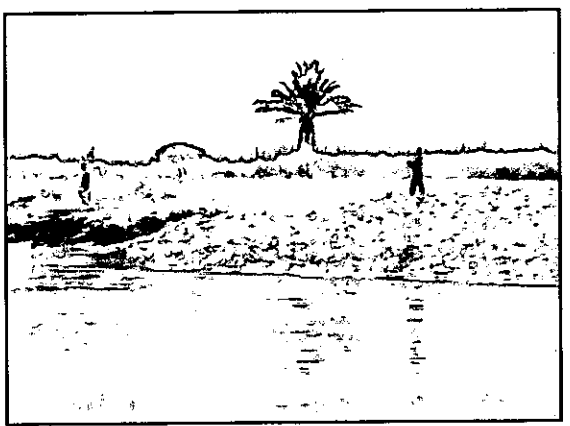


Figure 41: Agriculture activity next to Cuanza River.

4.2.2.1.2 Construction of dams and embankments

The construction of dams and embankments to control water level, energy production or water supply to populations and to agriculture has been shown by some authors as capable of causing large negative impacts to ecosystems and the manatees therein. In Florida, mortality caused by the crushing of the embankment's doors, symbolized 8% of the populations mortality between 1976 1981 (O'Shea, *et al.*, 1985) and in 1966 at the St. Paul River in Liberia, the construction of an hydroelectric undertaking was apparently responsable for a reduction in the number of manatees in the area (Reynolds & Odell, 1991).

It must ne noted that interruption of the fluvial flow upstream the dam, the decrease or increase of the flooding area downstream and the change in the normal regime of the water's level variation, may imply, in the short term, the disappearance of the zone's natural vegetation and so subsequently influence the behaviour of many species.

According to the analyses of the survey results, the retention of water flow caused by the construction of dams significantly contributed to a decrease of the water's level in many shelters of the animals. This combined with annual dry seasons exposes them to greater hunting activities.

However, according to Powell (1996), embankments will also be able to benefit manatees as they contribute for the increase of less deep zones, which allow the fixation of the aquatic vegetation, for example, the Kanji lake in Nigeria, which was artificially created after the construction of a dam and which seems to accommodate an important center of manatees.

4.2.2.1.3 Pollution

Pollution which results from urban, industrial and agricultural effluents can influence the manatee's survival in many ways (Silva, *et al.*, 1999). Many pollutants are known for producing biologically adverse effects in vertebrate animals (such as a reduction of the immuno-suppressive capacity) and can cause an increase in individual mortality, as well as reduce individual fecundity (decreasing the fertility or increasing embryos mortality) (Silva *et al.*, 1999). The toxic effect of some these substances on species can also lead to the decrease of food availability.

It must be noted that although they are not quantified, wastes from riparian villages, which are increasing all the time, as well as the improper use of soils, can provide sources of disease and degradation of water bodies. Another factor which may constitute a medium term threat to the species is an initiative for the development of an industrial park throughout the system. This should be properly investigated because of its pollution poletntial and possible impact on the manatee ecosystem.

4.2.2.1.4 Direct perturbation

With populational growth and due to deficient terrestial access, an increase in motorboat traffic is already noted throughout of the analysed system. This results in an increase in the noise pollution and disturbance, a decrease in the water quality from from fuel pollution, and the risk itself of collisions with manatees. The latter is a factor shown in Florida where 21% of the mortality registed between 1976 an 1981 resulted from the collisions of manatees with boats (O'Schea *et al.*, 1985).

4.2.2.2 Natural mortality

4.2.2.2.1 Natural predators

There was no report of natural predators to manatees. However, it should be noted that there are crocodiles in the area, although their numbers have been considerably decreasing in recent years. According to Powell (1996), in some regions there was information of some attacks by crocodiles on manatees. In other regions (Silva *et al.*, 1999), natural predators do not seem to constitute any threat to the survival of the manatee's population in Cuanza River.

4.2.2.2.2 Strandings

Some reports describe the existence of dredging in some points of the analysed system, mainly in small lagoons, which lose a large part of their water during the dryness period. This has in some way caused discomfort among the animals, exposing them to easy capture. One example is given in section 4.1.7., where a manatee was killed by a lady, shows the stranding evidence in this system.

However, these strandings do not justify a large natural mortality since there are not many reports, unlike what happens in other countries (Dupuy & Maigret, 1976 *in* Silva *et al.*, 1999; Silva *et al.*, 1999) where such strandings result in a greater probability of capture by humans.

4.2.3 LONG TERM THREATS

4.2.3.1 Loss of genetic variability

Loss of genetic variability can, in the long run, present the greatest threat to the species (Silva, *et al.*, 1999). The response capacity of a species towards habitat modifications and resistance to new illnesses depends directly from genetic variability. Powell (1996) states that the reduction of the populational number of the African manatee may have reached, in some areas, numbers so low that the population may no longer be considered healthy or viable. As populational numbers in each region decreases due to habitat modifications and subsequent isolation of populations, this results in the reduction of the genetic variability as a whole and may render species extremely vulnerable to new threats (Silva *et al.*, 1999).

4.2.3.2 Climatic changes

According to Silva *et al.*, (1999), distribution and abundance of the African manatee may undergo significant alterations following climatic changes which may occur. For example, similarly to other sirenian species, the African manatee's distribution seems to be closely related to the water's temperature. The existence of the species in the Western coast of Africa is limited to areas where the temperature is higher than 18ºC (Hatt, 1934 *in* Silva *et al.*, 1999). On the other hand, there are reports of a decrease in the manatee's population in Allahein River, Gambia, caused by the reduction of the water level and the disappearance of mangroves after the drought which devastated the area in the 80's (Powell, 1996). However and for the analysed system, such changes are difficult to predict.

5. FINAL THOUGHTS

The African manatee is well known throughout Cuanza River and it is commonly known as a 'seal'. With regard to its distribution throughout the area, we can consider its existence from the Cambambe dam to its mouth, as well as in the great majority of connecting lagoons. It also is present in the Lucala River, which is a Cuanza affluent and its presence was proven at least 30 Km upstream of the Cuanza river.

Generally, the species show a considerable decrease, presenting a rare observation frequency when comparing to the 1980's. Notwithstanding this it is considered 'frequent' in certain places of the system, namely, in Cauigia Lagoon near Bom Jesus Township, Tôa Lagoon, Quissungo and Ngolome.

There is no precise biological seasonality for manatees throughout the Cuanza River. However, observation probability increases throughout the river at the start of the rainy season, at locations streams and lagoons directly connected to the flooding. A similar increase in sightings occurs within the system of lagoons which are adjacent to Cuanza River during the dry season, when the water level drops considerably.

The manatees' populations have a diversified diet, which includes vegetation and aquatic plants, preferably the *Echinocloa pyramidalis* and *E. crus-pavonis* species. However, when food is scarce, they can feed on silts and roots from the bottom of small lagoons.

With regard to reproduction and according to information recieved from the survey, there was the presence of pregnant females throughout the year as well as young of different ages. However, there seems to be an increase in sexual activity during the rainy season – the flooding period of the system.

Manatees seek out remote places in the system's lagoons during the dry season, where the observation of small groups is possible. Generally, they are seen in pairs, essentially constituted by a female and its offspring.

We can consider that the hunting activity is the most important factor for the mortality of the manatee's population, although they have total legal protection. The hunting activity is practised throughout almost all the study range. Areas of greater pressure and concern are Quingolo, Bom Jesus, Cabemba, Cacua-Caquengue, Quissungo, surroundings of Novo Holongo and Muenga.

Traditional hunting practices are being abandoned in favour of simpler methods and the use of large nets, which are now used by the great majority of a new generation hunters. Aditionally there are encounters between fishermen and manatees, which in some cases ends up with the death of the manatee. It must be stressed that the majority of present hunters come from other parts of the country and are essential young people and therefore they were not trained or educated by the previous generations which had deontological principles.

From recorded conflicts between humans and the species, there is evidence of the destruction of fishing artefacts, which seem to be placed in the system in an arbitrary manner. However, the species is used as a meat supplement, but essentially as a trade commodity by those who carry out the hunting activity.

The threats to the species' survival are mainly directed hunting. However, we cannot ignore the degradation and destruction of the species' natural habitat, which in the medium and long run is the greatest threat factor.

6. RECOMMENDATION FOR THE CONSERVATION OF THE MANATEES' POPULATION

In order to reverse the current pressure on the manatee population and to promote the re-establishment of their numbers the following recommendations are made:

The immediate preparation and implementation of an environmental education programme with the minimum duration of 3 years to all riparian communities (or at least in areas of greatest risk as indicated in this survey), involving governmental administrations, local administration, political parties, environmental organizations, churches and the private sector. The aim is to communicate the need and importance of manatee preservation and the benefits which can come from preservation. This will involve the creation of pilot project within the local community. One of the main targets should be the younger generation and for that, the project should incorporate in its action plan, the official or particular learning system existing in each area.

Greater involvement of the regulatory and supervisory entities in order to comply with the Country's laws related to the manatee's complete protection. Fine amounts should be reviewed and publicised in communities where hunting takes place to discourage such practices. Disclosure should be as extensive as possible.

We recommend the creation of at least one natural reserve for the species in the areas with greatest probable density indicated as being important and outside the Quiçama National Park area. The great Tôa Lagoon, which starts in Cacua and extends into a region of small lagoons in the Caquengue region, is recommended as a nature reserve.

A greater analysis of the system is imperative, to determine the effective extension of the population's movements and the habitat's use and evaluate the quantity and quality of available habitat. This should not in any way disregard the need of a sustainable development (fishing, agriculture and industry) for all system.

A study programme should also established in order to more accurately determine the real manatee's populational number, using a suitable methodology.

The entities which are responsable for the maintenance of biodiersity in Angola should, as soon as possible, promote a national enquiry about the real situation and condition of the African manatee in the country. According to available information, mortality results from human activities, habitat's degradation and destruction. These factors constitute the main threat to the survival of the species' and should be investigated and monitored in order to determine the real impact of mortality. The impact from the different types of fishing should also be evaluated.

A programme directed to the collection of scientific information from dead animals is also warrented to better understand the biology of the species.

From a general prespective, management practices for the reduction of mortality caused by humans and the habitat's conservation should be based upon the value of the species to the human population. Management needs to include a system for the collection of information about the species, a revision and update of protective legislation and increase regulatory control efforts. In addition community education is essential to increase awareness of damage being done to the population, to assure protection in the most important areas. An evaluation of the potential of the current network of protected areas for the conservation of the manatee's population should also be promoted.

We must emphasize that prior to the application of any measure, all parties which may be involved in this process should be consulted and meet to discuss the issues. Actions intended to reduce mortality caused by humans present a higher priority in terms of conservation of the population and therefore should be initiated sooner than the others. Since many actions depend from the population's sensitivity, carrying out environmental education actions, should occur with the implementation of a process to reduce fatalities alternatives should be the first actions to develop. In additon, the functioning of the collaborator's network will allow the collection of information which is in the center of many actions, directed to the reduction of mortality and to the conservation of natural habitat. At the same time, contacts with international organizations can be made in order to assure the integration with ongoing projects in other countries.

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ANNEXES

ANNEX I: RECORD OF MANATEE'S OBSERVATION AND OTHER RELEVANT INFORMATION

Date	Time	Place	N. of animals		Activity			Observer
			Adults	Youngs	Feeding	Sexual activity	Locomotion	

The informer _____ Date_____

ANNEX II: NUMBER OF DEAD ANIMALS AND ITS CAUSE

N. of dead animals	Date	Time	Place	CAUSE		
				Hunting		Other (which?)
				Eelspread	Net	

The informer _____

Date_____

ANEX III:

INQUIRY FOR THE ACHIEVEMENT OF GENERAL INFORMATION ABOUT MANATEE

FICHE Nº

1. GENERAL INFORMATION

Date:..... Location:..... Lat. (S):..... Long. (E):.....

Inquired (s):.....

.....

Age (s):..... Sex:

M		F	

Population present

Traditional	
Emigrants	
Refugee	
Others	

Main activity

Fisheries	
Hunting	
Agriculture	
Outhers	

Do you know manatim:

Yes		No	

Local Names:.....

Last Observation:.....

Alive		Dead	

Currente observation:

Very common	100%	
Common	50-100%	
Frequent	10-50%	
Rare	<10%	
Doesn't exist	0%	
Uncertain	?	

Last condition:	2 years	5 years	10 years	20 years	30 years
Very common					
Common					
Frequent					
Rare					
Doesn't exist					
Uncertain					

Practical overwhelmd to manatins :

Hunting

Common	50-100%	
Frequent	1-50%	
Rare	>1%	
Not hunting		

Who hunts?.....

.....

.....

.....

Material and method of hunting:.....

.....

.....

.....

Use of the hunting portions :

Consumption	%
Commercial	%

Partes que se aproveitam .....
Other Utilities.....
.....
.....

Boarded aspects for the presence of manatees:

Negatives:

Yes		No	

Se sim quais?.....
.....

Positives:

Yes		No	

If yes, which.....
.....
.....
.....

Information on the specie:

Sazonal model (season with the most observation):

	Rivers	Lagoons
Beginning of rains		
End of rains		
Beginning of dry weather		
End of dry weather		

Size of the group: Maximum ..... Minimum .....;
Frequente..... .

Preferential habitats:.....
.....
.....

Alimentary habits :.....
.....
.....

Reproduction: (Sexual activity observation; pregnant females; recent calf) .....
.....
.....
.....

Adittional information:.....
.....
.....
.....

Mortality (cause):.....
.....

.....

Comments (stories):.....
.....
.....
.....
.....

2. FIELD SURVEY

Location: .....

Animal observation: Hour..... (GPS) S ..... E .....

Habitat: .....

Dominant vegetation: .....

Deep: ..... m

water transparency: Transparente .....; Semi - transparente .....; Muddy ..... .

Signals of alimentary activity :

Present		Absent	

Plant Species: .....
.....

Prefcrential Parts: .....
.....

Comments: .....
.....
.....
.....
.....

The Investigator:.....

ANNEX IV: VISITED PLACES AND THEIR GEOGRAPHIC POSITION

PLACE	GEOGRAPHIC COORDINATES	
	Latitude (S)	Longitude (E)
BARRA DO CUANZA – R.Cuanza	9°20.857'	13°09.300'
TOMBO – Canal do Bumba	9°10.236'	13°14.995'
BITA (Sapu) – Canal do Bumba	9°07.514'	13°17.771'
NGUENGUE – L. Casseque	9°07.489'	13°20.108'
QUINGOLO – L. Casseque	9°09.712'	13°22.428'
MIGUENGUE (CAUA) – R.Cuanza	9°10.258'	13°21.984'
CALUMBO – R.Cuanza	9°09.384'	13°25.156'
CASSENDA – R.Cuanza	9°10.782'	13°30.359
BOM JESUS – R.Cuanza	9°10.420'	13°34.379'
CAUA – R. Cuanza	9°10.836'	13°34.414'
MAZOZO	9°06.009'	13°37.012'
CACUNGO – L. Cauigia	9°08.354'	13°36.744'
BAIRRO AUGUSTO – L. Cauigia	9°08.514'	13°35.991'
ONGA DAMBWA – L. Cauigia	9°08.845'	13°35.646'
NGUIMBI – L. Cauigia	9°09.844'	13°39.241'
HOMBO – L. Cambala	9°09.548'	13°41.402'
GOLUNGO – L. Caunga-Unga	9°11.756'	13°41.164'
CABALA – R. Cuanza	9°16.911'	13°44.732
CUBAZA – R. Cuanza	9°13.226'	13°38.183'
CAXICANE – R. Cuanza	9°13.710'	13°40.423'
CACOBA – R. Cuanza / L. Cacoba	9°17.184'	13°42.254'
CACEFO – L. Cabemba	9°16.993'	13°46.821'
MASSESSO – L. Cabemba	9°15.977'	13°51.524'
ZAMBECA – L. Cabemba	9°16.662'	13°49.043'
CACULO CAZONGO	9°14.585'	13°51.170'
QUIONZO – L. Cabemba	9°16.892'	13°51.443'
UAJUJA – L. Cabemba	9°18.088'	13°51.578'
CATENDE – L. Dila	9°20.898'	13°52.315
BOA VENTURA – Ls. Tôa	9°23.088'	13°53.844
GONÇALO – Ls. Tôa	9°22.256'	13°55.641'
CAQUENGUE – Ls. Tôa	9°24.959'	13°57.727'
SALÃO – Ls. Toa	9°26.372'	13°57.641'
SAGUA - R. Cuanza	9°28.460'	13°55.438'
LIBÉRIA – R. Cuanza	9°27.295'	13°54.884'

PALANCA – R. Cuanza	9°25.854'	13°53.272'
CACUA – Ls. Tôa	9°24.357'	13°24.905'
MUXIMA – R. Cuanza	9°31.190'	13°57.474'
WENZA – Ls. Olongo	9°27.539'	13°59.737'
NOVO HOLONGO – R. Cuanza	9°32.231'	14°03.309'
CABONDA – L. Lende / R. Cuanza	9°31.140'	14°05.908'
MUSSEQUE CARIAPUCO – R. Cuanza	9°31.463'	14°07.163
SARAIVA – L. Ngolome	9°30.122'	14°09.330'
MULENDE – L. Chilé e Cagia Grande.	9°33406'	14°08.179'
MUCUMBI – L. Camuele e Ndolo e R. Cuanza	9°37.972'	14°09.902'
MASSANGANO – R. Cuanza	9°37.663'	14°15.448
NDALAMGOMBE – R. Cuanza	9°38.960'	14°15.904'
CASSEQUELE – R. Cuanza	9°41.463'	14°17.554'
NDELE – L. Ndele	9°40.655'	14°15.861'
QUIOMBE – L. Quiombe	9°37.048'	14°18.578'
4 DE FEVEREIRO – R. Lucala	9°35.723'	14°15.790'
NOVA CASSOALALA – R. Lucala	9°31.468'	14°22.476'
DONDO – R. Cuanza	9°42.291	14°27.621'
CAMBAMBE – R. Cuanza	9°44.638'	14°29.056'