

Report for
**CONSERVATION
INTERNATIONAL**
on the
SOURCE TO SAND
expedition
that followed the annual
flooding of the
OKAVANGO RIVER
from its source in
Angola
through
Namibia
and to
Botswana's Delta
during
May – August 1997

BY DAWID ALHEIT

EXECUTIVE SUMMARY OF AN EXPEDITION ALONG THE OKAVANGO RIVER THROUGH ANGOLA, NAMIBIA AND BOTSWANA.

FOR CONSERVATION INTERNATIONAL

From May to August 1997, this expedition traversed the catchment area in Angola by 4WD and kayaked the river through Namibia and Botswana.

IMPRESSIONS

ANGOLA

Although we had to negotiate around ill-defined mine fields and blown-up bridges and with men with guns, the impression remains of a lush, sparsely populated environment, with high carrying capacity, yet devoid of animals. However, resettlement is taking place rapidly, there are many areas that appear conducive to construction of dams and there is new geological exploration taking place at Cuito Cuanavale.

NAMIBIA

Angola's stretches of virgin forest and grass plains show what densely populated Namibia's overgrazed dust plains once were. Muhango Reserve's clean environment and abundant wildlife indicate the potential for extending reserve areas. The Caprivi Game Park protects the eastern bank up to Angola but there are no plans for further extensions.

BOTSWANA

The sense of wholeness of the Delta as ecosystem was clearly felt. Mechanical clearing of channels, causing downstream blockages, is a major concern.

CONCERNS

IT IS SCIENTIFICALLY PROVEN THAT THE OKAVANGO DELTA IS A SENSITIVE ECOSYSTEM

Travelling through the Delta one experiences a sense of the wholeness and fragility of the system. Scientific studies have now proven the sensitive balance maintained in the Delta. Because the Okavango River does not flow into the sea, but fans out into a 15 000 square kilometre wetland, none of its water is "wasted". An estimated 80% of the water is involved in an extremely complex process of evapo-transpiration where plant communities regulate dispersal of water and salt, employing interconnected geological, botanical and biochemical processes throughout the Delta.

THEREFORE ANY ARTIFICIAL INTERVENTIONS MUST BE SUBJECT TO EIA's, BASED ON A STUDY OF ECOLOGICAL CRITICALITY

Existing interventions range from channel clearing and tourism activities in Botswana, to irrigation schemes in Namibia. Future interventions could include Botswana's dredging, Namibia's planned water transfer scheme and Angola's resettlement, diamond mining, and hydroelectric development. A hydrological, biological, botanical and socio-economic study of criticality, to determine the minimum conditions necessary for the system to continue functioning as a healthy ecological whole, is urgently needed.

THIS STUDY NEEDS TO INCLUDE THE ENTIRE BASIN AREA - WITH SPECIAL REFERENCE TO THE CATCHMENT IN ANGOLA.

As the entire catchment area of the river lies in Angola, events here will directly influence the quantity and quality of downstream water. Without detailed analysis and projections of developments in Angola, an EIA can not be considered complete.

OKACOM MUST INVOLVE NGO's.

The Permanent Okavango River Basin Commission (OKACOM) commissioned an EIA of Namibia's pipeline and has made a good start, looking at issues of further study. NGOs operate across international borders without the constraints hampering government bodies. Therefore, OKACOM should collaborate with NGOs such as Conservation International, consortiums such as Okavango Liaison Group, and institutes such as Okavango Research Group and Okavango Research Centre, for collection, packaging and distribution of information.

THERE IS REAL POTENTIAL FOR CONFLICT, BUT IT CAN BE AVERTED BY COLLABORATION BETWEEN OKACOM AND NGO's, CREATING THE RIGHT POLITICAL WILL.

NGOs can operate across international borders without the constraints of formality that may hamper government bodies such as OKACOM. However it is OKACOM that will finally advise the respective governments on management of the river. Creative collaboration between the NGOs and OKACOM is therefore crucial, and should be instigated by invitation from OKACOM to the NGOs.

SOURCE TO SAND 1997

A REPORT ON THE OKAVANGO RIVER

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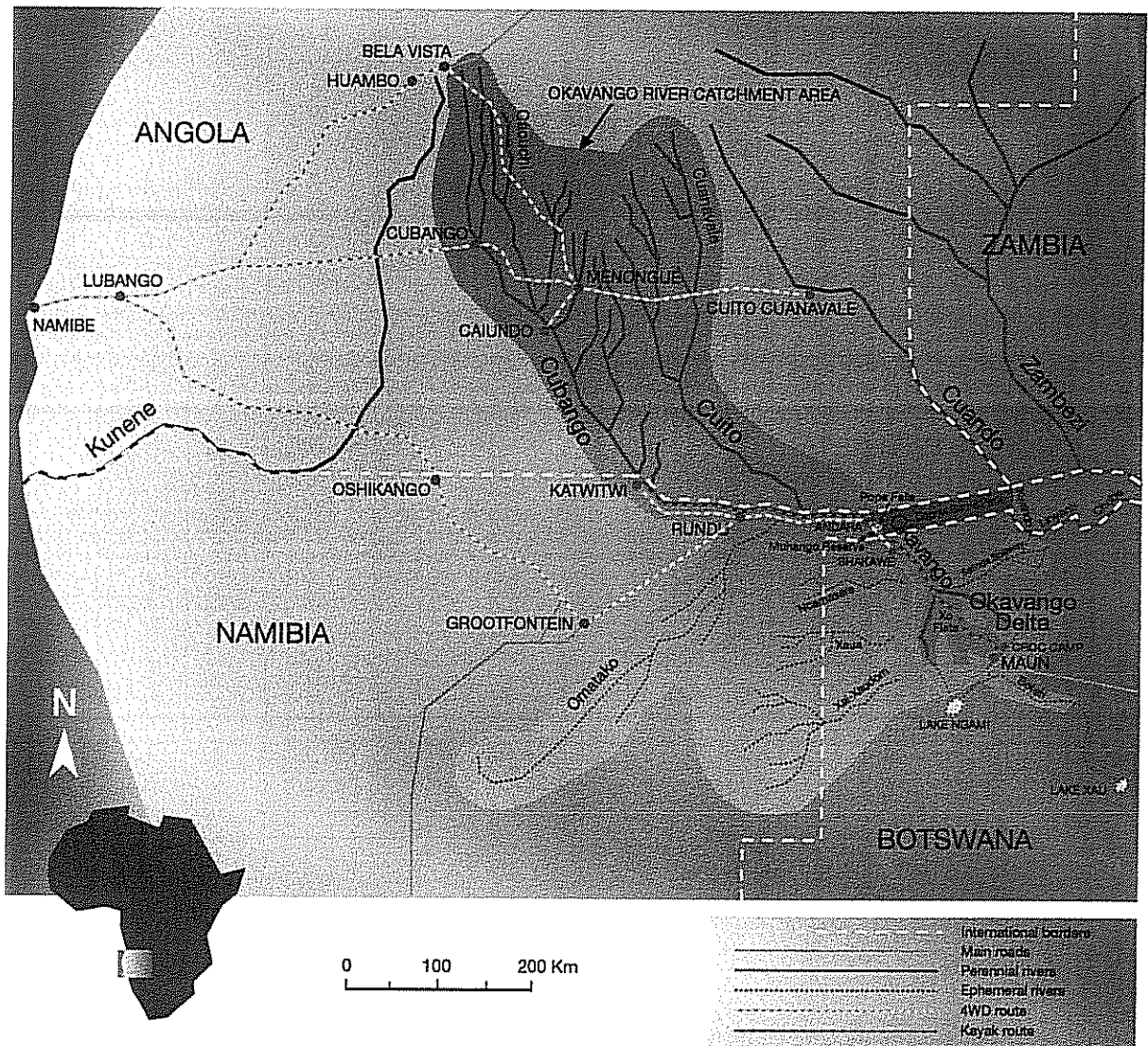
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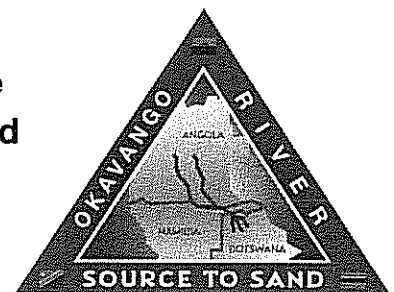


SOURCE TO SAND 1997

A report of an expedition from the source of the Cubango River at Bela Vista in Angola to the end of the Okavango River at Maun in Botswana.

For: Conservation International

By: Dawid Alheit



SYNOPSIS

In May 1997, as the summer rains on the central highlands of Angola came to an end, an expedition following the annual flooding of the Okavango River, caused by these rains, began. In a journey of discovery, never before attempted, this expedition explored the entire length of the Okavango River, by 4WD in Angola and by kayak through Namibia and Botswana to the river's end in the Kalahari Desert.

The expedition was preceded and followed up by a desktop study regarding the water sharing and environmental issues revolving around this river.

BACKGROUND

THE RIVER

FROM SOURCE TO SAND

Rising in the Bie plateau of Angola, the two major tributaries of the Okavango river, the Cubango and Cuito/Cuanavale flow south for some 700 and 650 kms, respectively, before turning east to form part of the northern boundary of Namibia. Now called the Okavango, it flows a further 450 km. before turning south across the Caprivi, to spill over the Popa rapids, enter Botswana and spread itself into the sands of the Kalahari desert. It is here that the famous Okavango Delta is formed.

This third largest river in southern Africa is unique. Although perennial it is subject to immense variations in flow volume. Between 400 mm and 1200 mm of rain fall on the Angolan Plateau from December to May. This runs into the Cubango and Cuito/Cuanavale rivers with catchment areas of some 115 000 and 75 000 square kms. respectively. It floods the Okavango River, filling the plains of the Delta to their highest level during June and July, then extending over some 15 000 square kms. The flood reaches the Boteti River only during August/September. Measurements along the panhandle indicate a mean annual runoff of some 10 000 million cubic metres, exceeding by a factor of 10 the combined flow of all internal rivers of Namibia.

AN UNEXPLORED RIVER

The unique biodiversity and sheer beauty of the Okavango Delta have long been the subject of film, photography and research. The need for its protection is a well-established concern with various NGOs and governments. However, the river's source and its course through Angola, on which the Namibian basin environment and the Delta depend, remain virtually unknown. Yet such information is vital for integrated management of the river as a whole system.

A THREATENED RIVER

Namibia is a thirsty land with a rapidly growing population. Installation of a pipeline draining water from the Okavango is in progress. The influence of this extraction on the whole river system is open to speculation.

Post-war Angola is facing a massive reconstruction task. New geological exploration at Cuito-Cuanavale as well as resettlement of displaced populations over the whole basin area are in progress. There is a possibility of hydroelectric development in the catchment area of the Cubango River. Botswana previously planned to dredge the Borro River for a water transfer scheme, a development narrowly averted due to pressure from local communities and NGOs receiving public exposure. Currently the Delta is the focus of expanding tourism, although future dredging has not been ruled out.

TOWARDS A SOLUTION: OKACOM AND NGOS

The three countries have not yet entered into a formal water sharing agreement. However, maintaining the integrity of the whole Okavango River System can be seen as a founding principle behind OKACOM. This agreement, signed in September 1994, established a permanent Okavango River Basin Water Commission to act as technical advisor to the three countries "on matters relating to the conservation, development and utilisation of water resources of common interest..."

Conservation International (CI), the Okavango Liaison Group (OLG) and Kalahari Conservation Society (KCS) are Botswana based organisations concerned with preservation of the Delta. There are no Namibian or Angolan based organisations concerned with the river.

OR CONFLICT?

"Rampant waste and pollution of our most vital resource create a crisis that could lead to future armed conflicts" (Time, November 1997). Internationally and in southern Africa specifically competition for natural resources, notably water, could spark future wars. The potential for conflict is huge. Botswana and Namibia need the river as a resource with immediate effect. These needs are already conflicting while Angola's future needs will complicate issues.

THE COUNTRIES

ANGOLA

With some 10 million people living on 1.5 million square kms of land rich in mineral deposits and with diversity of climatic and ecological regions, Angola has a potential 7 - 10 000 million dollar per annum economy. However, after 30 years of war actual GDP is under 5 000 million dollars per annum. Angola approached independence with an uneven and weak rural infrastructure, set off against two strong regionally segmented elite sets. Combined with prospects of substantial government revenues in oil and diamonds, this recipe for conflict was exacerbated by a series of outsider interests. The ideological concerns of the USA, Portugal's economic interest, France's search for oil, South Africa's destabilisation techniques, the USSR's socialist expansion and Cuba's promotion of world revolution all led to interventions which soon escalated from the political to the military.

Thirty years of war resulted in infrastructure devastation. Reconstruction cost estimates range between 25 and 40 000 million dollars. In human cost, apart from some 1 million deaths, current estimates place only 4 million of the country's 10 million people above the absolute



Thirty years of war resulted in infrastructure devastation



In the Cuando Cubango region IOM expects to resettle 5000 families, representing some 20 000 people

poverty line. Of the former, 3 million are either bureaucracy or military household members. Reconstruction will be facilitated by the petroleum sector which is still in good condition. About 1 000 million dollars in present oil revenues is divertable from war import bills. Angola is the fourth largest diamond producer in the world but it may take some time for output to be regulated. Most of the basic dam structures, but not transmission systems, are still structurally sound.

The 'moral economy' case - that no nation can be great and prosperous if the majority of its people are poor - is currently out of fashion. Large scale safety nets enjoy a high profile at the World Bank. Angola is likely to concentrate on increasing export revenue, then building GDP and investible surplus. The plight of the rural poor may well be left to NGOs such as the International Organisation for Migration (IOM). By Feb. 97 IOM had returned and resettled 2108 demobilised soldiers and dependants, 8159 internally displaced persons and 459 Zairian refugees. In the Cuando Cubango region IOM expects to resettle 5000 families, representing some 20 000 people.

Diamonds and oil are the main focus of potential revenue but Angola also seeks to become an exporter of hydroelectricity through joining a regional grid. The main export units for this regional grid are at Stieglers Gorge (Tanzania), Kariba (Zambia), Cahora Bassa (Mozambique), Kunene (Namibia) and the Angolan Plateau - the source of the Okavango.

NAMIBIA

With 1.5 million people living on more than 800 000 square kms, Namibia is a very sparsely populated country. It is an extremely arid land with 70% of the area receiving less than 400mm rainfall p.a., of which 60 - 80 % is lost to evaporation.

At independence in 1990, the new Government inherited a well-developed infrastructure in a land poor in natural resources. A small affluent commercial farming community, less than 10% of the population, owns 44% of the land. The majority of the people living subsistence lives are settled in Ovamboland and along the Okavango River. The population is growing at 3% per year, one of the highest growth rates in Africa.

Namibia's development goals are focussed on its quest for economic and infrastructural independence. However, due to its political history, there is also a leaning towards 'moral economy', aimed at more equitable distribution of such wealth as it has. The government remains committed to enhancement of marginal farming land by artificial water supply. Irrigation schemes on the banks of the Okavango River and the development of a massive water transfer scheme from the river are underway.



Namibia is a thirsty land

BOTSWANA

Botswana's 600 000 square kms support a population of 1.4 million people, more than 2 million cattle and a large, though dwindling number and diversity of wildlife, most densely concentrated in the Okavango Delta.

Average rainfall in the north is 650mm p.a. with 30% variability and in the south 250mm with 60% variability. Variability within seasons indicates a high chance of dry spells, severely limiting surface and ground water resources. The Okavango and Kwando/Chobe rivers, both emerging from Angola, are the largest surface water sources with mean annual run-off of

11 000 mln.m³ and 44 000 mln.m³ respectively.

Some 10 000 boreholes supplement Botswana's daily use of approximately 350 000 cubic metres of water.

Recharge is estimated at 1% of precipitation.

Socio-politically and economically Botswana is unique in Africa. A relatively homogeneous population (75% of the people are Setswana speaking Batswana) has

never known internal warfare. Since independence (1966) a multi-party democratic government, with the help of massive diamond reserves, economically

transformed one of the poorest countries in the world to one of the fastest growing. Botswana will continue

on a path of modernisation and developing commercially

to the highest level allowed by economic resources. Tourism is the third largest contributor to Botswana's GDP. The tourism industry is centred on the Okavango Delta.



The Okavango River in the delta

BRIEF SUMMARY OF THE ROLE OF THE RIVER IN THE THREE COUNTRIES

Angola - a war torn country facing a massive reconstruction task. Forex earning developments could include hydroelectricity and diamond mining in the basin area where large numbers of people are being resettled.

Namibia - an arid land with few resources, developing rural poor areas and maintaining services in urban areas, for which future use of the river is a given fact.

Botswana - a rapidly developing country, seeking to maintain its rate of development. Tourism centred on the Delta is expanding and water transfer from the Delta is still considered an option.

THE EXPEDITION

ANGOLAN SECTION

Having travelled extensively in Africa (including Zaire and Mozambique) we realised within days of crossing Angola's border that rowing the river here would be suicidal. We never saw more free-range guns and less free-range animals anywhere. Feeling like free-range targets we agreed on a recce trip by vehicle.



A beautiful lush environment, with high carrying capacity yet devoid of animals

From Lubango to Cuito-Cuanavale we crossed the major tributaries of the Cuvango and Cuito rivers. Returning via Huambo we plotted their sources.

Although we had to skirt ill-defined mine fields littered with wrecked military hardware and negotiate blown-up bridges and gung-ho men with guns, the overriding impression remains of a beautiful lush environment, with high carrying capacity yet devoid of animals.

SUMMARY

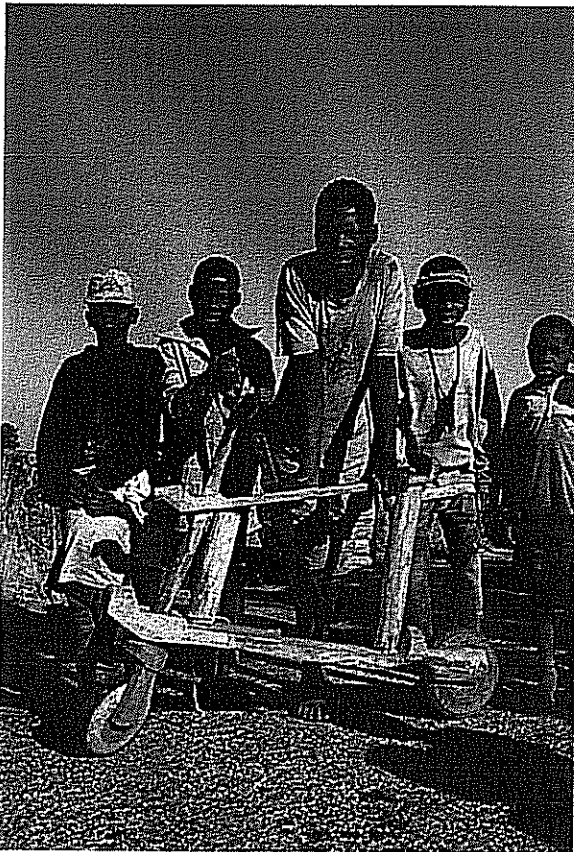
DATE	PLACE	LAT.(S)H/M/S	LONG.(E)H/M/S	REMARKS
1/7	Lubango	15 01 24	13 24 51	Mechem camp (SA landmine lifting co.)
2/7	Kunene	15 35 48	12 12 15	Bridge over Kunene with Hydroelectric installation.
2/7	Cubango	14 50 58	16 22 55	Crossed river on railway bridge. Strong flow. 25m wide, gently sloping banks.
3/7	Cutato	14 22 12	16 29 48	Crossed river on broken bridge. Strong flow. Narrow gorge, steep rocky sides
3/7	Cuchi	14 40 13	16 58 55	Waded past broken bridge. Strong flow, 0.5m deep, 50m wide. Gently sloping sand banks.
4/7	Cuelel	14 41 08	17 21 28	Waded through fast flow, 0.3m deep, 20m wide. Steep sand banks.
4/7	Cuebe/Luduca	14 39 59	17 41 40	Menongue. Confluence Cuebe + Luduca rivers
5/7	Cubango/Caiundo	15 41 48	17 27 33	Strong flow. Rocky rapids, deep gorge. Confluence of all above. Destroyed bridge + flow meter. About 50m wide, 1m deep, strong flow. Steep sandbanks. UNITA base.
5/7	Quatir	14 35 20	17 57 20	First tributary to Cuito. Near source.
5/7	Luassingua	14 35 22	18 10 12	Tributary of Cuito. New bridge. River about 10m wide, gentle flow. Sand banks.
5/7	Longa	14 36 20	18 28 00	As above. Very wide valley.
6/7	Cuiriri	14 41 07	18 40 06	As above.
6/7	Cuito	15 10 15	19 11 29	Cuito/Cuanavale confluence. Broken bridge. Destroyed flow meter. River 25m wide, slow meandering through wide sand valley.
7/7	Dondo	14 17 39	17 37 20	UNITA Base. Report before travelling north.
7/7	Cusseque	13 42 45	17 05 28	Tributary of Cacuchi River, near source. New bridge over fast stream.
7/7	Cacuchi	13 35 35	16 52 50	Tributary to Cuchi. Bridge over fast stream.
8/7	Cacuchi	12 39 45	16 45 45	Source of Cacuchi. Forestry area.
8/7	Cuchi	12 31 59	16 41 59	Source of Cuchi. On plateau. Flat land.
8/7	Cutato	12 34 15	16 29 30	Source of Cutato. As above.
8/7	Cubango	12 36 09	16 07 44	Source of Cubango. As above.
8/7	Bela Vista	12 34 02	16 13 06	Village close to source of Cubango.
8/7	Huambo	12 47 49	15 44 56	Unavem base at Huambo.
9/7	Lubango			

CONCERNS, COMMENTS AND SUGGESTIONS

1. Resettlement, land-use potential, environmental capacity building programs, collaboration with NGOs.

At present the basin area is sparsely populated by both people and livestock. However, it is good grazing land and the river valleys are easy to cultivate with abundant water for irrigation. With Angola stabilising, NGOs will help to resettle these areas rapidly.

A study on the land-use potential of the entire basin area should be undertaken as a matter of urgency. A regional NGO should be established to teach sustainable farming practices through capacity building programs. Menongue would be the right place to establish a base. It is central to the basin area with some form of infrastructure remaining and there are other NGOs based there. Collaboration with other NGOs such as CARE and IOM, involved in resettling of communities, is vital.



The people are hungry for input from the 'normal' world

2. Working with local populations, collaboration with UNITA and the Government

It seems strange to suggest advocating environmentally friendly practices in a war-traumatized community. However, having spoken to a variety of people in city streets and rural villages, I believe they are hungry for input from the "normal" world. There seems to be a great need to be proud of something but presently very little to be proud of. This is fertile social ground for grass root environmental programs.

As much of the area is under UNITA control, collaboration with them would be vital. Having met with some of UNITA's officers I do not think this would be a problem. Collaboration with Governors of the Huambo, Huila, Cunene and Cuando-Cubango Provinces would also be essential. I do not know if this will present any difficulty.

3. Travelling/working in Angola is:

- ▲ a bureaucratic nightmare,
- ▲ difficult because of destroyed infrastructure and
- ▲ dangerous because of landmines and bandits.

Future expeditions, studies or other operations should take cognisance of:

- ▲ the importance of having all the correct paperwork,
- ▲ allowing ample travel time and sourcing
- ▲ all possible information on security conditions.



4. Restocking with Game and Preventative Education

The southern area has a high game carrying capacity. If a transfrontier park (see Namibian Section P 11) becomes a reality and game migrate north, poaching will become an immediate problem as there are guns everywhere. Preventative education will be necessary.

5. Diamond mining

"Six hundred miners working individual claims at Kao diamond mine in Lesotho are causing extensive pollution to three water courses in the mountainous kingdom" (The Sunday Independent, 17/8/97). Presently there is no known mining taking place in the Cubango and Cuito basins. With De Beers' new exploration operation at Cuito-Cuanavale this situation may change. These developments should be monitored.



There are broken flow meters at Cuito-Cuanavale and Ciaundo

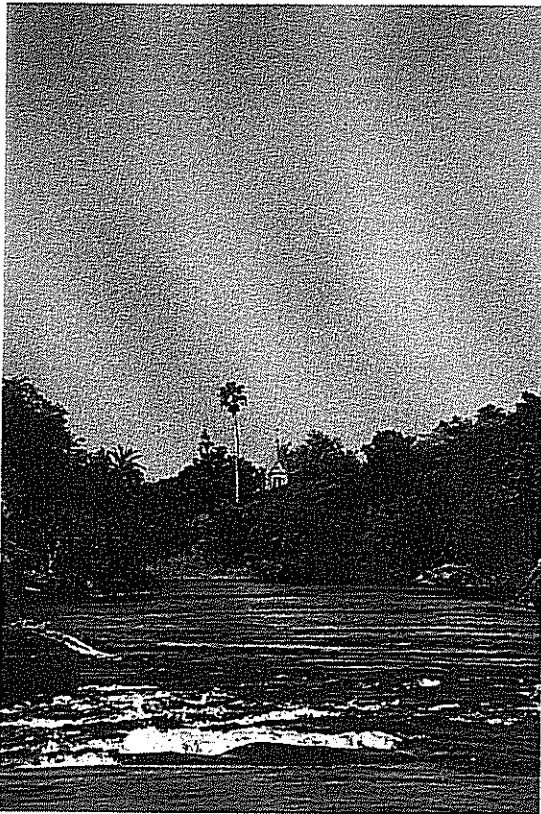
6. General Hydrology and Hydro-electrical development

There is a need for hydrological information on the whole basin area. Old statistics may well exist. There are broken flow meters at Cuito-Cuanavale and Ciaundo. "Angola does seek to become an exporter [of hydro-electricity] and could be one within a regional grid whose main export units would be on the Angolan Plateau and Kunene (Namibia), Cahora Bassa, Kariba.." (Green in Hart + Lewis '94). There are many areas (i.e. Cutato, Cuelel, Cuelebe - see SUMMARY P 7) which are geologically conducive to building new dams. Possible developments here should be monitored.

NAMIBIAN SECTION

We kayaked this 450 km. over 12 days. Angola's sparsely populated stretches of virgin forest, interspersed by yellow grass plains, show what densely populated Namibia's overgrazed dust plains once were. Wars are environmentally friendly. However, watoes loaded with hardwood for cooking fires regularly cross from Angola to Namibia.

Only after Shadikongoro did we find some of Namibia's natural environment unscathed by human population pressure. Around Andara densely wooded islands split the river into channels cascading over rocky outcrops and forming silent pools lined by strong roots of thick trees. Muhango Reserve's clean environment and abundant wildlife indicate the potential for developing more reserve areas.



Densely wooded islands and silent pools at Andara

SUMMARY

DATE	PLACE	LAT.(S)H/M/S	LONG.(E)H/M/S	REMARKS
30/5	Katwitwi	17 23 28	18 25 12	First launch. Strong flow from Angola.
30/5	Namuntuntu	17 29 44	18 30 14	1st Camp
31/5	Nkurenkuru	17 44 58	18 46 50	2nd Camp
1/6	Rupara	17 48 44	19 09 12	3rd Camp
2/6	Mica	17 52 06	19 30 01	4th Camp
3/6	Sarasungu	17 53 23	19 46 44	Lodge at Rundu. Halfway to Botswana.
4/6	Utokota	17 52 27	19 57 05	5th Camp
5/6	Ndonga	17 52 18	20 20 14	6th Camp
6/6	Katere	18 00 29	20 42 43	7th Camp
7/6	Cuito	18 01 41	20 47 30	Confluence, Cuito + Okavango.
7/6	Mbambi	17 56 48	21 03 47	8th Camp. Just before islands.
8/6	Islands	18 02 09	21 26 00	9th Camp
9/6	Popa	18 07 19	21 34 48	10th Camp at Popa falls.
10/6	Muhango	18 09 07	21 41 27	11th Camp. Border of Muhango Reserve
11/6	Border	18 15 15	21 46 49	Border of Botswana.

CONCERNS, COMMENTS AND SUGGESTIONS

1. An opportunity to study “normal” environmental impact

The environments on the two sides of the river currently offer a unique opportunity to record the environmental impact of normal civilisation. The area around Rundu is Namibia's most densely populated rural area. The people rely on the “spatially heterogeneous wetland” environment for subsistence farming (Diederichs '97). Topographically similar, the Angolan side has been de-populated for many years. A record of the differences between the two banks will be a valuable tool for development planning.



The contrast between Namibia's deforestation and Angola's pristine environment

2. Deforestation and desertification

Angola's pristine environment will not last long. These areas will be resettled soon. Cross border deforestation will increase with population growth. An integrated river management plan should include measures for prevention of deforestation and desertification.

3. Transfrontier Park

The success of Muhango Reserve is heartening. S. Bethune of the Namibian Department of Water Affairs has mentioned the need for more reserve areas along the river. The beauty of the environment around Andara ensures a reserve here will generate high income from tourism, which can be to the benefit of local populations.

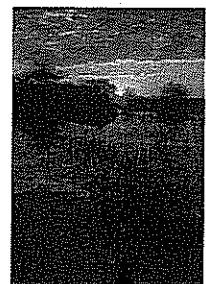
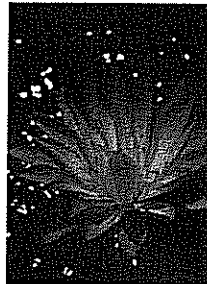
In southern Africa “transfrontier” or “peaceparks” are not just new buzzwords. Transfrontier parks spanning the borders of South Africa, Mozambique and Botswana are already realities. Their benefit goes beyond the environment. Internationally shared responsibility for a reserve will contribute greatly to avoiding possible conflict over one resource.

BOTSWANA SECTION

I kayaked the Delta solo over 16 days. The tranquillity of not seeing any sign of humanity for 6 of these days was often interrupted by scares from aggressive hippo and curious or hungry crocs. Blockages in many channels often made progress difficult. The extent of these blockages is worrying as some were clearly due to mechanical interference.



Aggressive hippo



SUMMARY

DATE	PLACE	LAT. (S)H/M/S	LONG. (E)H/M/S	REMARKS
13/7	Divuyu Isl.	18 03 59	21 27 22	Redoing the section down stream of Shadikongoro.
14/7	Muhango	18 08 47	21 41 10	
15/7	Mohambo	18 17 15	21 48 49	Just after Botswana border.
19/7	Drotsky's	18 24 51	21 53 06	Restcamp near Shakawe.
20/7	Barry's	18 25 52	21 54 11	Shakawe Fishing Camp.
21/7	Nr Nxamasere			GPS broken.
22/7	Sepupa			Sepupa Boat Services camp.
23/7	Etsatsa			Abandoned hunting camp.
24/7	Dube Isl.			North of split, Jao + Nqoga channel.
25/7	Jao			Madinare Isl. ? Channel very narrow.
26/7	Jao			Xigera Isl. ? Channel blocked.
27/7	Xo			Lost on Xo Flats. No defined channel.
28/7	Xo			As above.
29/7	Xo	19 25 12	22 53 48	GPS fixed. Xo Flats near Chiefs Island.
30/7	Chiefs Isl.	19 29 25	22 58 40	Tsawaralengwana. Well defined channel.
31/7	Chiefs Isl.	19 32 00	23 09 23	Near Delta camp.
01/8	Bokwi Isl.	19 41 33	23 13 15	Borro channel, well defined.
02/8	Borro	19 50 08	23 24 21	Near Buffalo Fence.
03/8	Croc Camp	19 55 50	23 30 44	Crocodile Camp at Maun.

CONCERNS, COMMENTS AND SUGGESTIONS

1. Transfrontier Park

The area south of Mohebo border is sparsely populated. Creating a reserve to complement Muhango in Namibia, jointly managed by the two countries, will have the same benefits as mentioned in the Namibian Section (P11).

2. Changes in Animal Behaviour

Hippos in the Delta are notably more aggressive than those in the Muhango reserve. It has been said that the Delta's elephants' habit of feeding at night and hiding in shade during the day is due to hunting. A study of changes in animal behaviour due to contact with people will be valuable in management decisions.

3. Changes in Channels. Natural and Mechanical. The Sensitivity of the Delta as Ecosystem and a Management Plan for the Delta.

The first blockage was encountered just below Jediba camp. Workers had cut away encroaching papyrus to open sections of channel. The stems floated downstream to collect in a sharp bend, forming an impenetrable barrier.

Other blockages were clearly due to normal geological and botanical processes. The people of Maun are concerned about the decrease in water reaching the Thamalakane River. This may be due to a natural shift in channels. Good research packaged in user-friendly format should be distributed amongst locals to avoid misappropriation of blame.

Research done by the Okavango Research Group under Prof. McCarthy of the University of the Witwatersrand explains that the Delta is indeed a very sensitive ecosystem. This study found that plant communities regulate both dispersal of water and accumulation of salts throughout the Delta. A natural accumulation of toxic salts in the centre of islands is prevented from entering the system through the "hummocky" shape of the islands, maintained by their vegetation. After an average of 150 years this accumulation starts killing off the trees on the island. The toxic materials could now be washed into the system. However, and I quote: "Remarkably, the lifetime of a channel system is about the same as the time it takes for serious toxicity to develop on the islands in the swamp system supplied by that channel, so balance is maintained". Remarkably, the lifetime of the channel system is determined upstream of the islands according to geological processes - sand deposits - and botanical processes - papyrus encroachment - which have nothing apparent to do with the biochemical process happening on the islands. Prof. McCarthy concludes: "It is almost as if the Okavango is a single organism, with the different communities serving the function of specific organs, and working together to ensure the well-being of the whole - a kind of super-organism." (McCarthy, 94)

Given such information, the environmental impact of increasing tourism through, for example, mechanical clearing of channels and possible changes in animal behaviour, should be studied urgently.

The results of this study should be incorporated in the creation and implementation of a management plan for the Delta.

CONCLUDING RECOMMENDATIONS: POSSIBLE TASKS FOR NGOS

1. Distribution of Available Information

The ORG alone has to date published 38 scientific articles on the Delta. Studies on the river in Namibia and the Delta have been done by various other universities and institutions, such as Dr Ellery and N Diederichs of the Dept of Geographical and Environmental Sciences, University of Natal. OKACOM commissioned an EIA (in Namibia and Botswana) of Namibia's planned pipeline and has a study group currently deciding on issues of further study. Yet, in speaking to people during the expedition and observing the public media, there seems to be a general lack of knowledge regarding the functioning of the ecosystem and the current and future impact of natural and artificial interventions. A central "library" of relevant information should be established with an NGO such as Conservation International or at the Okavango Research Centre. Information should be packaged in user friendly format and actively distributed. The OLG, which is a consortium of NGOs, would be an excellent vehicle for such distribution.

2. Further Research, the Validity of EIA's

The lack of knowledge regarding developments in Angola is the most disturbing concern. A study on the land-use potential of the Angolan basin area must receive the most urgent attention. For example, a point of contention in OKACOM's recently completed EIA of Namibia's intended pipeline is the percentage of water that will be subtracted from the river. The percentage that the subtracted quantity constitutes depends on the total volume of water flowing past the subtraction point. As the entire catchment area of the river lies in Angola, with Namibia and Botswana contributing nothing to the flow, the volume of water in the river and therefore the effective percentage subtracted, depends entirely on events in Angola. It is therefore clear that any EIA would be incomplete without detailed analysis and projections of developments in Angola.

3. The Potential for Conflict, and a Formal Watersharing Agreement

The potential for conflict may be overplayed by the media but is underplayed by the scientists. When Angola starts using the river in ways detrimental to downstream areas Namibia and/or Botswana may well react aggressively. Social Psychology research suggests that the most effective means of minimising international conflict is to establish positive attitudes between groups before conflict has a chance to begin. In addition to OKACOM's technical and scientific input it is crucial that ways are found whereby this potential conflict situation can be turned into an example of international co-operation. In collaboration with NGOs and via the media, attention must be shifted from national gain towards universal sustainable management of a shared resource. This must be complemented by a formal watersharing agreement.

4. Collaboration between OKACOM and NGOs.

NGOs can operate across international borders without the constraints of formality that may hamper government bodies such as OKACOM. However it is OKACOM that will finally advise the respective governments on management of the river. Creative collaboration between the NGOs and OKACOM is therefore crucial, and should be instigated by invitation from OKACOM to the NGOs.

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